FACTORS AFFECTING GOVERNMENT LOCATION DECISIONS, WITH REGARD TO THE NEW SOUTH WALES DECENTRALISATION PROGRAMME

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SUMMARY

The study examines factors affecting one type of government location decision, namely, giving incentives to industrialists to set up or expand in socially desirable locations. Data are drawn from the New South Wales decentralisation programme up to 1969, concentrating particularly on the 1965 to 1969 period.

The first part establishes the background to the empirical study comprising the remainder of the thesis. In the first chapter the need for a study of this type of decision-making is examined, and several features distinguishing such decisions from private sector industrial location decisions are discussed. The second chapter gives the background of the decentralisation programme itself, in terms of its particular theoretical rationale, its evolution, and the resulting spatial and sectoral pattern of assistance.

The next chapters develop and apply a programming model of government location decisions of the programmed type. The model is a linear programming one. Its objective function is a utility function which is empirically estimated by examining the preferences revealed in past decisions concerning decentralisation assistance. The model is initially applied to the decentralisation programme assuming

semi-normative conditions. The most extensive part of this application is the development of quantitative criteria of goals hypothesized to apply to the Department of Decentralisation's programmed decisions; in particular, econometric estimates of the employment change resulting from a given loan are developed. The model's predictions, under semi-normative conditions, of a sample of loans made in 1968/69 are fairly close to the actual pattern, except that loans between zero and the full amount of the respective requests are not satisfactorily accounted for. Similar results are achieved when the model is applied under conditions of bounded rationality.

A decision rule model, allowing for other than "all or nothing" loans, is then tested but does not result in improved prediction. Two behavioural aspects of the programmed decision process - the variation in relevant factors from case to case, and the influence of the decision environment - are then shown to contain significant explanatory elements.

Chapter 8 considers three types of non-programmed decisions: suggestions by the Department as to suitable locations for new industry; bargaining between applicant companies and the Department on the terms of assistance; and the implementation of new policies.

The penultimate chapter investigates intra-organizational factors, and highlights differences between senior and other officers in the reasons given for, and the importance of, their decisions.

The conclusion develops an empirical model of the Department's loan decision process, based on the sequential linkage of elements found to be significant in previous chapters. In addition, the importance of political factors on the one hand, and large companies on the other, in regard to the location of assistance is stressed.

I hereby certify that this work has not been submitted for a higher degree to any other university or institution.

(Signed) ....G. H. Searle....

G-H Searle

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CHAPTER 1

TOWARDS A THEORY OF GOVERNMENT INDUSTRIAL LOCATION DECISIONS

Governments have a large and expanding role in determining the location of secondary industries because of a recognition that market-determined patterns of industry may not be socially optimal. A geographer, according to the traditional aim of his research, should describe the spatial pattern resulting from such intervention and also, more importantly, "explain that pattern by way of the causal mechanisms which have generated it" (Harvey, 1968, 71). This study examines the spatial patterns and causative processes associated with an Australian example of government modification of manufacturing locations, namely, the New South Wales Government's decentralisation programme to encourage industrial development outside the state's three principal cities, Sydney, Newcastle and Wollongong. The study focusses on elements of order and regularity which could be used in the construction of a theory of government plant location decisions and in particular it develops and tests a decision model which attempts to unify a number of the most potentially significant of such elements.

Government industrial location decisions can be classified into three basic types:

(a) decisions concerning incentives for, or regulations against, private sector industrialists setting up in particular locations;

(b) decisions concerning the development of "social overhead" capital, or infrastructure, at certain locations as a means of attracting industry;

(c) decisions relating to location in industries owned by the government.

The New South Wales decentralisation programme is an incentive scheme and therefore an example of type (a) decision-making. Government location decisions of the other two types seem to warrant separate theoretical constructs and are not included in the scope of the present study.

Existing location theory does little to accommodate government influences on the location pattern and "provides a very poor explanatory and predictive framework for economic development policy formation" (Thomas, 1968, 279). Before considering the reasons for the relative neglect of government by location theorists, it is instructive to briefly review previous studies in order to see how close they come to providing the necessary framework.

PREVIOUS STUDIES

General scope

The main concern of past research into government industrial location decisions has been the construction of optimal models. These have been highly developed by writers from socialist countries in particular (for example Dadayan, 1965), while there is also an expanding Western literature (for example Sakashita, 1967).

There has, however, been little attempt to establish the relationship of such ideal constructs to the manner in which governments actually operate in the locational field. An obvious first step is a comparison of an existing pattern of government decisions with the patterns produced by various types of optimal behaviour. The distribution of secondary industries in Poland has in fact been analysed in this way, with the final location chosen found to often represent a compromise between the optimal locations according to a "sector" approach and a "regional complex" approach (Lissowski, 1965). More recently Hamilton (1971) and Barr (1974) have investigated the way in which industrial location in Eastern Europe and Russia is influenced by general socialist principles on the one hand and the behavioural decision environment on the other. But these studies have not been followed up by any development of formal models. In addition, models of government location decisions in Communist countries would probably not be applicable to Western nations, since governments in the former own all industrial establishments and decision makers at the firm level have only partial independence (Barr, 1974).

The analyses of government industrial location decisions in Western nations have generally concentrated on the impact, spatial and otherwise, of these decisions rather than their causes, in terms of decision criteria and so forth. Where such studies have looked at the latter, usually only the official criteria for government intervention and assistance, such as certain levels of unemployment, have been investigated (for example, McCrone, 1969). More rarely, theoretical criteria for spatial allocation by governments have been suggested, such as Harvey's three criteria for a "just" spatial distribution (Harvey, 1972). The implicit criteria which actually determine government location decisions have rarely been analysed. Two recent exceptions are the study by Horne, Tweeten and Holland (1974) of criteria used by the United States government in selecting counties for development benefits, and the study by McFadden (1976) of decision rules used to select freeway routes in California. Similarly the behavioural environment within which the choice of locational criteria by government takes place, has not been studied in a manner allowing the testing of hypotheses. The next step, the development of a systematic framework of explanation of government location decisions, has not yet eventuated. The present study is designed to contribute to this objective.

Reasons for the lack of research

There are three possible reasons for this lack of substantive research. Perhaps the most obvious has been a belief that the presence of a single government for a certain function in a given area tends to make decisions unique, so that "general rules of behaviour are far harder, if not impossible, to ascertain" (Chisholm, 1966, 207). However many government policies, such as increased regional development, require decisions which are repeatedly implemented over time and space. Certain techniques are usually developed to allow these decisions to be made quickly and efficiently, so that they have been termed "programmed" decisions (Simon, 1970). Because of this, it would seem possible to derive at least some theoretical insight, if not general rules of behaviour, concerning the reasons for the industrial location decisions of governments, at least for decisions of the programmed kind. This approach has not been used in the analysis of industrial location decisions of entrepreneurs presumably because such decisions are rare in the majority of companies (Townroe, 1971, 7).

A second explanation for the lack of research in this field may be that most traditional location studies have been made in capitalist economies in which government ownership of industries has been generally restricted to a few specialized activities (such as power generation and other utilities), and in which government assistance to, or takeovers of, privately-owned industries is a recent phenomenon.

A more important factor may be that government locational decisions can not be adequately dealt with by existing theory. This is an important question which warrants examination.

THE ADEQUACY OF EXISTING THEORY

The tenets of traditional theory have been developed to be applicable to the environment within which the individual entrepreneur makes his decisions. Government location decision-making, however, takes place in an entirely different environment because of differences in scale and differences in location aims.

Large scale and monopoly aspects

The total expenditure controlled by government in any area is usually far greater than that of the largest firm. The total impact of its location decisions should therefore justify special consideration of government as a unique case.[1]

Existing location theory has not, however, ignored those decision makers who can significantly influence the total economic activity of a region. Recent studies such as that of Krumme (1969) which have examined large companies and which have been designed to contribute toward a behavioural theory of the firm are evidence of this.

The scale of even big firms is, nevertheless, much different to the scale on which governments make their decisions. Only the largest corporations have to decide on the sites of more than a handful of factories, whereas a government can influence the location of many plants. In effect, governments are in the position of a monopolist who must optimize the sum total of many separate plant location decisions.

The only kind of monopoly considered by present location models is the one plant type, which arises from the friction of distance on demand (Lösch type) or supply (Weber type). Economic theory suggests, however, that the aggregate of the single location decisions of such monopolists may produce a different pattern to that associated with the same number of decisions made by one government.

Consider, for example, government assistance to firms which locate in selected areas. Suppose that the criterion for the selection of firms was the ability to repay a certain rate of interest on assistance, the same criterion as it would be if the firms were financed by private sector institutions. Firms could be arranged in order according to the rate of interest they could pay. In Figure 1.1, A represents the firm able to pay the highest interest rate of r and B represents the lowest paying firm which is only able to repay a rate s. Suppose that private financial institutions and the government are willing to finance firms down to C and D respectively. The government monopoly is demand-induced, with firms' ability to repay different rates of interest notionally equivalent to different rates of return. The government will attempt to equalize marginal cost (MC) and marginal revenue (MR) (Robinson, 1933), where revenue here is taken to include social benefits. This is illustrated in Figure 1.2. The x axis represents the number of firms assisted,

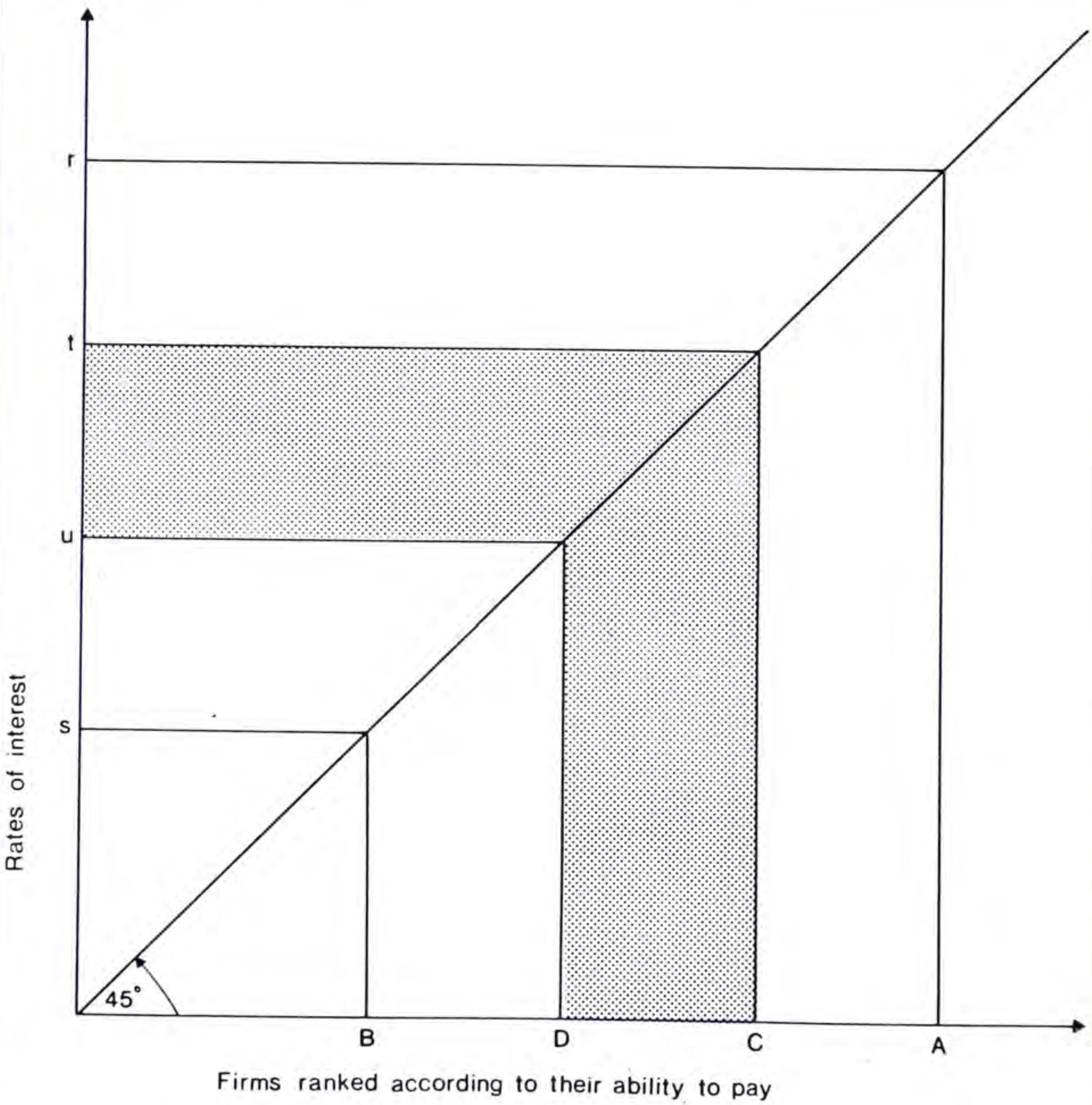

Figure 1.1 Identification of Firms subject to Influence of Government Assistance

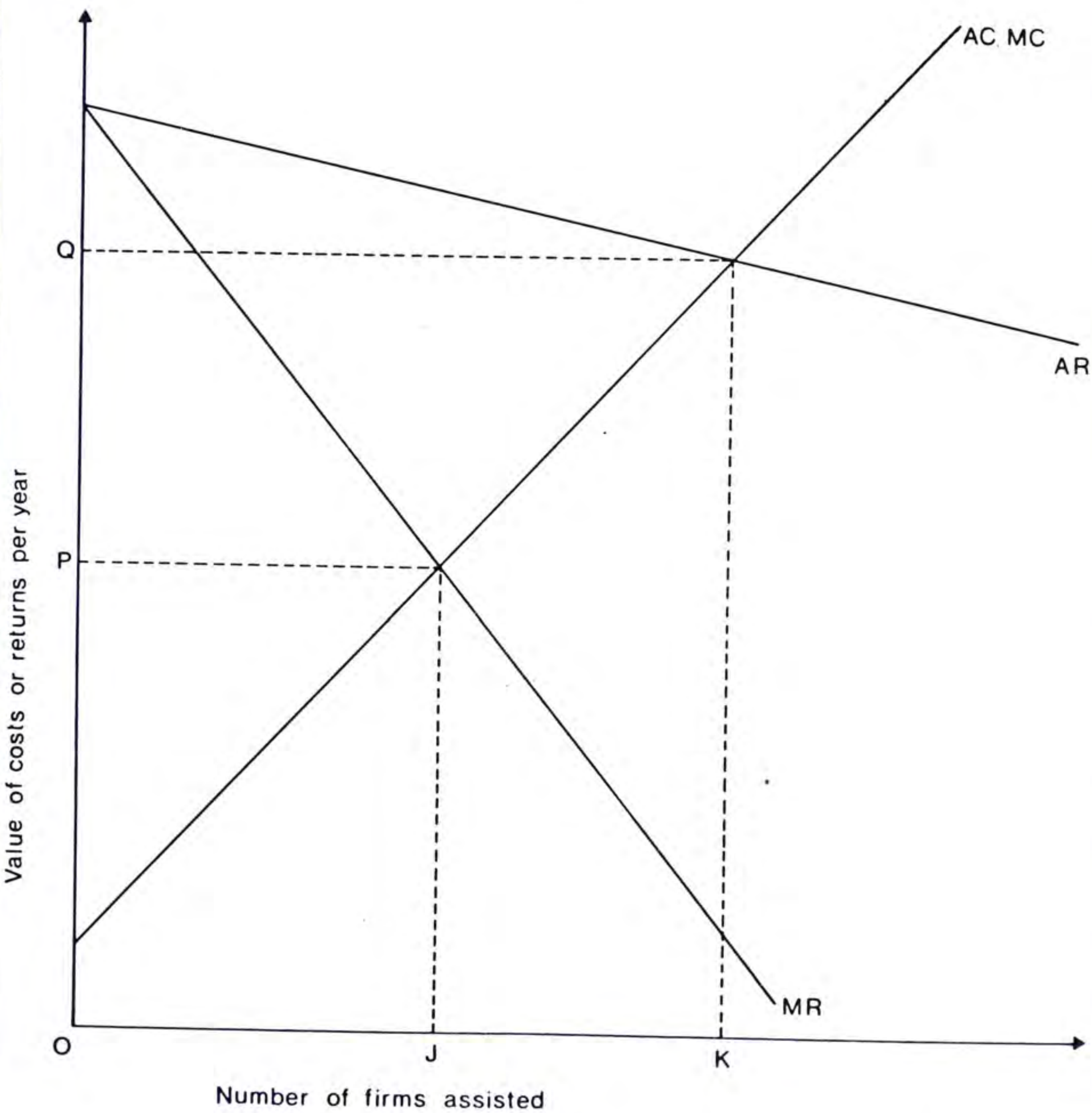

Figure 1.2 Effect of Government Monopoly on Number of Firms Assisted

the y axis the costs or returns per firm, and AC and AR respectively the average cost of finance to, and return from, assisted firms.

Since the monopoly has not arisen through supply considerations, AC equals MC. However, the monopoly over revenue (demand) means that, unlike the perfect competition case, MR is less than AR. Maximum returns will occur when MR equals MC, that is, at P. The number of firms assisted will therefore be OJ. If, on the other hand, a number of competing private financial institutions had been willing to accept the same rate of return as the government, MR would become equal to AR, and maximum returns would have occurred at Q. The number of firms receiving finance would have been OK, an increase of JK over the government monopoly case. (Strictly speaking the conditions represented in Figure 1.1 should involve no change in the total number of firms assisted if the acceptance of risk is the same for private institutions and the government, but Figure 1.1 is merely intended to illustrate the general situation in which a monopoly may arise through different risk preferences.) The firms represented by OK may have had monopolies over their markets. But as the above example shows, their ultimate ability to set up a new factory may depend on whether or not monopolistic conditions prevail in their sources of supply (including finance supply). If the firms represented by DC in Figure 1.1 are in different locations, as is likely, the government becomes a monopolist in respect to a series of decisions which have a spatial impact.

A consequence of the monopolist opportunity to maximize returns by adopting marginal, rather than average, revenue policy is the possibility that arises for governments to adopt policies that are selective, spatially and otherwise. Firms yielding high social benefits because of locations in particularly depressed areas can be assisted to a greater extent than other firms because there are no competing sources of finance ready to offer funds on equally attractive terms in non-depressed areas.

But there is a potential complication. The final outcome may be different if DC represents the various plants of a single firm. This firm therefore has a monopoly demand over finance available at interest rates from U to T. In this situation, with monopolists on both supply and demand sides (monopsony), the ultimate outcome will depend on bargaining. In terms of Figure 1.2, with the x axis interpreted as the amount of finance provided, funds totalling between OJ and OK will be supplied, the exact amount depending on the bargaining strength of each side. The deals between Australian state governments and various companies on the siting of aluminium smelters appear to contain elements of this situation, with power supplies instead of finance in general being the central issue. The monopoly position of governments is more absolute if industrial locations are influenced by regulations rather than incentives, since bargaining is made much less possible.

One further aspect of the scale at which government location decision-making operates is that specialised location decision administrative units are possible. Within these, location decisions can be made as a matter of routine and thus become "programmed" in the sense referred to earlier. While some very large companies may approach this situation, in making a large number of decisions (Rees, 1972), the great majority of private industrial location decisions involve a lack of precedent and a high degree of uncertainty (Townroe, 1973). It is around such "unprogrammed" decision situations that the more recent (private) industrial location decision models have been structured (for example, Lloyd and Dicken, 1972).

Differences in location aims

The second reason why existing theory is not adequate to analyse government decision-making is that the aims of the public sector contrast with those of the firm, the focus of present location theory. The aims of firms and governments will be discussed in turn to help show up the contrasts.

Traditional spatial theories have assumed that firms have the attributes of "economic man" who has perfect foresight and powers of computation and reasoning, and who aims solely at maximizing profits. In reality, firms may decide to locate for reasons other than profits, as suggested by the large number of possible goals of the firm mentioned by Johnsen (1968). However, perhaps the most frequently cited non-profit goal, that of increased growth, has recently been proposed as necessarily being tied to the search for profits, since profits are necessary for growth (Aaronovitch and Sawyer, 1975). More generally, Tiebout has shown that the predictions of (profit) maximization models may still be in accordance with reality because poorly located firms tend to go out of business, so that optimal patterns evolve as a product of economic forces (Tiebout, 1957). Webber has noted other arguments supporting the notion that existing location theory based on the aim of maximum profit of some kind or other still provides an adequate prediction of the location of firms (Webber, 1969), provided search costs are taken into account. Whether such views are accepted or whether the multi-goal theories of Greenhut (1956) or Isard (1969) are preferred, location theories of the firm are all necessarily capitalistic in that they are centred around objectives which enhance the owners or managers in some way.

Government location decisions, on the other hand, are associated with an entirely different aim, the maximization of social welfare (Musgrave, 1959). This differs from the operational goals of the firm in large part because of the existence of so-called public goods (such as roads, public parks, etc.) which are only, or are most efficiently, provided on a socially collective basis. The other main reason is that social welfare is also concerned with the distribution of goods, services and resources throughout the community. This distributional concern is most commonly directed at achieving a more equal distribution of personal incomes. Redistributive government action may also be needed because the free market system is not just inequitable, but socially inefficient. For example, government intervention may be necessary because the social costs of urban concentration are not reflected in firms' cost functions: entrepreneurs are able to internalize external economies of agglomeration while not internalizing many concomitant diseconomies (Hansen, 1968, 14). This conflict of public and private sector aims results in a divergence of social and private patterns of optimal spatial allocation.

Besides pointing to the need for a separate theory of government industrial location decisions, the arguments of this section have several implications for the structure of such a theory. Before discussing these, however, the implications of existing theories and ideas on location decision-making of the firm need to be analysed. The latter seem an appropriate place to start since there are now fairly well-developed theoretical and empirical constructs of the location decision process of firms, while the elements common to organizations in general (March and Simon, 1958), whether government or private, suggest that these constructs may have some relevance for government location theory.

IMPLICATIONS ARISING FROM EXISTING LOCATION DECISION THEORY

Existing location decision theory provides several pointers to elements of potential relevance for a theory of government industrial location. Each will be discussed in turn in this section. It is convenient here to also include relevant aspects of general decision-making analyses which are not specifically spatial, although most such analyses mentioned below have actually featured in some part of the geographic literature.

Bounded rationality

It has been recognised for some time that the "economic man" assumptions of traditional theories, locational and otherwise, of firms' behaviour are not met in the real world. Perhaps the most comprehensive and widely used alternative model of organizational behaviour is Simon's (1957b) bounded rationality model. The relevance of this model to locational decision-making was initially demonstrated by Wolpert (1964). Since then it has been widely applied in spatial decision analyses, with Rees' (1972) study in particular illustrating its applicability to location decision-making in large organizations.

Simon asserts that decision makers mentally construct a simplified (bounded) model of the real world because of their limited reasoning and computational powers and stock of knowledge (Simon, 1957b, 198). Within this subjectively bounded environment, alternatives are assessed as merely satisfactory or unsatisfactory, depending on the decision maker's aspiration level (Pred, 1967, 28). Failure to find any satisfactory alternatives leads to either a search for alternatives over a wider area, or to a lowering of aspiration levels.

A particular advantage of the model is that organizational objectives can be allowed to vary. Wolpert (1964) and Harvey (1969b) among geographic contributions on the subject, recognized that the satisficing concept could encompass non-profit aspects of location decisions, such as leisure time availability. More generally, in Simon's model decision makers differentiate between courses of action with regard to expected utility as a whole (including the disutility of the friction of adaption and change). Isard and Smith, by demonstrating that satisficing is a special binary classification case of optimizing (Isard, 1969, 209-210), in effect indicate that the bounded rationality model is compatible with the generally held view that all decision makers act so as to maximize their expected utility (Webber, 1972, 88-116). Hence the model appears to have a general validity in this respect to decision-making within organizations, whether government or not.[2]

In view of its potential applicability to government decision-making, the bounded rationality model is tested in this study in Chapter 7 (routine decisions) and Chapter 8 (non-routine decisions). At the same time, however, it should be recognized that much of the widespread application of this model to decision-making may simply be because it is the most comprehensive alternative to the "economic man" framework. It may be that modifications of normative location theory to take account of its most unrealistic assumptions would provide just as adequate a framework as the full bounded rationality model. Webber's (1969) suggested normative modification, that firms may maximize expected profits subject to available information, seems particularly worth pursuing. This "semi-normative" decision framework is therefore also tested in this study in Chapters 4 to 6, substituting expected social utility for Webber's expected profits to take account of the different nature of government goals.

Within these possible frameworks, however, there are several matters which deserve particular attention. These are the treatment of uncertainty and the related problem of interdependence, and the handling of time and related aspects. Each is surveyed in turn.

Uncertainty

The foregoing discussion has indicated that organizational goals are better couched in terms of expected utility (whether expected profits or not) than some absolute, objective measure of utility. This is a result of the existence of uncertainty in the real world (Webber, 1972, 88-116; Marschak and Radner, 1972, 44), a factor not allowed for by normative location theory.

It is convenient at this point to list the three types of uncertainty defined by Arrow (1958, 7):

(1) uncertainty involving objective probabilities;

(2) uncertainty involving subjective probabilities; and

(3) situations in which no probabilities can be adduced.[3]

Type (1) is the basis of traditional formal statistical decision theory. It has been applied widely to general problems of economic analysis (for example, Tisdell, 1968), although not to purely spatial decision problems. Apart from the availability of suitable data, the central problem of this approach for locational analysis is that decision makers are not trained in the theory and interpretation of probability to the extent required to implement full objective probability models (Stafford, 1972, 201). Indeed, some aspects of such models seem to call for greater computational capacity than does the certainty environment of normative economic man models. For example, the programming model of Charnes and Cooper (1963), which is designed to replicate satisficing under conditions of (objective) uncertainty, requires a knowledge of advanced mathematics to iterate.

The reformulation of probability in subjective terms (type (2) uncertainty) appears to overcome many of the problems of objective probability models in this regard. The most well developed framework here is Bayesian decision theory, which describes how subjective probability changes as a result of experience (Harvey, 1969a,249-250). There is evidence that in actual decision situations, however, Bayes' theorem is not followed: less information than required by the theorem is in fact extracted (Edwards and Tversky, 1967, 123). Moreover, subjective probability models in general appear to be difficult to calibrate empirically unless experimental testing conditions are possible, and this is usually not the case for organizations, least of all governments.

In this study the possibility that both types of probability are criteria for government decisions is tested in relation to programmed decisions (but not non-programmed decisions, since differences from one decision to the next would not allow much useful probability information to emerge). Both types of probability are tested as part of the semi-normative analysis in Chapters 4, 5 and 6, while subjective probability is also dealt with in the non-normative analysis in Chapter 7. Despite the probable inapplicability of the former as a criterion in practice, testing is justified by the prominence given to this approach in texts on economic allocation under uncertainty, representing what was probably the first attempt (apart from relaxing the assumption of profit maximization as the firm's only goal) to modify traditional normative theory based on the attributes of economic man.

Lack of data has precluded testing of the Bayesian approach to subjective probability. A simpler approach, and one which is closer to the stated decision criteria in the study case, has been used. This involves the use of selected deterministic, subjective surrogates, for which data are readily available, for the probability of achieving a given level of social utility. This approach seems to have been virtually unused in studies of spatial decision-making, although Webber (1972, 212 and 220) has used a surrogate method to characterize uncertainty in an analysis of spatial decision-making in aggregate.

Geographers have given greater attention to type (3) uncertainty, in which there is neither objective nor subjective information on probability, than they have to uncertainty in which such information is available. In industrial geography, this probably stems from the unique nature of most location decisions. Perhaps the only definitive model of decision-making under this type of uncertainty is game theory. The model is a flexible one, and can incorporate various objectives ranging from payoff maximization to failure or regret avoidance (Prentice, 1975, 163). It has now been widely accepted by geographers as a tool for explaining decisions under uncertainty (for example, Gould, 1963; Abler, Adams and Gould, 1971; Found, 1971).

Game theory has, however, been subject to several criticisms relevant to organizational decisions.

Simon (1959) claims that its use requires great cognitive power on the part of decision makers, a line of attack also noted above regarding the more complex forms of probabilistic uncertainty. This point is related to another criticism, that the use of game theory requires a prior phase in which decision makers must learn properly to assess a game theory problem and acceptable strategies (Harvey, 1966; Prentice, 1975). In regard to the social welfare decisions of prime concern here, game theory notions can be used in linear programming to define certain inferior solutions for particular decision environments, but are not able to identify which of the solutions not rejected should be chosen (Arrow, 1958, 7-8).

Originally, game theory was conceived for situations in which the payoffs resulting from various strategies of a particular decision maker could be affected by the strategies of other decision makers, specifically in situations of bargaining. Subsequently the theory's applicability was seen to extend to situations in which payoffs are influenced by randomly expected states of the general decision environment, or "nature" (Gould's (1963) paper was the first spatial application of this wider interpretation). Since governments may generally have a monopolistic bargaining position when involved in industrial location decisions, as outlined earlier, the second, wider application of the theory is likely to be more relevant for governmental decisions. It is this second approach which is applied in the present study (Chapter 5). Programmed rather than non-programmed decisions are the focus of the application, since the necessity of having expectations about minimum or maximum payoff values (as required by several game theory stratagems), for example, seems more likely to be satisfied in programmed decisions. This is because of the greater similarity of previously experienced decision situations to the decision in question in programmed decisions. The original application of game theory, involving actual bargaining with other decision makers, has been particularly criticized as presenting too structured a model of the actual decision process (Prentice, 1975). Preplay bargaining, for example, is possible here, whereas this difficulty does not arise where "nature" is the opponent. Where bargaining cases are analysed in this study (Chapter 8), a looser framework, testing a range of possible explanatory variables, is used.

Even if game theory is applied just to non-bargaining situations, its tight structure still presents problems in regard to real world decisions. In particular, the number of relevant possible states of nature perceived by the decision maker may not only be quite large, but difficult for the researcher to identify after the event. Applications of game theory in this regard have usually been limited to consideration of only two or three basic states of nature, such as flood and no flood, or drought and no drought (for example, Gould, 1963). By contrast, the relevant possible decision states in the choice of industrial locations by governments seem likely to be rather greater in number, or at any rate less obvious. In practice, however, the only relevant states of nature may be those which yield, for a particular action, the maximum and minimum payoff values since these are the values required to implement the more prominent game theory strategies such as maximin and maximax (for example, Luce and Raiffa, 1958). Within a semi-normative framework, maximum and minimum values could be derived from the probability distributions of action criteria. Thus the semi-normative analysis in this study uses such values as a basis for testing the applicability of the principal game theory strategies to the government location decisions being studied.

This discussion of the role of game theory has brought out the fact that interdependence between producers, often resulting in bargaining, can be an important source of uncertainty in industrial location decisions. This interdependence, as Massey (1974) notes, has been examined either through market area analysis (for instance, Hyson and Hyson, 1950) or by a game theory type of approach (as in Hotelling, 1929, and Stevens, 1961). For government industrial location decisions, interdependence has two aspects.

The first is that, in influencing the

decisions of particular producers, the resulting effects on location decisions in general, both government and private, need to be taken into account. To the extent that these go beyond the normal supply and demand considerations of individual producers, the analytical framework for the location decisions of governments needs to be wider than that of existing industrial location theory. An analysis of the potential multiplier effects arising from such interdependence is carried out in Chapter 4 as part of the semi-normative model.[4]

The second aspect of interdependence here is that there may be interdependencies between different governments, equivalent to those between firms, which affect the formulation of location policies by particular governments. Virtually no study has been made of this topic, even in situations (such as the growth centre programme in Australia) in which location policy is constitutionally the responsibility of one level of government and the funding of such policy comes substantially from a higher level. An exception to this neglect is the discussion of Isard (1969, 830-833), who has suggested a framework for determining the outcome of interdependent situations in political space. While lack of data is obviously a prime reason for the absence of empirical studies in this connection, the present investigation omits such an analysis because this kind of interdependence did not appear to be a factor in influencing the spatial pattern being studied.

The various frameworks discussed above (including game theory) for handling interdependence and other types of uncertainty are, however, largely static, whereas the government location decision process may frequently need to be seen in dynamic terms. The potential significance here of a period in which acceptable actions are learned has already been noted. The importance of a cognitive approach therefore highlights the role of time in the decision process.

<u>Time</u>

The importance of time in spatial decision processes has become increasingly accepted, in large part because of a recognition that the behavioural approach to decision-making requires consideration of learning processes. While the joint operation of changing preference functions and changing spatial opportunities can make the task of modelling time in location decisions a difficult one (Louvière, 1975, 317-318), some success has been achieved in applying psychological learning models (particularly the Bush and Mosteller (1955) models) to spatial choice situations confronting individuals (Golledge and Brown, 1967; Golledge, 1970), although not (as yet) organizations. Such models are most applicable to programmed decisions (such as the shopping location decision), since these are more routine in nature and involve a high degree of precedent.

The learning in these models is made implicitly in reference to a constant environment and personal goal structure, but as Louvière's observation suggests these factors are not necessarily constant over time. The relaxation of the economic man assumptions to include in models only information that is actually available to the decision maker, as previously described, would seem to allow in part for perceived changes in the external decision environment. The joint modelling of learning on the one hand and dynamically changing goals on the other, however, requires a separate operation. Even the most advanced spatial learning models (for example, Burnett, 1973) have not embraced the question of secular changes in preference structures. The latter, in the form of non-constant social welfare preferences, is conceivably of greater importance in the overall government decision-making process than the best way to implement given social goals. The present study therefore tests whether changes over time in the programmed decision pattern of the government have in fact been significantly influenced by corresponding time changes in the importance of goals.

However, the importance of time, via a learning process, may also be evident in non-programmed spatial decisions, although theoretical and empirical support here is not as strong. One possibility in this connection is that the decisions to introduce new goals or new programme strategies, which provide the framework for programmed decisions, may themselves have been brought about through learning experience of implementing previous goals or strategies. This is in fact suggested in Simon's bounded rationality model, whereby alterations to aspiration levels are one response to failure to achieve existing aspiration benchmarks. The analysis of changes in government decentralisation policy in Chapter 8 thus considers the applicability of such a learning response.

The assumption of utility maximization

It is appropriate at this point to turn to an aspect of spatial decision theory which, although crucial, has nevertheless received less critical attention from geographers than uncertainty or time. At the heart of current theories and models of spatial decisions is the assumption that decision makers act so as to maximize their expected utility (for example, Webber, 1972, 105). For governmental behaviour, this is equivalent to maximazing expected social utility. Isard and Smith (Isard, 1969, 209-210) have shown that this assumption can incorporate the seemingly incompatible notion of satisficing, if the latter is seen as a process of binary-valued utility classification.

Stemming from this idea of utility maximization is the concept, deriving from micro-economic theory, that it is the maximization of an appropriate utility function which determines the decision pattern of an individual or organization. The utility function, explicit or implicit, of a decision maker combines his preferences for different goals together in a manner which reflects their influence on his actions. It follows that in the case of governments, the concept corresponds to maximization of a social welfare function. This is now being seen by some geographers (such as Smith, 1975) as fundamental to understanding the spatial decision patterns of governments. In practice, though, as discussed in Chapter 3, the theoretical conditions necessary for government decision makers' utility functions to be equivalent to social welfare functions are not likely to be realized. Nevertheless, the hypothesis that government decision makers act in programmed decisions according to an implicit utility function, even if this is not the same as a social welfare function (see page 73), is implied in existing theories of decision-making. The absence of a utility or preference function would suggest a change in preferences with each new decision. This is *a priori* unlikely in the programmed situation of frequent decisions of the one type, except insofar as there may be a consistent, measurable change over time (as discussed in the previous section). A further, partial exception is suggested by the so-called random utility model (Dalvi, 1978, 91), in which the utility of each decision has two elements: one which is common to a group of decisions, and another which varies randomly from decision to decision. The notion of a preference function is still valid in such a situation, even though it does not embrace the full variation between decisions. The empirical derivation of such functions, using a "revealed preference" approach (c.f. Rushton, 1969), forms the main line of attack - as part of the development of the basic model described in Chapter 3 - to explain and predict the pattern of programmed decisions made in the New South Wales decentralisation programme.

The assumption, however, that utility functions are a necessary corollary of utility preferences may be questionable. It has been pointed out (Isard, 1969, 305-306), for example, that it is possible to have lexicographic preference orderings, which are not compatible with the simultaneous trading off of preferences required if a utility function is to be constructed. A lexicographic ordering occurs when one decision criterion is always dominant over one or more alternative criteria in determining the action to be taken. More generally, the decision process may be characterized by separate consideration of successive criteria. Thus real world decision makers tend to handle uncertainty and simultaneously acting variables by considering each major component separately and in turn (Stafford, 1972, 213). This notion is used in the final synthesis of the programmed decision process carried out in Chapter 10.

Intra-organizational factors

The literature on organizational decision-making points to the importance of distinguishing between organizations and individuals as decision-making units. This arises largely because organizations are an aggregate of a number of individuals. Only in the smallest organizations does just one of its personnel have freedom of choice in decision-making in the manner of the individual, non-organizational decision maker. For all other organizations (including probably all government departments and authorities), decisions will be shaped not only by the decision makers' personal characteristics, but also by the purely organizational characteristics of dividing steps in the decision and action cycle among different persons, and the need for conflict-controlling and consensus-creating mechanisms (Downs, 1967).

Personal attributes are important in the first place because individuals come into an organization with a prior set of preferences (deriving from the influence of outside "reference" groups) which can thereby lead to a multiplicity of organizational goals (Pred, 1967, 57-61). The maintenance of individual goal differences is in turn greater, the less subjectively operational are the overall goals within the organization and the greater the "organizational slack"[5] (March and Simon, 1958, 125-126). Another important type of organizational conflict arises from personal differences in perceptions of reality (March and Simon, 1958, 127-129). Such differences tend to be promoted by a large number of independent information sources and the transmission of information to a limited number of personnel.

The nature of the personal attributes which can initiate these variations in goals and perceptions are wide-ranging, among the most important being the character of personal information fields, position in the life cycle, education level, and past experience (Pred, 1967; March and Simon, 1958). Sonnenfeld (1966 and 1967) proposes that the most useful comparison for studies of spatial preferences and perceptions is between natives and non-natives of an area. The critical importance of personality and attitude variables in determining choice has been noted by a number of authors (such as Cattell, 1965; Isard, 1969, 822-823; and Irving, 1975).

Such inter-personal differences within an organization can, given suitable personal strategies, lead to bargaining and the formation of coalitions of individuals to strengthen the chances of achieving desired goals. Isard and Smith (Isard, 1969) point out that two main themes underlie coalition concepts. The first relates to the normative aspects of interdependent behaviour, such as the principles of split-the-difference and parity-norm (payoff proportionate to relative contribution to the coalition). The second theme relates to concepts which focus on strategic aspects, such as sequential coalition formation, or fixed versus variable threat reference points.[6] Regardless of whether coalitions are formed, however, individual decision makers in the most powerful positions within an organization may always dominate the final choice (O'Riordan, 1971, 117). Commonly, this will reflect an official position at the top of the administrative hierarchy, although where location decisions are infrequent the question of who really motivates the end choice may not be so obvious (c.f. Rees, 1972). Within the field of government, the relative influence of the departmental head and the responsible minister will critically influence the type of decisions made. The parameters of this influence will be at least partly set by the extent to which the particular system encourages the emergence of politicized bureaucrats (Putnam, 1973). For a particular decision, the relative influence of a minister and his department will vary with the technicality of the subject and the strength of an existing departmental view, for example, as well as the political sensitivity of the matter and the Minister's personal attributes (Razzell, 1976).

The question of who has the most influence on decisions suggests that the internal organizational structure itself may influence the kinds of decisions that are made. Geographers have, for example, recently begun to study the locational implications of a (spatially) centralized industrial management structure, which gives rise to a branch plant pattern, compared with the consequences of more autonomous, decentralised management (Westaway, 1974; Townroe, 1975). The analysis of the spatial pattern of decision authority is likely to be especially important in the case of governments for, as Isard and Tung (Isard, 1969, 96) point out, the dominant locational cost differences here are likely to be decision-making costs, with traditional cost differences such as transport and labour of negligible importance. Variations in the spatial structure of organizations could influence the spatial pattern of decisions in several ways, such as a bias against more remote projects caused by a centralized structure (noted in the Russian case by Hamilton, 1973), or a variation in locational criteria occurring in decentralised organizations. Similarly, a structure in which the search, analysis and evaluation phases of the decision process are separated may cause each official to press his own needs, and result in a central search agency exaggerating expensive and extensive forms of search and analysis to be carried out by its own personnel (Downs, 1967). In the government situation, the extent to which the decisions of particular agencies and departments are subject to wider influences within the government as a whole, via inter-departmental committees and the like, may be significant.

In analysing a single organization, an assessment of the influence of structural factors is necessarily limited unless changes over a lengthy time period can be studied. Consequently the present investigation concentrates on the effects of one structural feature that does not require such secular analysis: the position of decision makers within the administrative hierarchy. The personal variables whose influence is investigated are necessarily limited to those attributes that do not require the extensive psychometric testing that is extremely difficult for outsiders to be allowed to conduct on government personnel.

IMPLICATIONS ARISING FROM THE DISTINCTIVENESS OF GOVERNMENT ACTIVITIES

The preceding discussion has surveyed the implications for government location theory of existing models and theories of spatial decision-making in firms and organizations in general. However, as shown earlier in the chapter, governmental decisions differ in several important ways from private sector decisions, so that theories of government decision-making also require that this distinctiveness be taken into account. The importance for the required theory of various elements of this distinctiveness has already been noted at certain points in the above analysis of relevant themes from general decision theory. The most significant of these elements is undoubtedly the fact that governments aim to maximize the welfare of society as a whole, and not just a small part of society as in the private sector. The implications of at least three aspects of this difference are worth exploring here.

Interdependence with society

The first of these aspects is that government decision criteria and processes are subject to direct modification through representations from groups within the community, as well as through the internal processes (such as using aspiration levels as benchmarks) by which changes take place within firms. While private firms are not free from attempts by the social environment to dominate their goals, the social pressure on governments is much stronger (Newell, 1968, 54). This general external interdependence means that government decision-making takes place in a "turbulent" environment (Walmsley, 1973) in which no section of society can be taken as given. Suitable strategies are learned by a vicarious trial and error process. This interdependency with society at large must therefore be recognized in a theory of government location decisions. It would, for example, add to the bounded rationality model the notion that goals could be modified without any reference to aspiration levels. The forces fostering interdependency may obviously be in contradiction with the forces giving rise to a government position of monopoly mentioned earlier.

This introduces a current debate within the social sciences about the nature and extent of this interdependency with society. At one end of the spectrum is the "economism" concept that the economic system, or some elite group within it, determines government activity, as exemplified by Galbraith's view that corporate industry is able to impose its own political goals on the state in western countries (Hall, 1977, 147). The opposite approach stresses the "relative autonomy" of governments from the economy, as represented in spatial terms in the work of Castells (1976). Other alternative theories of the state (see Dear and Clark, 1978, 174) can be placed along this spectrum, the traditional view of government as an agent of social welfare maximization being somewhere in the middle. Dear and Clark (1978), drawing on Habermas (1976), see a synthesis of these conflicting approaches, in which the state is regarded as an input-output mechanism, having its own functions and objectives and at the same time being part of society's wider set of power relations, as a valid model for examining government's role. Day (1978) goes further and argues that the dynamic of the relationship between the government and other elements of society should be seen in terms of a dialectic, in which the government is at once in unity and conflict with those elements. As a result of the conflict, the government 'interferes' with the other elements in order to strengthen its unity with them, producing interpenetration. This framework could have value in analysing government regional development policies, in which the conflict between capitalist and socially optimal patterns of economic activity is the rationale of such policies, but which operate via financial incentives in unison with the private sector goal of profit maximization.

The specific mechanisms by which government and the rest of society interact are not, however, self-evident from these views of the nature of the state. A full theory of government location decisions needs to incorporate a realistic mechanism through which this interdependence can operate. The most comprehensive such operative framework so far developed is that of Wolpert (1968, 1970). He envisages that the pressures exerted by community groups can be regarded as posing a threat to public sector decision makers, who thereby respond in various stages to reduce the stress to which they now feel subjected. O'Riordan (1971, 115), following Kasperson, notes that whether community pressures actually result in mollifying political action depends on the stress-intensity perception. This is greater when stress becomes manifest rapidly and when powerful public opinion is mobilized. The support of members of parliament may be particularly effective here, because of the wider threat posed to the minister by the possibility that the matter may be debated in parliament.

Vagueness of goals and criteria

The second relevant aspect of the wider

social welfare objective held by governments is that public sector goals and decision criteria are vaguer and less quantifiable than those of private organizations. In part this is due to the different nature of public and private goods. It is also the result of the much greater number of competing interest groups with which governments must contend (Arrow, 1964) (traditionally, only two such groups have been mooted in the case of the firm: management and shareholders). In a celebrated theorem Arrow (1951) has shown that when individual preferences differ, there is no unique solution to the problem of combining these into a social welfare function. The consequent existence of a number of equally plausible welfare strategies, each preferred by different groups, would obviously tend to favour the emergence of diffuse, rather than specific, goals which are acceptable to more than one group. O'Riordan (1971, 110-111) has cited a number of resource management examples to demonstrate that the aims of public policy in this field are indeed generally vague and confused.

This vagueness will probably be reflected in the decision process itself. There is likely to be, for example, a strong reliance on decision precedents. This would be helped by the fact that public attitudes shift very slowly (O'Riordan, 1971, 111). Part of the decision process may in fact represent an attempt to create vagueness and generality in an attempt to obfuscate pressure groups and remove the stress they generate (Seley and Wolpert, in Cox and Reynolds, 1974).

Bureaucratic independence

This last comment hints at a further element arising from the distinctiveness of government objectives: the opportunities for bureaucrats to pursue their own goals because of the unique goods and services they provide to society. Perlman (1976, 74-75) argues that consumers of public services do not have many alternatives with which to compare such services, and that the consequent lack of relevant information tends to protect government officials. This leaves them freer than their counterparts in private organizations to maximize their personal utility which, Tullock (1976, 29-30) argues, means making their bureaucracy as large as possible. An example of the locational implications of such behaviour would be the allocation of industrial assistance funds which is larger than socially warranted, leading to greater interference of the pre-existing industrial location pattern. The results of greater bureaucratic protection in the public sector arising from the information barrier are obviously in potential conflict with the results of greater exposure to social demands, and empirical studies seem called for to assess the circumstances in which each is dominant.

In the present study the interdependence aspect of government decision-making is specifically analysed in an examination of the conditions under which private firms achieve gains in bargaining with the government. The role of precedent, raised in the previous paragraph, is central to the later analysis of ways in which government policy changes over time. Finally, the influence of bureaucrats' own utility goals is incorporated by including all potentially significant decision criteria in the empirical calibration of utility functions.

THE STUDY IN OUTLINE

This chapter has examined, firstly, the rationale for a separate theory of government location decisions and secondly, the more important potential elements of such a theory. The subsequent chapters examine the empirical significance of as many of these elements as feasible, using the example of the New South Wales government's decentralisation programme.

In the next chapter a historical background of the decentralisation programme is set out in order to provide factual reference points for the subsequent analytical chapters. Chapter 3 sets out the basic model used to test the applicability of the idea of the maximization of a social utility function, as it applies to programmed decisions. Chapter 4 describes the derivation of values of the employment criteria used in the semi-normative version of the basic model. In the following two chapters these values are used for calibrating and testing the basic model. First, empirical estimates are derived for various forms of the utility function (Chapter 5), and then these empirical forms are used to test the model itself, via linear programming analysis (Chapter 6). Non-normative versions of the utility function are also developed and used to test the model; a "decision rule" extension of the model for non-normative decisions is then investigated, as is the influence of various aspects of the decision environment which are not incorporated in the model (Chapter 7). The next chapter analyses three types of non-programmed decisions: advice to applicant industries concerning desirable locations, bargaining with applicants, and changes in policies over time. Chapter 9 investigates intra-departmental influences on decision-making, including the role of personal attributes and administrative position. The concluding chapter posits a static model of the most important type of decentralisation assistance, based on the results of previous chapters, and also uses these results to suggest the relevance of certain previously neglected aspects of the government location decision process.

Footnotes

1. In New South Wales, for example, Bureau of Census and Statistics figures indicate that the number of factories outside the Sydney Statistical Division and the Newcastle and Wollongong Statistical Districts increased by a net 24 between 1965/66 and 1967/68. During the same period approval was given by the New South Wales Department of Decentralisation and Development for approximately 80 factory loans (excluding loans for extensions of existing factories) to firms in N.S.W. country areas. Although some of these loans were used to finance replacements of old existing factories and also factories smaller than those included in the Statistician's definition, the total does suggest the significance of government assistance in maintaining the overall number of country factories in New South Wales.

2. On one point, however, the structure of the model is not clear. The original concept of a satisfactory action was an action in which each of the decision criteria were themselves satisfactory for that action (March and Simon, 1958). Isard and Smith, on the other hand, see a satisfactory action as being one in which the expected outcome as a whole is satisfactory, regardless of whether this is so for each of the criteria.

3. Strictly speaking types (1) and (2) indicate situations of risk rather than uncertainty, with only type (3) denoting genuine uncertainty. This distinction between risk and uncertainty dates back to Knight (see Webber, 1972, 95).

4. The complexity of the analysis is such that it seems inappropriate to apply it to the more simplified non-normative approach.

5. Cyert and March (1963, 36) define "organizational slack" as "payments (cash and otherwise) to members of the coalition in excess of what is required to maintain the organization".

6. For a full discussion of the concepts mentioned here, see Isard (1969, Chapter 8).

CHAPTER 2

THE EVOLUTION AND STRUCTURE OF THE NEW SOUTH WALES DECENTRALISATION ASSISTANCE PROGRAMME

The programme of the New South Wales Government of providing financial assistance to industries setting up or expanding outside Sydney, Newcastle or Wollongong provides a comprehensive empirical basis for the analysis of factors influencing government location decisions designed to directly alter private sector location patterns. The programme has involved a large number of assistance decisions of a number of types over a fair period of time. These conditions enable the significance of a number of different factors to be analysed in some degree of detail. This is done in subsequent chapters. However, to set the analysis in perspective and enable references to particular policies to be set in context, it is worthwhile first to trace the evolution of the programme from its beginnings up to 1969, the last year for which sample data were collected,[1] and comment on the spatial and sectoral structure of expenditure thus resulting.

The term "decentralisation programme" is here used to describe the state government's measures to provide financial assistance to secondary industries[2] in areas outside Sydney, Newcastle and Wollongong. It does not include the various forms of assistance given to primary industries over the years, since these measures were not primarily a response to the state's centralised pattern of population distribution. Nevertheless, this aid to primary industries often had important consequential effects on population distribution, perhaps best illustrated by the oasis of closer settlement that developed in the Murrumbidgee Irrigation Area following its establishment in the earlier part of this century.

THE THEORETICAL CONTEXT

The theoretical context within which governments are able to use one type of incentive, low interest loans, to influence private industrial location decisions has already been outlined in Chapter 1. It is useful at this point, however, to provide a very brief theoretical perspective to the particular context of the New South Wales decentralisation programme.

A stylized representation of the way in which the programme influences industrial location patterns is shown in Figure 2.1. The marginal revenue (MR) of firms is assumed, for illustrative purposes, to be constant as distance from the metropolitan area (Sydney) increases. Firms' marginal costs (MC), on the other hand, are assumed to increase with greater metropolitan distance. This is the result of increasing freight costs, arising from the fact that the metropolitan area represents the main market and the chief source of industrial components and materials (apart from raw materials, whose cost generally varies fairly randomly with metropolitan distance).[3]

The result of rising marginal costs is that beyond A, marginal costs exceed marginal revenue and, under laissez-faire conditions, no industrial activity

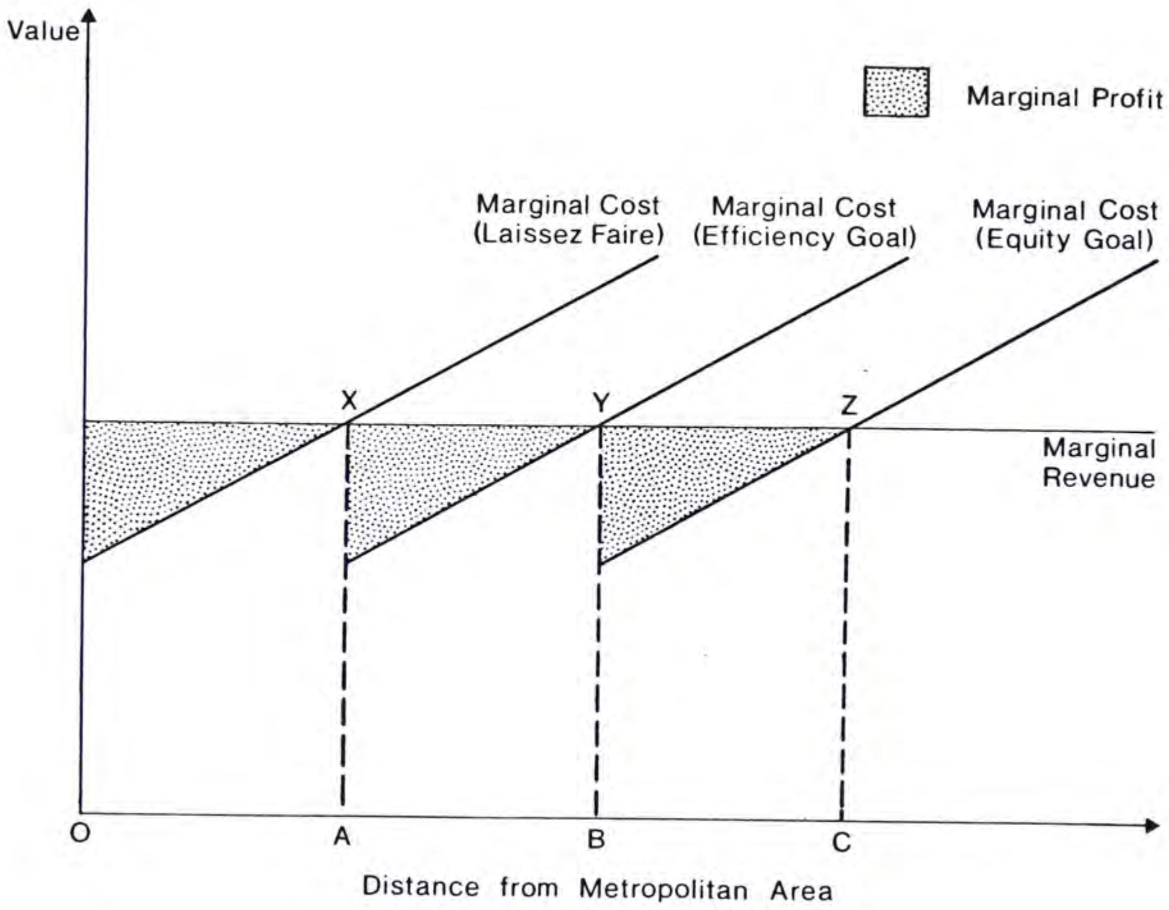

Figure 2.1 Spatial Impact of Government Assistance on Marginal Costs and Profitability

would occur. With the introduction of decentralisation assistance, however, firms' costs beyond A are subsidized. The resultant lowering of marginal cost curves enables industry to commence activities and make profits as far out as B, beyond which marginal costs again exceed marginal revenue.

The application of assistance at a standard rate in all areas beyond A will have the effect of causing producers to locate at the most profitable point beyond A (assuming profit maximization as the firm's chief goal). Thus a standard rate policy will be compatible with the goal of maximizing the programme's efficiency, in the sense that the location pattern which maximizes the profits of assisted firms will probably also maximize total production and employment. However, the decentralisation programme is a discretionary one, allowing assistance levels to be varied according to the degree of social benefit conferred by each project. Thus incentives applying to particularly depressed areas can be set at higher levels to attract more projects - this is an equity goal. If such areas are more remote from the metropolitan area, arising from the high production costs of such locations, then the effect of higher incentives is to spatially extend the area of industrial production. In Figure 2.1, the lowering of marginal costs by higher assistance rates in depressed areas beyond B allows profitable production as far out as C. Location C will not necessarily coincide with the state boundary, as beyond this point the costs of attracting industry may outweigh the social benefits therefrom. The decentralization programme's lack of success in the isolated maximum assistance area of Broken Hill (Far Western region), noted in the final section of this chapter, perhaps indicates this point.

Having set the theoretical framework within which the decentralisation programme has developed, the following section describes the evolution of the programme structure itself.

THE EVOLUTION OF THE PROGRAMME

This section gives a brief history of the decentralisation programme. Deeper consideration of the organizational and environmental factors underlying the more recent changes, however, is left until Chapter 8.

The programme up to 1958

The beginnings of the decentralisation programme appear to date back to the start of the Second World War, following a long period in which the state's population had become increasingly centralized in Sydney. Between the 1901 and 1933 population censuses, for example, the percentage of New South Wales' population living in Sydney had increased from 35.6 to 47.5.[4] By 1939 there was a Development and Information Committee, comprising officers of relevant state government departments. It came under the aegis of the Development and Information Bureau of the Department of Labour and Industry and considered applications from country industries for rail freight subsidies. Recommendations from the Bureau were considered by the Committee, which in turn made recommendations to the

Minister for Labour and Industry. The first freight subsidy recorded in the annual reports of the New South Wales Auditor-General was £80 paid to a fellmongering business in Bathurst in 1939/40. In 1940/41, freight subsidies on the manufacture of flour by-products were also paid. During the rest of the war, subsidies were extended to the country manufacture of other cereal products, and to processed metal production associated with the war effort. After the war, rail freight subsidies were extended to a range of secondary industries. By far the most important in value terms was the assistance given to a large domestic appliance manufacturer at Orange which had set up after the war in a disused munitions factory. Also significant were the subsidies from 1947 onwards for the four country food canneries at Batlow, Leeton, Bathurst and Cowra. The cost of subsidies was generally met either wholly by the state Treasury, or else shared between the Treasury and the Department of Railways.

In 1946, following the end of the war, the Development and Information Bureau was replaced by a Secondary Industries Section within the new Department of Secondary Industries and Building Materials. The Development and Information Committee was correspondingly replaced by the Secondary Industries Committee, later to become the Secondary Industries Inter-Departmental Committee. With the abolition of the Department in 1952, the Secondary Industries Section was transferred to the Premier's Department.

The second phase: 1958-1964

The rail freight subsidies failed to produce significant decentralisation, and in 1958 the scope of the decentralisation programme was considerably broadened. The main action was the establishment of a Decentralisation Fund. The aim of the Fund was to provide assistance to areas of the state outside the County of Cumberland (Sydney) and the cities of Newcastle and Greater Wollongong. It applied to industries which were at a locational disadvantage compared with those in the metropolitan area and which were unable or unwilling to expand without government aid. These criteria have remained as the basic ones for eligibility for decentralisation assistance up to the present time. The types of assistance available from the Fund were:

a) rail freight subsidies on raw materials to reduce or offset the disadvantage incurred because of location in the country, for new or expanding industries supplying local or neighbouring markets with goods normally supplied by metropolitan manufacturers, given during an establishment period of up to five years;

b) rail freight subsidies on the transport of machinery for new or expanding industries where additional employment would result;

c) housing for key personnel (executives, specialist tradesmen, etc) whose employment was essential to the effective operation of the factory,

d) subsidies on the cost of training unskilled labour where this cost would not have arisen in the metropolitan area;

e) subsidies on water and gas charges where these were greater than Sydney charges; and

f) subsidies on the cost of trunk telephone calls.

The rail freight concessions a) and b) were in addition to the concessional rates offered by the Department of Railways for inward and outward country industry goods which had been established over the period from 1939. The subsidy given in each case was the difference between the railways' freight charge from Sydney (or Newcastle, where appropriate) for the item concerned, and the charge using the "Development Freight Rate". The latter was the rate applying to the transport of animal fertilizer, a rate low enough to constitute a reduction of up to 75 per cent on the usual rate. No specific subsidy level was set in the case of d), but within a few years it became standard practice to grant $50 per employee trained. The trunk telephone subsidy was 75 per cent of the cost of calls. To administer the Fund two sections of the Premier's Department - the Secondary Industries Section and the Regional Planning Section - were merged to form the Division of Industrial Development (Department of Decentralisation and Development, 1975, 3).

In 1959 an extension was made to the scope of freight subsidies on raw materials. It was decided that the fabricated products of country engineering works should also be eligible, although the subsidy in such cases was only to apply where the output was forwarded to destinations within a "reasonable" distance of the works, and to the extent necessary to offset any freight advantage of metropolitan manufacturers. The freight rate structure of the state railways, with rates being tapered with distance from Sydney, had meant that freight costs on country engineering products even to local markets were often greater than the cost of railing equivalent items from Sydney or Newcastle. Subsidies over wider markets were not considered warranted as this might have indicated that the production concerned was basically inefficient. Assistance was limited to a maximum of £100 yearly per employee.[5]

In 1960 an important new type of assistance financed from the Fund was introduced. Factory loans at concessional interest rates were made available to industries in Lithgow, Cessnock and Maitland (Figure 2.2), provided finance was not available through normal banking channels. This assistance was designed to counter the reduction in coal mining employment which was occurring in those areas as a result of mechanization. By favouring certain areas, for welfare reasons, the measure marked the introduction of a purely equity objective within the framework of the decentralisation programme.[6]

The new policy of granting loans was to grow into the principal means of decentralisation assistance. The first extension of the policy came in 1962 (Figure 2.2). Loans were made available for the construction of factories in other country areas on land owned by local councils, with the councils themselves providing 30 per cent of the total finance and the Decentralisation Fund, 60 per cent.[7]

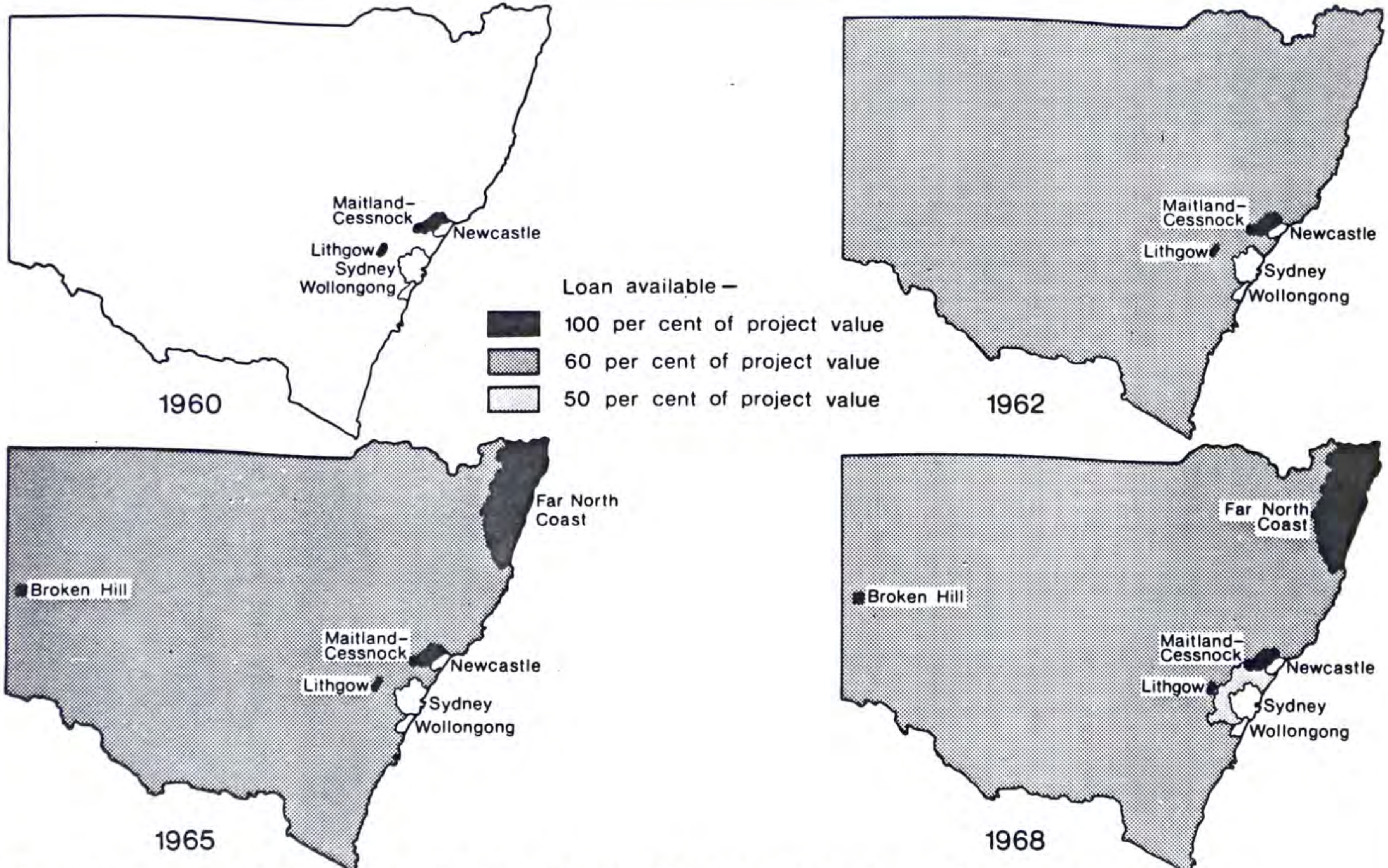

Figure 2.2 Spatial Evolution of New South Wales Factory Loan Assistance

Unlike the coalfield areas, therefore, applicants for financial assistance were required to fund 10 per cent of each project, while in addition the interest rates involved were not as low. Hence the equity objective of favouring development in the coal mining towns was maintained. During this period some loans were also provided from the Fund for country industries to purchase machinery.

While the importance of loans as a means of assistance rose, there was no commensurate increase in the overall significance of grants. The subsidy on trunk telephone calls was discontinued in 1961, except for special cases. It was felt that the sums involved had been small in many instances, while the additional employment by firms receiving subsidies had not been found to be worthwhile in relation to the assistance granted. The Department considered, moreover, that telephone cost subsidies should not be the responsibility of the state Government, but rather of the Commonwealth government, since the latter was responsible for the operation of telephone services. On the other hand, this period also saw the initial emergence of grants which were not part of the official "package" of measures advertised by the government, but nevertheless considered warranted to offset locational disadvantages not borne by metropolitan manufacturers. The first example appears to have been a subsidy comprising rail passenger fares given to meet travel costs incurred by executives journeying between Sydney and a new country branch plant during an initial production period. The same subsidy was given in similar cases in subsequent years.

Although Wollongong had been excluded from the areas eligible for decentralisation assistance, its rapid industrial expansion had created development problems of a different kind. The concentration of heavy industry production had created high female unemployment, and one survey known to the government had found that 28 per cent of the female work force was unemployed. In 1964, therefore, approval was given for factory loans to be made from the Decentralisation Fund to industries establishing in Wollongong and having employment which was at least three quarters female. The proportion of the project value to be met by a Fund loan was to be determined on a case by case basis. In one of the first cases a loan equal to 50 per cent of the cost of the factory was given.

By the end of 1964 the basic elements of the decentralisation programme as it stands now had been established. On the administrative side, the forerunner to the present department was set up in 1963, when the Division of Industrial Development became the Department of Industrial Development and Decentralisation. The changes that took place in 1965 a nd 1966 were largely changes in degree rather than in kind.

The third phase: 1965 onwards

By 1965 the basic rationale for the decentalisation programme had changed from overcoming the lack of development in country areas to overcoming the problems arising from over-development in Sydney. It became a significant issue in the state election campaign early in 1965, during which the opposition Liberal-Country

Party coalition promised that, if elected, it would contribute $2 million per annum to a new decentralisation fund, compared to the total of $3.6 million spent between 1958 and 1964/65. This promise was subsequently carried out when the coalition came to power at the election, and was part of a series of measures designed to boost decentralised development.

The structure of the programme was altered in several ways with the enactment of the State Development and Country Industries Assistance Act in early 1966.[8] A Country Industries Assistance Fund was established, replacing the Decentralisation Fund. The new Fund was a revolving one, in that repayments of principal on loans were to be deposited back in the Fund, unlike the previous arrangement by which repayments went back to the Treasury. Of greater locational significance was the extension of the loans scheme to factories not sited on council land to all country areas, and not just Lithgow, Cessnock and Maitland. Moreover, this was accompanied by an expansion of the maximum assistance areas, so that low interest loans equal to 100 per cent of the finance required for factory land and buildings were now available in the upper north coast and Broken Hill (Figure 2.2). The economy of the former area had stagnated because it was largely based on the dairying industry, in which employment was steadily declining. In Broken Hill the work force in the main source of employment, base metal mining, had started to decrease. Outside the maximum assistance areas, the loan arrangements previously applying just to projects on council land (that is, 60 per cent of total finance coming from the Fund, 30 per cent from the local council, and 10 per cent from the applicant) were instituted.[9] Provision was also made in the Act for loans on plant and machinery.

In a new assistance measure, the Minister was empowered by the Act to acquire land for industry or industrial housing, or for the erection or purchase of premises for industry. The latter provision was subsequently used to provide factories for lease to various companies. The former provision, on the other hand, was virtually unused up to 1969. Another new measure was that the Department was now able to guarantee loans raised for the erection of country factory buildings and the purchase of plant (Australian Government Publishing Service, 1972, 74),[10] while rental payments could also be guaranteed. Administratively, the most important change was the establishment of a separate Ministry of Decentralisation and Development, the Department being re-named accordingly.

With the 1966 changes, the essential framework of the New South Wales decentralisation policy in the late 1960s was complete. As before 1965, certain new grants outside the standard package of the Department came to be given. Perhaps the most important of these were subsidies for the remission of road co-ordination tax where the transport of goods by rail was found to be not practicable (the tax was payable where road transport was used in competition with rail transport).

Although the 1966 Act had included wholesaling as an eligible industry for the first time, assistance for this activity had to await the passing of an amendment to the Act early in 1967. The amendment widened the definition of "industry", to which assistance was limited, so that wholesaling and certain other service activities (in particular, machinery repairs) were included. In recognition of the lesser contribution made to the Department's objectives by wholesaling, loans from the Fund in such cases were limited to 50 per cent of the total amount financed (with the local council supplying a further 25 per cent).

By 1968 it had been recognized that a lesser contribution to objectives was also being made by industries in fringe areas near Sydney but outside the County of Cumberland, such as North Richmond. The Department's share of loans in these areas was therefore limited to one third of the total, instead of the previous 60 per cent. Thus a three-tiered locational equity structure had evolved within the programme (Figure 2.2), areas with declining employment in a staple product having maximum preference and locations closest to the central area of state development having the lowest preference.

The changing pattern of expenditure

The changing structure of the decentralisation programme up to 1969 can be illustrated by a comparison of annual disbursements from the two decentralisation funds for each of loans, freight subsidies, and other grants (Table 2.1). The most striking feature of the table is the rapidly increasing significance of loans in the overall programme.

Table 2.1

Disbursements From Decentralisation Fund And Country Industries Assistance Fund

Year ending 30th June	Loans	Grants: Freight subsidies	Grants: Other	Total
1960	140,624	244,384	75,956	460,954
1961	27,734	242,238	30,312	300,284
1962	125,610	237,266	2,583	265,458
1963	223,580	248,608	24,504	496,692
1964	442,330	300,962	25,158	768,450
1965	832,914	413,862	26,962	1,273,738
1966	1,250,074	413,862	51,697	1,714,802
1967	2,561,402	453,483	46,791	3,061,676
1968	1,962,697	430,499	91,594	2,484,790
1969	2,999,780	488,137	274,835	3,762,299

This largely parallels the steadily widening spatial coverage of factory loans. Freight subsidies are seen to have been the most important type of grant, but the relatively slow growth in real terms between 1959/60 and 1968/69 highlights the significance of freight subsidies given in the earlier years of the decentralisation programme and generally renewed for later years. The other feature is the rapid growth in total disbursements following the establishment of the Country Industries Assistance Fund in 1965/66. This reflects the injections into the Fund given by repayments of loan principal and steadily increasing contributions from the state's Budget and its Loan Fund. It is upon this 1965/66 to 1968/69 period that most of the analysis in ensuing chapters has been concentrated.

THE SPATIAL AND SECTORAL PATTERN OF ASSISTANCE

The previous section has described the evolution of spatial variations in loan assistance offered by the New South Wales Government. What this does not indicate, however, is the extent to which those variations were reflected in the locations of assisted establishments. Moreover one other important aspect of assisted establishments, the types of industries to which they belong, has not been considered. The concluding section of this chapter therefore looks briefly at the spatial and sectoral pattern of assistance.

The spatial pattern of assistance

The spatial variation within country areas in the degree of available loan assistance indicates that the locational pattern resulting from the decentralisation programme was socially important. To a large extent this areal pattern would have been conditioned and constrained by the pre-existing distribution of economic activity and population. Thus the "expected" distribution of assistance, in the absence of any spatial variation in incentives, could be hypothesized to have been related to the existing distribution of population. A comparison of the regional distribution of expenditure from the

Country Industries Assistance Fund between 1965/66 and 1970/71 (the shortest period for which data has been published) and the regional distribution of population at the 1966 population Census is shown in Table 2.2 (the location of regions is shown in Figures 2.3 and 2.4).

Table 2.2

Regional Distribution of Expenditure from Country Industries Assistance Fund 1965/66-1970/71 and Population in 1966

Region	CIAF expenditure (dollars)	Per cent of total	Population	Per cent of total
North Coast	2,752,767	10.4	211,842	16.3
New England	1,591,208	6.0	155,365	12.0
Orana	962,312	3.7	96,405	7.4
Far Western	-	-	35,535	2.7
Murray	4,277,312	16.2	85,378	6.6
Riverina	2,498,173	9.5	129,344	10.0
Central Western	6,274,022	23.8	153,962	11.9
South Eastern	1,930,277	7.3	115,420	8.9
Hunter/ Illawarra/ Outer Sydney	6,112,978	23.2	313,992	24.2
TOTAL	26,399,049	100.0	1,297,243	100.0

Sources: Department of Decentralisation (1972, 13); Bureau of Census and Statistics (n.d.).

A considerable disparity between the pattern decentralisation expenditure and the distribution of population in 1966 is evident. Perhaps the most striking feature is that the expenditure share of the North Coast region is significantly less than its share of population whereas, given that most of this region was eligible for maximum loans, the reverse would have been expected. This highlights the basic limitation of an incentive policy: assistance cannot be given until firms themselves decide to apply for it, and if they consider the assistance offered is not sufficient, industrial development on that account will not occur. It is apparent that the relative isolation of much of the North Coast was not completely offset by its designation as a maximum loan area. In terms of Figure 2.1, the marginal cost curve resulting from the application of the equity goal was not sufficiently lowered. Indeed, the table indicates a dichotomy between the more peripheral regions (such as the North Coast, New England, Orana and Far Western), which did not receive as much assistance as expected on the basis of their populations, and regions more accessible to Sydney (or to Melbourne, in the case of the Murray region), which generally received a share of funds about the same as, or more than, expected. The very high level of expenditure in the Central Western region was, however, undoubtedly assisted by the fact that Lithgow was a maximum loan location.

Since loans were the most important

element in the decentralisation programme, and since they were the vehicle for attempts by the government to manipulate the location pattern of industries within country areas, they are worth particular examination. Figure 2.3 shows the location of factory and general loans made before 1965/66, when the Country Industries Assistance Fund came into being, and Figure 2.4 shows the location of factory and general loans given between 1965/66 and 1968/69. The pattern of loans before 1965/66 indicates the predominance of the maximum loan areas: Maitland, Cessnock, Kurri Kurri (located within the Cessnock council area) and Lithgow. The paucity of loans in other areas is presumably at least partly a reflection of the loan condition requiring council land, as well as the later eligibility (from 1962 onwards only) of these areas for loans.

The distribution of loans between 1965/66 and 1968/69 is much more dispersed. The maximum loan areas prominent before 1965/66 continued to receive significant loan allocations, but this was in the context of a general concentration of loans in areas relatively close to Sydney. Thus Bathurst, Orange Wollongong, Shellharbour and Nowra also received significant amounts. Queanbeyan spawned a number of assisted industries, by virtue of its location adjacent to the rapidly expanding city of Canberra. The North Coast is relatively prominent as a destination for

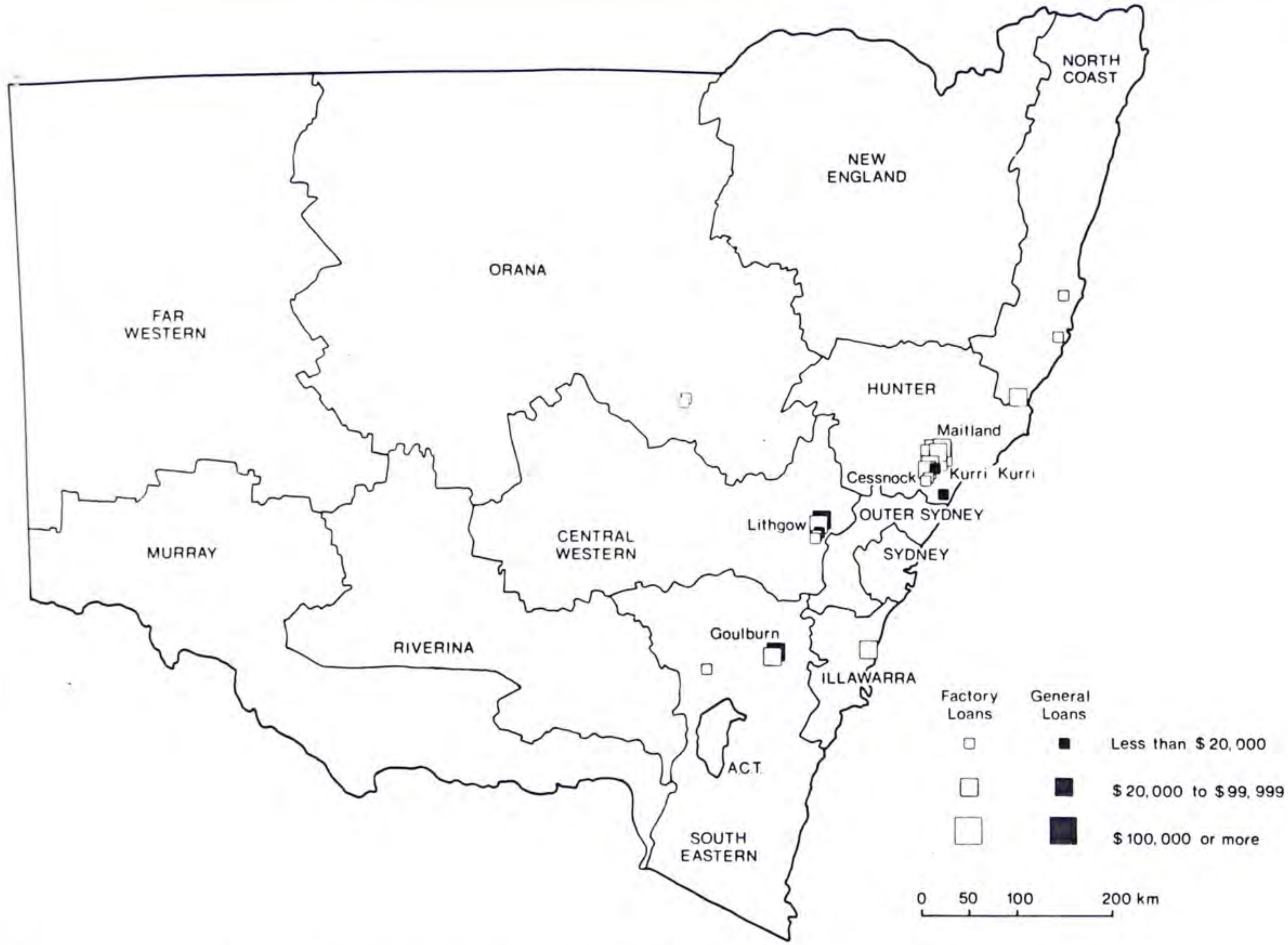

Figure 2.3 Location of Decentralisation Loans Granted before 1965/66

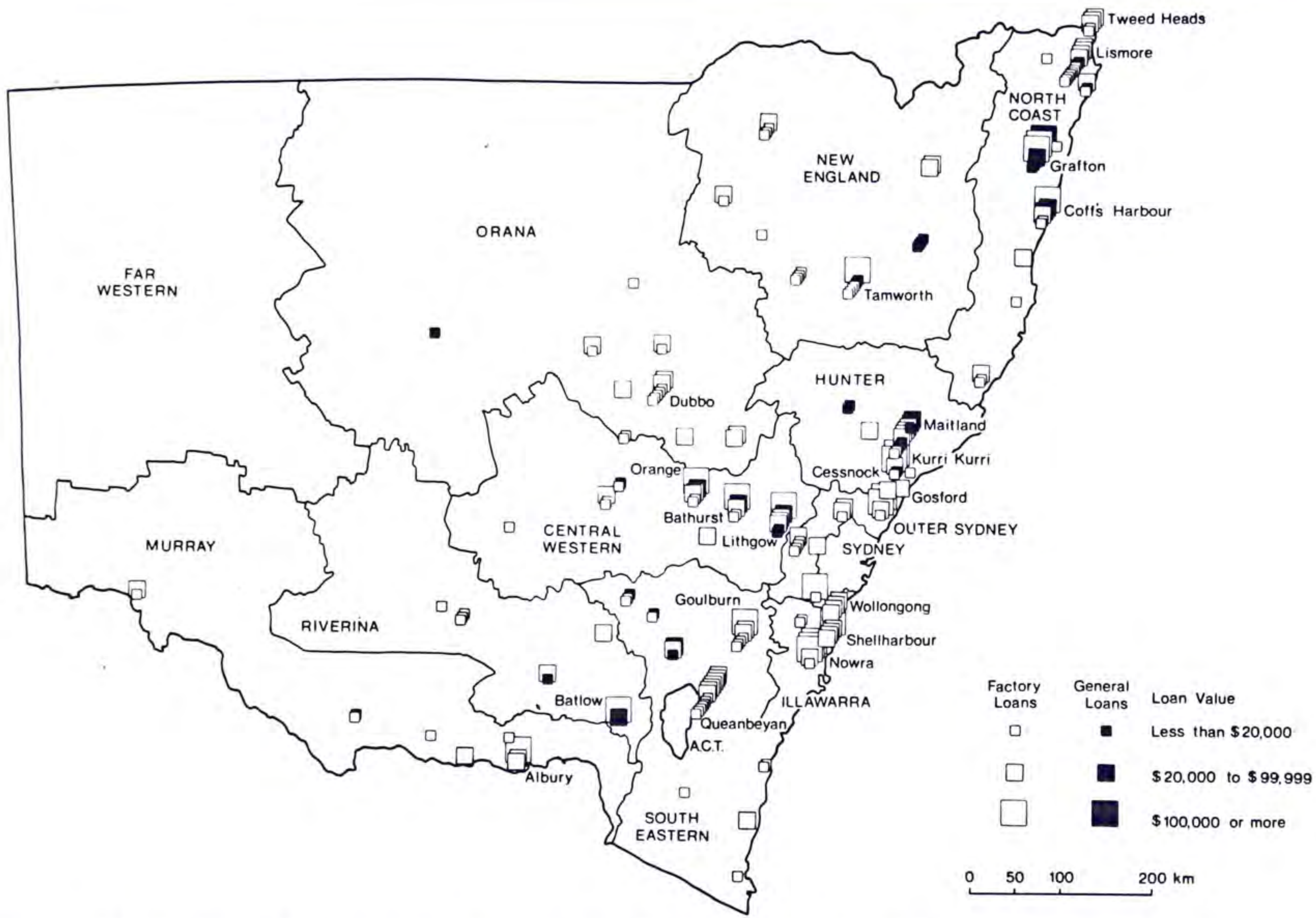

Figure 2.4 Location of Decentralisation Loans Granted between 1965/66 and 1968/69

loans, suggesting that its loan incentive advantage had at least some significance. The polarized nature of the North Coast pattern, with almost all loans going to Tweed Heads, Lismore, Grafton and Coff's Harbour, is striking. An examination of individual cases indicated a general absence in this region of loans to small engineers producing for the rural sector, in contrast to the number of such loans going to minor towns in other regions: a characteristic which is perhaps ascribable to the region's dairying economy.[11] To sum up, then, the detailed pattern for loans generally supports the broad picture of assistance at the regional level.

<u>The sectoral pattern of assistance</u>

Although the decentralisation programme did not formally differentiate between those types of industries which found country locations disadvantageous, the implications of different industrial structures for development may be considerable. Table 2.3 therefore shows, for a sample of 97 factory and general loans (with a total value of $4,713,306) made from the Country Industries Assistance Fund up to June, 1969, the share of loan expenditure going to each industry group, together with the median industry size of such loans, and the wages, value added and employment growth characteristics of the industry groups.

Table 2.3

Industry Characteristics of Sample of Factory and General Loans Made from Country Industries Assistance Fund during 1965/66-1968/69

Industry	Country Industries Assistance Fund expenditure		Total New South Wales		
	Share of total (dollars)	Median loan size (dollars)	Value of production per employee 1966/67 (dollars)	Value of wages and salaries per employee 1966/67 (dollars)	Employment Change 1959/60-1966/67 (per cent)
Bricks, pottery, glass etc	0.4	18,000	5,377	2,880	5.4
Industrial metals, machines, conveyances	29.7	10,778	5,061	2,838	18.0
Textiles and textile goods	24.2	34,856	4,796	2,250	-9.0
Clothing (except knitted)	11.0	41,083	3,202	1,754	2.3
Food, drink, and tobacco	22.2	25,000	6,770	2,546	12.4
Sawmills, joinery etc	6.6	21,825	4,540	2,460	-5.6
Furniture	1.3	20,588	4,457	2,350	2.1
Paper, stationery, printing, bookbinding etc	0.9	5,940	6,030	2,795	19.8
Miscellaneous products	3.0	12,000	4,625	2,469	35.3

Table 2.3 (cont)

	Share of total (dollars)	Median loan size (dollars)	Value of production per employee 1966/67 (dollars)	Value of wages and salaries per employee 1966/67 (dollars)	Employment Change 1959/60-1966/67 (per cent)
Non-manufacturing industries	0.7	13,500	N/A	N/A	N/A
Total all industries[1]			5,588	2,671	12.2

Sources: CIAF sample: Department of Decentralisation questionnaire sent to all assisted firms in 1969 (Appendix 2); New South Wales data: Bureau of Census and Statistics (1964, 1970)

N/A Not available

1 Including industries not separately listed above

The bulk of loan expenditure in the sample was made to three industries: engineering (that is, industrial metals, etc), textiles, and food and drink. The value of loans to clothing firms was not as high as might have been expected, given their reliance on cheap female labour such as characterizes country areas. The median loan sizes of the three main recipient industries, however, showed a contrast between large median loans in the case of textile and food and drink projects, and small loans for engineering projects. The latter indicates the frequency with which loans were given to small engineers producing bespoke products for local primary producers. The large loans going to textile and clothing projects, on the other hand, were symptomatic of a completely different production structure: large branch plants producing standard items.

The three state-wide indices have been chosen to give a rough indication of the expected contribution of each industry to certain aspects of community development. The value of production per employee is indicative of the extent to which a given loan will generate employment (higher value per employee suggesting lower employment generation); salaries and wages per employee indicate the extent to which industries might lift average incomes; and the employment growth rate points to the potential longer term employment effects of each industry.

On all three criteria, the engineering industry compares favourably with the state average for all industries. When the generally high level of employment skills is also taken into account, the high proportion of loan funds used in engineering projects can be surmised as having produced a large measure of generally satisfactory development. Textiles and clothing, on the other hand, rate poorly on the salaries and growth criteria. These industries do, however, have a favourable impact in another direction not indicated in the table: the creation of employment for females who would otherwise be unemployed or not in the work force. In this manner they are significant in raising average household, if not per capita, incomes. On the other hand, this may not be sufficient to stem emigration from country areas if the (male) breadwinners lack suitable employment. The food and drink industry is an average one in regard to salaries and growth, but has a high value added per employee. There appear to be no commensurately higher skill levels to offset this. The criteria of community benefits suggested here are indicative only and often in conflict, but the extent of overall differences between some industries suggests the decentralisation programme may usefully have included a formal sectoral element.

This section has briefly described aspects of the structure of expenditure from the decentralisation programme. The remaining chapters attempt to explain the factors underlying this expenditure pattern.

Footnotes

1. Most of the information for this chapter was obtained from files of the Department of Decentralisation and Development. Where this source has been used, no separate reference has been given.

2. And, after 1967, to wholesalers.

3. For some industries the importance of cheaper labour in country areas may mean that marginal costs do not rise with distance.

4. Source: Cunningham (1974), drawing on earlier data of Linge and the Commonwealth Bureau of Census and Statistics.

5. Or a maximum of $1,000 per annum where 10 persons or less were employed.

6. The rationale of the programme considered as a whole was also of course mainly one of equity at that stage, favouring non-metropolitan areas for non-efficiency reasons.

7. The proviso that finance was unavailable through normal sources again applied.

8. Approval in principle for new forms of assistance permitted under the Act had been given for a short period before this.

9. As with the earlier loan policy, finance was only lent provided it was not available through normal financial channels.

10. Amounts in excess of $50,00 0 required the approval of the Treasurer.

11. The depressed level of the dairying industry means that little farm investment took place. In addition, any such investment was perhaps not as suitable for supply by local engineers - unlike wheat growing areas, for example, where bulk handling equipment, *inter alia*, was readily made locally.

CHAPTER 3

A MODEL OF GOVERNMENT INDUSTRIAL LOCATION DECISIONS

The recent trend toward the construction of models of geographic processes has been seen as an important means by which geographic theory can be generated and tested. As the discussion in Chapter 1 indicates, this modelling approach toward theory construction is the principle analytical strategy used in the present study. This chapter describes the structure of the basic model used, while the next three chapters describe the calibration and application of the model to location decisions of the New South Wales Department of Decentralisation and Development.

The model is intended to apply to industrial location decisions of the repetitive, or programmed (Simon, 1965, 57-79), type since these are usually relatively numerous and are presumed to involve common rules. This provides an opportunity to generate statistically significant estimates of certain constant parameter values required in the model. Public sector location decisions each involving expenditure which is large in relation to the overall size of a programme are probably best analysed, following the normalistic approach used in this chapter, by conventional cost-benefit and/or programme budgeting techniques (or possibly, in the case of assistance to single private sector enterprises, a game theory analysis of bargaining strategy as illustrated by Isard, 1967). They are therefore excluded from the present framework. It is assumed in this chapter that no enterprise is of sufficient size to be able to bargain with the government.[1]

The model has two basic parts, corresponding to two hypothesized steps in the governmental decision process. The first relates to the specification of preferences among the various possible decision outcomes, or more specifically, to the determination of a utility function. The second concerns the process by which this utility function shapes the pattern of locational decisions, having regard to available public expenditure and other resource constraints. This latter part of the model uses values of utility and other variables from former periods to forecast the decision pattern of a particular period so that the model thus attempts to fulfill the basic scientific aim of reliable prediction (see Harvey, 1969, 30 and 155). The particular steps involved in developing and testing the model are shown in Figure 3.1. The discussion in this chapter follows this sequence. Accordingly, consideration is first given to the notion of a utility function and its possible structure.

SOCIAL WELFARE AND UTILITY FUNCTIONS

Overview

Theoretically, the basic rationale for government decisions is the maximization of social

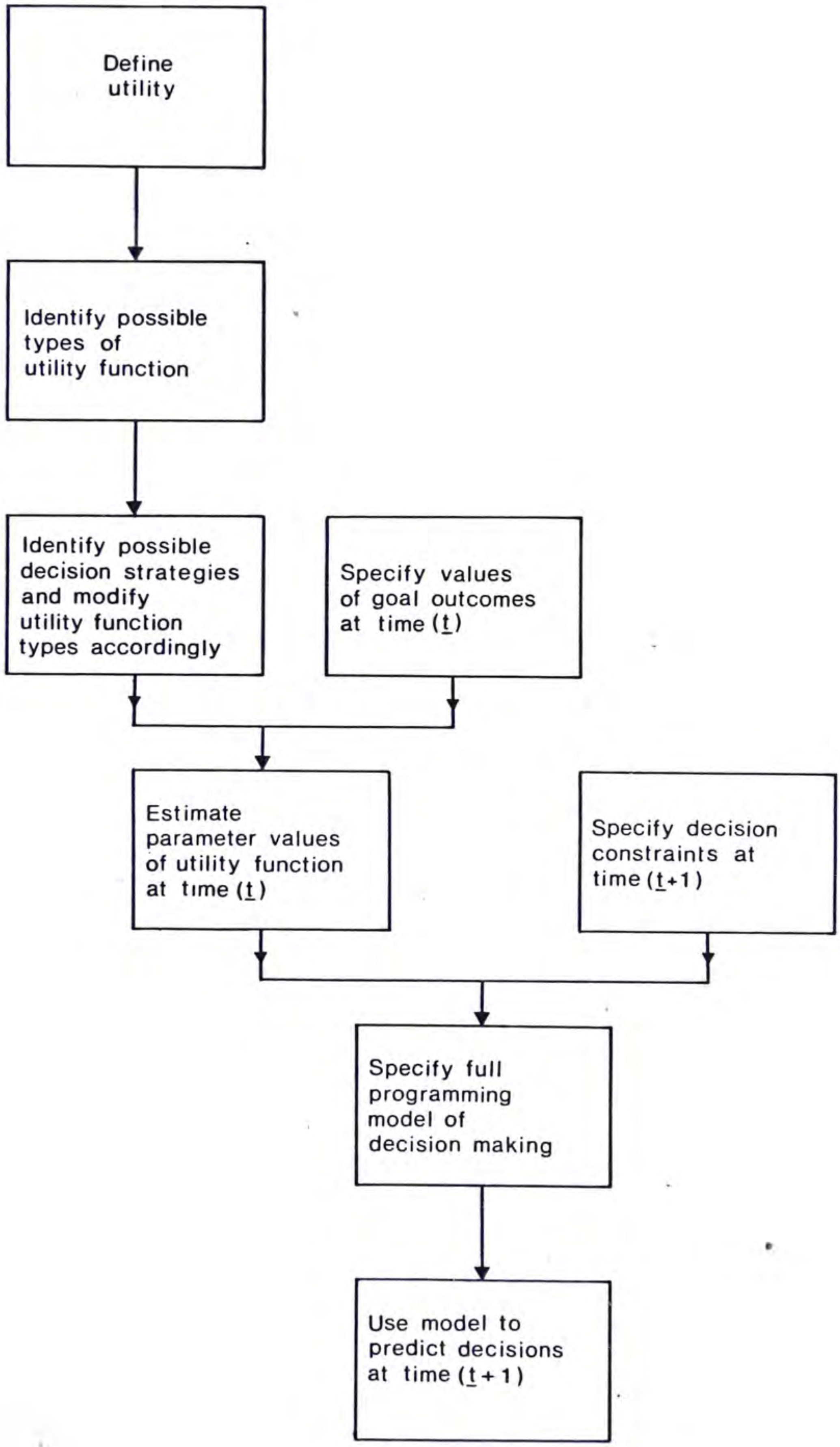

Figure 3.1 Steps in the Development and Testing of the Decision Model

welfare. The diversity of the components of social welfare mean that government actions must usually have regard to more than one goal. Simultaneous attainment of optima for every goal in a particular programme can rarely be achieved, since goals are usually open-ended while available expenditure is limited, and since single decisions usually influence the attainment of more than one goal. Tinbergen (1952, 216-220) has also noted the general case in which joint optimization is precluded, arising when the number of instruments or policy measures is less than the number of goals themselves.[2]

This situation leads to goal conflicts such as the well-known regional development dichotomy between maximising growth over the whole area covered by the programme and improving the intra-area distribution of income or employment. To resolve such conflicts, governments must make a "trade-off" between goals (Mera, 1967). A trade off involves giving each goal a weight which corresponds to its relative importance. In terms of traditional economic theory, these preferences between goals (or, more exactly, preferences between the outcomes associated with each goal) can be considered to be related to the overall utility arising from a particular programme via a function of the general form

$$U = f(w_1 g_1, w_2 g_2, \ldots, w_n g_n) \qquad (1)$$

where U is total programme utility, g is the outcome associated with each goal, w is the preferred weighting of *g*, and the subscripts 1, 2,..., *n* denote goals 1, 2,..., *n*. Governments can be hypothesized, following Isard (1969, 202), as aiming to maximize *U*. As Graaf (1967, 166), notes, maximizing government utility will be equivalent to maximizing social welfare only if governments are perfect judges of community welfare, and provided there is no change in the distribution of income, external effects and similar Pareto optimum-type conditions. A further assumption in the case of individual government departments and their ministers is that decisions are made principally in the interest of the community rather than the groups represented by each department (such as agriculture, labour etc) or the interests of departmental officials themselves.[3] Providing these assumptions are met, the government's utility function will become a social welfare function. In practice these conditions are unlikely to be met in full. Prentice (1976) for example, has discussed judgemental problems involved in deriving social welfare functions from individual utilities. Accordingly, government utility functions are probably better regarded as preference functions, or decision functions, of the decision makers concerned. Concomitantly, the goals incorporated in such functions will be the goals which the government decision makers themselves see as relevant in executing regional development policy. Except in politically sensitive cases, programmed decisions may be expected to be effectively taken by public servants so that it will be the latter's perception of appropriate goals which is paramount.

The idea that a set of government goals has a utility function equivalent means that the pattern of decisions in a programme can be seen as structured according to the components of the appropriate utility function. Basic aspects to be resolved in determining, for a particular programme, the specific form and parameters of (1) are the definition of utility, $\underline{U}$, the mathematical form of the equation to be used and its relationship to decision-making strategy, and the methodology to be adopted for obtaining the parameters in the form chosen. Each of these three aspects will be considered in turn.

Defining utility

The basic proposition underlying the discussion so far is that governments obtain varying degrees of utility from different levels of expenditure. The empirical relationship between government expenditure and government utility is not known (see Isard, 1969, 178-183). It could, however, be hypothesized to follow the usual theoretical and empirical relationships applying to individuals; that is, utility from each extra unit of expenditure (marginal utility) decreases as total expenditure increases (for example, see de Neufville and Stafford, 1971, 116; Hamblin, Clairmont and Chadwick, 1975).[4]

Two principal forms of the utility function can incorporate the decreasing marginal utility hypothesis: a log function and a power function. Using the first, utility will be defined simply as the logarithm of expenditure, but with a power function version the expenditure exponent needs to be specified. The most widely postulated specification is that utility increases as the square root of expenditure (see Webber, 1972, 101, for example), which is not inconsistent with the range of results obtained in empirical studies such as the two cited in the previous paragraph. Where the decreasing marginal utility hypothesis is being tested in this study, therefore, it will be assumed that utility is a function of either the logarithm (base 10) or the square root of expenditure. The definition of utility is complicated, though, by the fact that under the operation of programmes to which the model applies, government expenditure is only made in response to requests from enterprises for assistance. Hence the level of expenditure will depend on the size of each request as well as the relative social importance. To put it another way, expenditure on a project can never exceed the value of the request, no matter how socially worthwhile the project is in unit value terms. It is the relative importance of social goals in each case, however, which the structure of the utility function reflects. Because of this, utility is here defined in unit terms, as the ratio of expenditure (or its square root or logarithm) to request value. Within a particular year the utility of each dollar of expenditure could be expected to be constant, providing two assumptions are met. These are: that the full budget allocation to a programme is intended to be spent (so that effectively there is no marginal expenditure); and that the government has an idea of the number and type of projects (for example, firms requesting relocation assistance) likely to be available over the whole year.

Form of the utility function

Having considered the concept of utility itself, the possible form(s) of the utility function must now be defined. The simplest form of the utility function is an additive linear relationship of the kind

$$U = w_1g_1+w_2g_2+\ldots+w_ng_n \qquad (2)$$

This implies that the marginal utility of each goal is constant, and that the marginal rate of substitution between any two goals is also constant (Theil, 1964, 3). But these assumptions may not ordinarily hold. The interdependencies between goals may imply rather that the marginal utility of one goal depends on the level of attainment of other goals. At the same time, higher weightings (utilities) are generally given to outcome resulting from initial expenditure, so that subsequent expenditure on a particular goal has a lower weighting (utility), *per se*, than initial expenditure on another goal. In other words, there is a decreasing rate of marginal substitution between goals. A utility function which incorporates these relaxations of the assumptions in (2) is the quadratic form (Theil, 1964, 3)

$$U = a_1g_1+\tfrac{1}{2}a_2g_1^2+a_3g_1g_2+a_4g_2+\tfrac{1}{2}a_5g_2^2+\ldots+a_ig_{n-1}+\tfrac{1}{2}a_jg_{n-1}^2+a_kg_{n-1}g_n+a_lg_n+\tfrac{1}{2}a_mg_n^2 \qquad (3)$$

where $a_1, a_2, \ldots, a_m$ are constants and in addition $a_2, a_5, \ldots a_m$ are less than zero.[5]

More complex functional forms involving the same relaxation o. assumptions as (3) are possible[7], but are not considered here since the number of decentralisation goals incorporated in the functions would have pre-empted more time than was available; additionally the solution of the programming model developed here would often have been extremely difficult, if not impossible, if very complex functions had been used. It should be pointed out that the log formulation of utility proposed above is effectively an exponential formulation which can be tested using the model proposed here[6]; while the success of multiplicative exponential models in predicting spatial consumer choices, (for example, Piccolo and Louviere, 1977) suggests that the applicability of this could be a fruitful area for future research on government locational decision-making.

One kind of modification to functions (2) and (3) must be considered, however. This is the incorporation of the potential influence of time. Time can influence the composition of government utility functions in several ways. In the first place, different projects have different gestation periods and lives. To allow for this, the forecast project returns (and costs, where necessary) are usually standardized by discounting back to a common time $\underline{t}$, with further off returns being discounted more because of their lesser value at $\underline{t}$. Another reason why time may influence utility functions is because a learning process is continuing over time (Cyert and March, 1963). This process includes changes in the desired level of goals and in the decision criteria themselves, both of which effectively result in changes in the composition of the utility function. Changes in goals through time may also come about through exogenous influences such as political pressures exerted by community groups.

It is desirable, therefore, that parameters to represent the impact of time on the utility function should be included. Because, among other reasons, changes in the perceived need for, and effectiveness of, different goals may not be equal over time, a separate time variable needs to be included for each goal in the utility function (see (4) below). The most obvious technique here is to regard the function as a set of time series, one for each goal, and accordingly attaching to each goal variable a parameter denoting elapsed time. Thus the dynamic version of (2) might be

$$U = a_1 \sum_{t=1}^{m} g_{1,t} e^{-\alpha t} + a_2 \sum_{t=1}^{m} g_{2,t} e^{-\alpha t} + \ldots + a_n \sum_{t=1}^{m} g_{n,t} e^{-\alpha t} \qquad (4)$$

where t refers to the period in question ($t = 1,2,\ldots,m$), α is the rate used to discount future returns to time t, the point at which the corresponding expenditure is made (this formulation takes after Solow, 1970, 81), and $a_1, a_2, \ldots, a_n$ are constants. The quadratic utility function (3) can be similarly expanded. More general formulations could also be developed, such as making t itself a power or log function.[8] Whether any extra descriptive power would be added to offset the greater estimation problems seems doubtful, especially since the occasional existing studies of government decisions have used just the simple linear expression of t given in (4) (for example, Theil, 1964, 76-81).

By modelling the influence of time in this way the effects of random "shocks" (such as the impact of community pressure groups) on the structure of the function are not incorporated[9]. Such external influences will be less significant the shorter the period considered. Thus dynamic functions such as (4) above are best applied to short run, rather than long run, situations.

Influence of decision strategy

To this point it has been implicitly assumed that the "payoff", or net return, to governments of their decisions equals the actual outcome of those decisions, and that the utility thus derived is directly proportional to the payoff. The former assumption is probably a reasonable one in regional development programmes, which usually measure their success in terms of outcome variables such as employment or income. The latter assumption, however, does not necessarily hold for real world decision situations, and some alternative approaches are therefore now considered.

The formulations of the utility function given above assumed in general that the decision-making of governments takes place in a world of complete certainty. But this is obviously unrealistic. The existence of uncertainty produces various motivations and attitudes (Isard, 1969, 186), as a result of which different decision making strategies emerge. Payoffs are converted into a utility equivalent by a transformation process which differs according to the particular decision making strategy adopted. It is apparent that the type of utility function adopted for analysis should incorporate the general form and parameters of this transformation process.[10] Inherent in this process in the conversion of the general aim of maximization of utility into one of maximizing expected utility (Marschack and Radner, 1972, 44; Webber, 1972, 88-116).

A number of possible decision-making strategies in response to uncertainty have been suggested in the literature (Isard, 1969, 132-142 and 200-219; Tisdell, 1968, 24-39). The most potentially significant of these, in terms of constructing a model of government location decisions, are as follows:

a) One of the simplest strategies in the face of uncertainty is to regard the expected utility as being equivalent to the mean value of all the various possible levels of utility (after weighting each to take account of different probabilities of occurrence).

b) Another frequently suggested strategy is to convert prospective payoffs into certainty-equivalent payoffs. This enables decision makers to take account of the uncertainty of likely payoff values as measured by their dispersion, in addition to considering mean values. The most common measure of dispersion is variance. Following Isard (1969, 205), if π denotes the functions on the right hand side of equations (2) to (5) and the expected or mean of π is written as $E[\pi]$, then the variance of π is given by $E[(\pi - E[\pi])^2]$. If the government only considers the mean utility and the utility variance about the mean the certainty equivalent utility function will be

$$U = E[\pi] + kE[(\pi - E[\pi])^2] \tag{6}$$

where k is a constant whose value depends on the attitude of the government. More extensive functions would be required if skewness and higher "moments" about the mean are considered relevant in assessing dispersion.

c) A strategy used widely as a tool in decision analysis is the maximin strategy, in which the aim is to maximize the minimum possible utility value. This is difficult to apply where (as in regional development programmes) the range of payoff values, such as employment, is continuous. In these cases an operational criterion could be to regard the minimum value as the mean minus $z\,\sigma\pi$, where $\sigma\pi$ is the standard deviation of π and z is the usual test statistic,[11] expressed here by $\frac{\pi_{min} - \bar{\pi}}{\sigma_\pi}$ with π_{min} denoting the minimum utility and $\bar{\pi}$ the mean utility. The higher the value of z taken, the lower is the minimum calculated value of π and the less the chance that a lower value will occur in practice.

d) Contrasting with the maximin strategy is the maximax strategy, in which the maximum possible utility is maximized. In analogous fashion to (c), maximum utility could be taken to be the mean value plus $z\sigma_\pi$.

e) Hurwicz has suggested that decision makers may not be either fully pessimistic (maximin strategy) or fully optimistic (maximax strategy), but instead may simultaneously adopt both outlooks (Hurwicz, 1950). In this circumstance a weight α ($o \leq \alpha \leq 1$) would be attached to the minimum possible payoff and a second weight $(1-\alpha)$ attached to the maximum possible payoff. The utility function would thus become

$$U = \pi - \alpha \underline{z} \sigma_\pi + (1-\alpha) \underline{z} \sigma_\pi \qquad (7)$$

f) Different strategies follow from the fact that the utility of an action may not be derived directly from the payoff of that action but from the payoff less the opportunity cost of the action. Opportunity cost here is measured by either the expected payoff from that action, or if completely conservative behaviour is desired, by the greatest possible payoff that could have been achieved. The difference between payoff and opportunity cost has been termed the decision maker's "regret" by Savage (1951), who has suggested that the decision objective may be to minimize this regret. Unfortunately the regret criterion does not seem particularly operational in the present context, largely because the functional relationship between utility and regret is not known (Chernoff, 1954). Theoretical problems associated with the concept have also been noted.[12] For these reasons the minimax regret strategy will be excluded from subsequent analysis.

g) Operational difficulties also prevent the analysis of another uncertainty criterion, Bernoulli's principle of insufficient reason (see Peston and Coddington, 1968, 9).

This states that if uncertainty suggests that no one outcome of a decision is more likely than any other, the act with the highest mean utility arising from all the possible outcomes should be chosen.

h) All of the above strategies, and in particular the mathematical formulations of them developed here, ignore subjective estimates of utility probabilities in uncertain situations. But no data concerning subjective probabilities were available for this study. In addition, as mentioned in Chapter 1, there is evidence that the most comprehensive of the subjective probability strategies, as described by Bayes' theorem, is not followed in practice. Consequently subjective probability strategies as such are not dealt with here.

Two approaches introduced in Chapter 1 and related to the general problem of the subjective assessment of uncertainty are, however, considered. The first is the use of surrogate variables representing particular levels of subjective probability of payoffs and utilities. In terms of the model, this involves the selection of appropriate surrogates when criteria for goal outcomes have to be specified (see below). The management weighting and profit/loss criteria used in the following chapters can be regarded as such surrogates, with unsatisfactory management or past losses indicating a subjectively lower probability of achieving a certain utility from a particular action.

The second approach is the satisficing model, already mentioned in Chapter 1. It arises from consideration of a general decision framework in which subjective uncertainty is one element. The simplified (bounded)model of the real world, within which satisficing is hypothesized to take place, reflects the perceived uncertainty resulting from decision makers' limited knowledge and reckoning ability. The re-definition of utility in satisficing terms is straightforward. For example, alternatives can be limited to utility values of +1 or 0 depending on whether they are satisfactory or unsatisfactory, respectively (Isard, 1969, 209). Thus the values of would be required to take values of either +1 or 0.[13] The structure of the basic model developed below allows satisficing situations to be modelled in several ways, in fact, and these are discussed later in the chapter.

UTILITY FUNCTIONS: EMPIRICAL MEASUREMENT

Having identified possible forms that government utility functions might take we now turn to the question of how the actual function underlying a particular programme might be empirically measured.

Specifying values of goal outcomes

When it comes to the actual empirical measurement of utility functions, the first matter concerns specifying appropriate variables to represent goal outcomes. This is dealt with very briefly. The main problem here is that goals may not be expressed in terms which are sufficiently explicit to enable their achievement to be measured. In practice there may be a hierarchy leading from the general objectives of society down through successively more explicit goals to measurable performance criteria (Manheim and Hall, 1968; Kamrany and Christakis, 1969; Reiner, 1971). It is the latter which obviously must form the basis of any quantification of goals, as the studies cited recognize. The present study therefore uses selected performances criteria to denote goal outcomes.

Particular goals may have more than one criterion (that is, they are multidimensional - see Alonso, 1971), while certain criteria may relate to more than one goal. Thus the goals corresponding to a given set of criteria in the utility functions may not be able to be identified exactly.[14] The nature of the goals in the New South Wales decentralisation case, however, presented few empirical difficulties. Consequently the terms "goal" and "performance criteria" have been used fairly interchangeably in the following chapters, although it should be remembered that the empirical analyses use just performance criteria.

Estimating parameter values

The next empirical measurement step involves estimating the parameter values of the utility function. The literature suggests a number of possible measures.

The first method, which is the one chosen for this study, is the revealed preference approach in which multiple regression analysis is used to define the performance criteria weights implicit in past government decisions, employing an appropriate measure of decision utility (such as the level of expenditure) as the dependent variable.[15] Slovic (1972) and Moskowitz (1974) list a number of studies that have used multiple regression to determine the weights given by decision makers to different criteria, while Friedlander (1973) among others has applied this approach in the analysis of governmental goal weightings. Within the particular area of regional development programmes Weisbrod (1968) has used an equivalent approach, the solution of simultaneous equations, to obtain the equity-efficiency trade-off ratio(s) used by the United States Government for flood control.

The application of the revealed preference approach to government decisions, however, involves certain potential difficulties, discussed in large part by Johansen (1974). In the first place, the standard time-series method used to analyse single organizations assumes fairly permanent political preferences in the face of needs and pressures which are not static. The decentralisation assistance decisions of the New South Wales Government, however, share a common property with most other types of programmed location decisions of governments in that there are a large number each year. This means the other standard revealed preference approach, cross-section analysis, can be used without the common cross-section problem of interorganizational (or interpersonal) heterogeneity. The data thus available allow the analysis to be restricted to only one, or perhaps a few years (only three successive years are used for preference estimation in the present investigation), so countering the problem of changing preferences.

The second area of difficulty is that governments may wrongly perceive the real structural system linking decisions and results, so that *ex post* distributional results of expenditure may not indicate *ex ante* plans and utility expectations (Pearce, 1971, 29). It is likely, though, that this is more of a problem in the case of government decisions intended to influence much or all of the socio-economic system (such as national monetary policy) than it is for decisions relating just to certain sectors of selected regions (such as in the programme in this study). Another reason for possible *ex ante* and *ex post* differences is the lack of resources to gather and process requisite data. The effect of information shortfalls has, however, at least been partially simulated in the present model by allowance for different strategies in the face of uncertainty, the use of expected values, and the incorporation of time parameters which may reflect, *inter alia*, a learning process.

The third problem is that the choice possibility set may have a complicated structure, so that a particular decision may be the result of resource and capacity limitations, for example, as well as the basic goal weightings attached to that decision. Thus the opportunities for government expenditure of a certain level may vary from firm to firm because of different constraints, so that true preferences are not fully "revealed" (c.f. Eyles, 1971). In the present study the main such constraint is the variation in the size of each request for aid made by enterprises to the government, these requests being required under the New South Wales decentralisation programme before assistance can be given. This request size sets a maximum on the amount of potential aid in each case. To allow for this, the value of assistance given has been standardized for the value of the corresponding request, as previously noted.[16] Variations in the significance to the government of requests of a given size will be reflected in these standardized values, so that they can be used as a measure of utility. For each case of assistance, U is therefore given by A/R (where A is the value of assistance and R is the value of the request) assuming constant marginal utility, and by A/R or (log A)/R assuming diminishing marginal utility.[17, 18]

Other potential constraints on the size of aid, such as threshold population and factory size considerations are met in the utility function calculations because data on proposed new establishments which did not receive any assistance were not available, and all such cases therefore had to be excluded from the calculations. Thus these constraints would not have acted as direct restraints on the (standardized) value of assistance given to the firms included in the analysis.[19, 20] On the other hand, such constraints are included in the ultimate programming model since the model is intended to apply to all requests for assistance. Even if data had been available for applicant firms which failed to meet constraints, the multiple regression model would have required them to be excluded from the analysis, since the constraints would have dominated, in mathematical terms, the goal criteria as the cause of zero assistance.

Other methods of establishing government utility functions are also available, which Johansen (1974) has discussed as well. For example, a direct approach may be made to the decision maker to write down the function directly or answer suitably constructed questions,[21] but this is not politically feasible in most cases, including the present study. A similar objection applies to another method, the "imaginary interview" approach, in which the decision maker's interview answers are guessed by the researcher after the latter has followed the deliberations preceding policy decisions. A further method involves using information contained in planning documents to identify policy alternatives and the structure and coefficients of the government's preference function. Documents relating to the New South Wales decentralisation programme are indeed of some assistance in identifying decision criteria, but do not enable the weightings of these criteria to be inferred. Consequently, the revealed preference approach seems the only way in which the government's preference structure regarding decentralisation can be estimated. Nevertheless, the extraction of goal criteria from planning documents may be an important means of identifying potential explanatory variables for the revealed preference method (as in the present study, for example).

The basic multiple regression model, however, in which preference is a function of certain goal criteria, ignores variations from one decision to another in the importance of the means or instruments being used by the government. In particular, it ignores the "instrumental complementarity" concept by which one form of assistance (instrument) might be more effective in achieving one goal, and a second form more effective for another goal (Reiner, 1971, 224). In addition, certain forms of assistance may require extra decision criteria, such as the ability of a firm to make repayments in the case of loans. Hence the particular type of assistance being analysed can influence the parameters of the preference function derived by the regression analysis. Therefore such an analysis, together with the decision model developed from it (see below), should be applied separately to decisions of each assistance type within an overall regional development programme. (In the ensuing chapters, grant and loan decisions are correspondingly separated for analysis.)

Using the multiple regression technique

to analyse the more complex types of preference function may present certain technical problems, but methods for overcoming these are usually available. Shchigolev (1965), for example, gives two methods for reducing non-linear functions (such as (3) above) to linear equivalents which can then be analysed using the standard multiple linear regression technique. Methods are also available for carrying out multiple regression analysis on some types of non-linear functions (as discussed in Draper and Smith, 1966, 267-284, for example).

It should also be noted here that the standard multiple regression technique is to fit a linear surface (equation) so that the sum of the squared deviations from this surface is minimized (King, 1969, 135). This criterion has been used to construct preference functions by Theil (1964), for instance. But a criterion of minimizing the sum of absolute deviations could also be used, as has been done by Charnes and Cooper (1961) and Ijiri (1965). Although this criterion precludes the use of the standard multiple linear regression technique, linear programmes are available which generate solutions on this basis (Bracken and McCormick, 1968). While the absolute deviations approach may be preferable because it is conceptually simpler (and therefore possibly more likely to reflect the actual government decision process), any advantage therein did not seem sufficient, for the purposes of the present analysis, to offset the considerable disadvantage of not being able to use existing (stepwise) multiple regression computer programmes which employ the least squares criterion. Computer processing of the data was considered essential in view of the number of observations and variables involved, and accordingly the standard minimum squared deviations technique was retained.

One final technical aspect of the preference function estimation should be mentioned. Some of the possible forms of the function, such as (6) and (7) above, require prior knowledge of the overall payoff associated with each decision in order that the payoff variance or standard deviation can be included in the assessment of utility. It is not therefore generally possible to estimate such payoff variance with a multiple regression approach at the same time as estimating the goal weights contributing to such payoff, because variations in relative weights will affect the amount of variance contributed by each goal variable.[22] If, however, only one goal variable has a probability distribution of values and thus non-zero variance, this variance should correspond with that of overall payoff. A prior estimate can be made of the variance concerned, so it can be included as a surrogate for payoff variance in the multiple regression analysis without complications. Fortunately the ensuing empirical analysis is of this type, with only values of the variable denoting employment change per unit value of assistance having a probability distribution.

THE DECISION MODEL

This section outlines the basic decision model. In it, the utility function derived as above from decisions in period _t_ is used, within a programming model framework, to predict the pattern of decisions in period (_t_ + 1).

Choice of technique

The government's objective is presumed to be the maximization of its expected utility. But its freedom to pursue this is limited in various ways, notably by the annual programme budget and by the amount of assistance actually requested by enterprises. The best developed technique for replicating such situations is linear or non-linear programming, which optimizes an "objective function", subject to limits set by a constrained (numerically limited) set of activity possibilities (see, for example, Hillier and Lieberman, 1967, 127-171). The basic model developed here uses this programming approach.

There has been a growing appreciation by geographers of linear (and non-linear) programming's ability to solve such optimizing problems. Early spatial applications were centred on the Weberian problems of finding optimal transportation and resource use patterns, the objective being to minimize total costs (for surveys of particular applications, see Stevens, 1960; Isard, 1960, 474-488; Gould, 1969). Later studies have looked at a wide range of locational problems, frequently embodying multi-variate objectives.

Thus, linear programming has been used to generate optimal spatial patterns for human diets (Gould and Sparks, 1969), intra-urban population distribution (Courtney, Klastorin and Ruefli, 1972), town planning decisions (Ben-Shahar, Mazor and Pines, 1969), and regional planning decisions (Khan, 1967; Hill and Shechter, 1971; Hill and Tzamir, 1972). In a seminal contribution Wolpert (1964) highlighted the potential of linear programming to analyse the decision processes underlying existing locational distributions.

The development of extensions to the basic linear programming model has increased the potential of programming formulations to analyse spatial patterns. Integer programming, for example, has been developed to analyse problems involving discrete-valued optimization. Geographical examples of its use include Manne (1967) and Scott (1971). Of considerable significance for geographers is the scope offered for the analysis of risk and uncertainty by the development of stochastic programming. Daly (1972, 74) has described the general types of stochastic programming. In one type, expected values of variables are derived from their probability distributions and included as part of the programme. This embodies the regression estimation of goal weights (coefficients) outlined above (these comprise the parameters of the objective function in the model below).[23] Another type of approach puts pessimistic estimates of the random elements into the programme as constraints. Viewing these two approaches together suggests the possibility (which is incorporated into the model below) of specifying pessimistic (or optimistic) values for the goal coefficients themselves, in cases where the relevant independent variables in the regression analysis are only estimates.[24] Other approaches include chance constraint programming and the "slack" formulation, but despite the flexibility of stochastic programming for handling situations of non-certainty there has been virtually no application of it by geographers.[25]

The selection of programming as a modelling framework, however, needs to recognise the possible problems of programming for an analysis of the present kind. Linear programming, in particular, contains assumptions of constant returns to scale and, usually (though not necessarily), an absence of external economies and threshold conditions (see Richardson, 1969, 363, for example). The model below, however, allows these assumptions to be relaxed.[26]

The use of a programming framework must also be set against the possibility of using other techniques for solving a multi-variate constrained maximization problem of the type investigated here (see Adby and Dempster, 1975, for a general discussion of these techniques). The most well-known of these alternatives is the use of Lagrangian multipliers. This approach has been applied to spatial utility problems by Funck (1970) and Golob, Gustafson and Beckmann (1973), for example. But the greater mathematical complexity of the Langrangian technique, especially in probabilistic problems, does not seem in general to be offset by apparent advantages in relation to programming for the present kind of study.

For multi-period optimization problems the technique of dynamic programming has been developed (for a regional development example, see Rahman, 1963). This is not applied in the basic model formulated below, however, since the model assumes that government assistance decisions in a period are independent of decisions in past and future periods.[27] Future decisions are unknown because the supply of available projects is determined by the private sector, and the government is unable to forecast the period-to-period composition of these projects.[28] Later in the chapter, though, a methodology is suggested by which the feedback of new decisions on the payoffs of past decisions can be taken into account. This allows the model to become a dynamic programming model with regard to existing information.

Components of the model

The two basic parts of a programming model are the objective function to be optimized and the set of inequalities (constraints) limiting the optimization possibilities. Since the government's assumed objective is to maximize utility, its utility function forms the model's objective function. Goals are assumed to be open-ended (see Isard, 1969, 216-219) so that no upper or lower bounds are set on any of the goal values which are generated by the model.[29] The parameters of the function are found by a regression analysis of scores on each of the different goal criteria (independent variables) and the chosen government expenditure measure (dependent variable), using applications for assistance during a given period as observations.

The constraints included in the programming model used in the present study are of five kinds. The first limits the maximum value of assistance which can be given for a project to the amount requested from the government by the firm. The second is a standard budget constraint, ensuring that the value of assistance given for various projects during a period does not exceed the total budget allocation for such assistance during the period. The next two are production constraints, specifying that new establishments should meet minimum technical plant size and threshold population limitations. Lastly, there are constraints of the integer programming kind, ensuring that projects which are locationally mobile at the time of request are allocated to a single location.

Mathematical formulation

The model combines the above components into a single programming formulation, as follows (assuming an additive utility function and a maximizing of expected utility approach):

Maximize $\underline{U}$

$$U = \sum_{\underline{i}=1}^{\underline{j}} \sum_{\underline{k}=1}^{\underline{l}} \sum_{\underline{p}=1}^{\underline{q}} \sum_{\underline{t}=1}^{\underline{u}} \underline{a}_{\underline{i}} \underline{t}'\underline{b}_{\underline{i},\underline{k},\underline{p},\underline{t}} \underline{y}_{\underline{k},\underline{p}} \underline{g}_{\underline{k}} e^{-\alpha \underline{t}}$$

$$+ \sum_{\underline{m}=\underline{j}+1}^{\underline{n}} \sum_{\underline{k}=1}^{\underline{l}} \sum_{\underline{p}=1}^{\underline{q}} \underline{a}_{\underline{m}} \underline{t}'\underline{b}_{\underline{m},\underline{k},\underline{p}} \underline{y}_{\underline{k},\underline{p}} \underline{g}_{\underline{k}} \tag{8}$$

subject to

$$\underline{g}_{\underline{k}} \leq \underline{g}'_{\underline{k}} \tag{9}$$

$$\sum_{\underline{k}=1}^{\underline{l}} \underline{g}_{\underline{k}} \leq \underline{E}_{\underline{t}'} \tag{10}$$

$$\underline{P}_{\underline{r},\underline{k}',\underline{p}} \geq \underline{T}_{\underline{r}} \tag{11}$$

$$\underline{V}_{\underline{r},\underline{k}'} \geq \underline{W}_{\underline{r}} \tag{12}$$

$$\Delta \underline{L}_{\underline{p},\underline{t}_{max}} + \sum_{\underline{k}=1}^{\underline{l}} \underline{d}_{\underline{r},\underline{p},\underline{t}} \underline{h}_{\underline{k},\underline{t}_{max}} \underline{g}_{\underline{k}} \leq \underline{M}_{\underline{p},\underline{t}_{max}} \tag{13}$$

$$\sum_{\underline{p}=1}^{\underline{q}} \underline{y}_{\underline{i},\underline{k},\underline{p}} = 1 \tag{14}$$

$$\underline{y}_{\underline{i},\underline{k},\underline{p}} \leq 1 \tag{15}$$

$$\underline{y}_{\underline{i},\underline{k},\underline{p}} \geq 0 \tag{16}$$

$$\sum_{\underline{p}=1}^{\underline{q}} \underline{y}_{\underline{m},\underline{k},\underline{p}} = 1 \tag{17}$$

$$\underline{y}_{\underline{m},\underline{k},\underline{p}} \leq 1 \tag{18}$$

$$\underline{y}_{\underline{m},\underline{k},\underline{p}} \geq 0 \tag{19}$$

$$\underline{g}_{\underline{k}} \geq 0 \tag{20}$$

where

$\underline{i}$ denotes goal $\underline{i}$, for which project payoffs vary over time; $\underline{i} = 1, 2, \ldots, \underline{j}$;

$\underline{m}$ denotes goal $\underline{m}$, for which project payoffs do not vary over time; $\underline{m} = \underline{j} + 1, \underline{j} + 2, \ldots, \underline{n}$;

$\underline{k}$ denotes project (request) $\underline{k}$; $\underline{k} = 1, 2, \ldots, \underline{l}$;

$\underline{p}$ denotes prospective location $\underline{p}$; $\underline{p} = 1, 2, \ldots, \underline{q}$;

$\underline{t}$ denotes time period $\underline{t}$; $\underline{t} = 1, 2, \ldots, \underline{u}$;

$\underline{a}_{\underline{i}}, \underline{a}_{\underline{m}}$ denote the utility weighting of payoffs in respect of goals $\underline{i}$, $\underline{m}$;

$\underline{t}'$ denotes the time period during which the project is approved by the government; $\underline{t}' = 1, 2, \ldots, \underline{w}$;

$\underline{b}_{\underline{i},\underline{j},\underline{p}}, \underline{b}_{\underline{m},\underline{k},\underline{p}}$ denote payoffs per unit value of government expenditure in respect of goals $\underline{i}$, $\underline{m}$ for project $\underline{k}$ at location $\underline{p}$ ($\underline{b} = 0$ if government expenditure cannot be directed to $\underline{p}$);

$\underline{g}_{\underline{k}}$ denotes the value of government expenditure on project $\underline{k}$ during $\underline{t}'$;

α denotes the rate used to discount payoffs in periods $\underline{t}$, $\underline{t} + 1$, $\underline{t} + 2$, ..., $\underline{u}$ to time $\underline{t}$;

$\underline{g}'_{\underline{k}}$ denotes the value of government expenditure requested for project $\underline{k}$;

$\underline{E}_{\underline{t}'}$ denotes the total value of funds available for programme expenditure during $\underline{t}'$;

$\underline{r}$ denotes the industry classification of project $\underline{j}$; $\underline{r} = 1, 2, \ldots, \underline{s}$;

$\underline{k}'$ denotes that project $\underline{k}$ consists of a new establishment; $\underline{k}' \subset \underline{k}$;

$\underline{P}_{\underline{r},\underline{k}',\underline{p}}$ denotes the urban population at potential location $\underline{p}$ for project $\underline{k}'$ in industry $\underline{r}$;

$\underline{T}_{\underline{r}}$ denotes the threshold population of new establishments in industry $\underline{r}$;

$\underline{V}_{\underline{r},\underline{k}'}$ denotes the size of the establishment (in input or output terms as required) associated with project $\underline{k}'$ in industry $\underline{r}$;

$\underline{W}_{\underline{r}}$ denotes the minimum technical plant size (in input or output terms as required) in industry $\underline{r}$;

$\underline{t}_{max}$ denotes the time period during which the employment increase in project $\underline{k}$ is at a maximum;

$\Delta\underline{L}_{\underline{p},\underline{t}_{max}}$ denotes the estimated employment increase, in the absence of project $\underline{k}$, at $\underline{p}$ during $\underline{t}_{max}$;

$\underline{d}_{\underline{r},\underline{p}}$ denotes the single period employment multiplier for total employment at $\underline{p}$ of a unit increase in employment in industry $\underline{r}$ at $\underline{p}$;

$\underline{h}_{\underline{k},\underline{t}_{max}}$ denotes the estimated employment increase during $\underline{t}_{max}$ arising from expenditure of one unit of $\underline{g}_{\underline{k}}$;

$\underline{M}_{\underline{p},\underline{t}_{max}}$ denotes the maximum feasible increase in employment at $\underline{p}$ during $\underline{t}_{max}$;

$\underline{Y}_{\underline{i},\underline{k},\underline{p}}, \underline{Y}_{\underline{m},\underline{k},\underline{p}}$ are integers.

The components of this model can be briefly explained. The core of the objective function is the utility obtained from government expenditure of $\underline{g}$, the quantity to be generated by the model. To find this utility, the payoffs (for example, employment increase) in respect to each goal are arrived at by multiplying $\underline{g}$ by the payoff $\underline{b}$ which arises from one unit of $\underline{g}$, weighting the resulting figure by the utility weighting, $\underline{a}$, of the goal concerned, and summing over all goals. (The values of $\underline{a}$ are equal to the corresponding coefficient values in the regression estimate of the utility function derived from data for periods $\underline{t} - 1$, $\underline{t} - 2, \ldots$) This is repeated for each case of expenditure and the results summed to obtain total utility. If a final location has not been chosen for a project when government assistance is requested, a separate utility component is included for each potential location since the value of $\underline{b}$ may vary according to location. Further, if a particular project is expected to produce payoffs with a gestation occurring over more than one period (such as the build-up of employment from the project), the time stream of payoffs is discounted to period $\underline{t}'$, when the government's assistance is given, so as to enable a comparison to be made with payoffs completely generated within period $\underline{t}'$. Discounting is carried out by multiplying the payoff in period $\underline{t}$ by $e^{-\alpha \underline{t}}$, where α is the discount rate. To allow for the influence of time on the composition of utility, the objective function is also made a function of $\underline{t}'$ itself.

The first constraint of the model ensures that a project's government expenditure, g, cannot be greater than g', the value of expenditure requested for the project. Next there is a budget constraint, (10), limiting total government expenditure during period t' to the total value of funds available for the programme during t'. The third constraint, (11), ensures that the urban area in which a new enterprise in a particular industry is located contains at least the threshold population required by that industry's enterprises.[30] Another threshold constraint, (12), follows, requiring new establishments in an industry to meet the minimum technical plant size in the industry.[31] The next constraint, (13), limits the total employment increase per period at the location of each project to the maximum feasible employment increase per period at that location. The former's value is the sum of the exogenous employment increase and the project-generated increases, given by the per period increase in employment within projects at that location (being government expenditure, g, multiplied by the employment increase per unit of expenditure, h, for each project) expanded by a per period multiplier, d, to account for indirect employment increases generated at that location. The reason for this constraint is the possibility that employment arising from projects would cause a short term overloading of service and infrastructure capacity in the urban area concerned. The set of constraints (14) to (19) restricts expenditure on a project to one location. This is achieved by a multiplication in the objective function of $\underline{g}$ in each possible location of a given project by $\underline{y}$, an integer limited by the constraints to values of zero or one, and whose sum across locations for a given project is limited by constraint (14) or (17) to a value of one. The final constraint eliminates the possibility of negative values of $\underline{g}$. Economies of scale and external economies are incorporated in payoff values, $\underline{b}$, and specifically in payoffs relating to the maximum employment increase goal in the present study via the use of surrogates (such as initial employment size and urban population) as explained in the next chapter and Appendix 1.

Extensions of the model

Relationships (8) to (20) comprise the basic model. This can be expanded or modified in various ways to provide a better approximation of reality. Firstly, the structure of the objective function can be changed to accord with whichever of the possible types of utility function discussed earlier is found to be closest to the actual historic function, using regression analysis. In Chapter 5 a series of such analyses is carried out to determine the "best fit" function for the New South Wales decentralisation programme.

The second kind of extension concerns threshold constraints. The threshold population and minimum plant size constraints (11) and (12) are just two examples of these, albeit perhaps the most important in many cases. Another possible example is the overnight trucking distance between branch plants and main plants.

The most complex extension involves modelling the potential feedback of new projects on the payoffs, and thus the utilities, of previously approved projects. In particular, the utility from a new project may be more than outweighed by the ensuing loss of utility from existing projects. The most important way this is likely to occur is through repercussions on employment payoffs. These repercussions may be the result of direct input-output relationships, or else indirect influences such as the multiplier effects of expenditure of wages.

One possible employment model of input-output effects is the following, drawing in part upon the spatio-temporal autocorrelation models of Bennett (1975) and upon the gravity model concept. It consists of a set of simultaneous equations, with one equation for each type of industry, $\underline{i}$ ($\underline{i}$ = 1, 2, ..., $\underline{n}$) receiving assistance, thus:

$$\underline{l}_{\underline{i},\underline{p},\underline{t}+1} = \underline{a} + \underline{b}_{\underline{i}}\underline{w}_{\underline{p},\underline{t}} \left(\sum_{i=1}^{\underline{n}} \underline{c}_{\underline{i}}\underline{l}_{\underline{i},\underline{p},\underline{t}} + \right.$$

$$\sum_{\underline{i}=1}^{\underline{n}} \underline{d}_{\underline{i}}\underline{l}_{\underline{i},\underline{p}+1_{\underline{A}},\underline{t}} \Big/ \underline{s}_{\underline{i}_{\underline{A}}}^{\beta} + \sum_{\underline{i}=1}^{\underline{n}} \underline{e}_{\underline{i}}\underline{q}_{\underline{j},\underline{p},\underline{t}} +$$

$$\sum_{\underline{i}=1}^{\underline{n}} \underline{f}_{\underline{i}} \underline{q}_{\underline{i},\underline{p}+1_{\underline{N}},\underline{t}} \Big/ \underline{s}_{\underline{i}_{\underline{N}}}^{\beta}) \qquad (21)$$

where

$\underline{l}$ denotes the change in employment in assisted establishments in industry $\underline{i}$ at centre $\underline{p}$ or $\underline{p}+1_{\underline{A}}$ during period $\underline{t}$ or $\underline{t}+1$, according to subscripts;

$\underline{p}$ denotes urban centre $\underline{p}$;

$\underline{t},\underline{t}+1$ denote time periods $\underline{t}$ and $\underline{t}+1$ respectively;

$\underline{w}_{\underline{p},\underline{t}}$ denotes the population of centre $\underline{p}$ in period $\underline{t}$;

$\underline{p}+1_{\underline{A}},\underline{p}+1_{\underline{N}}$ denote the nearest centre to $\underline{p}$ containing respectively an assisted or a non-assisted establishment in industry $\underline{i}$;

$\underline{s}_{\underline{i}_{\underline{A}}},\underline{s}_{\underline{i}_{\underline{N}}}$ denote the distance between centre $\underline{p}$ and centre $\underline{p}+1_{\underline{A}}$ or $\underline{p}+1_{\underline{N}}$, respectively;

$\underline{q}$ denotes the change in employment in non-assisted establishments in industry $\underline{i}$ at centre $\underline{p}$ or $\underline{p}+1_{\underline{N}}$ during period $\underline{t}$ or $\underline{t}+1$, according to subscripts;

$\underline{a},\underline{b}_{\underline{i}},\underline{c}_{\underline{i}},\underline{d}_{\underline{i}},\underline{e}_{\underline{i}},\underline{f}_{\underline{i}}$ and β are constants, β being the distance exponent.

Equation (21) states that the change in assisted employment in a particular industry and urban centre over a particular period is a function of (a) changes in employment in the previous period in assisted and non-assisted establishments in each separate industry, both in the centre itself and in the nearest centre for each industry; (b) the distances from the centre in question to these nearest centres; (c) the population of the centre itself. Changes in assisted and non-assisted employment are distinguished from one another to allow the impact of assisted employment changes to be separately traced. The population variable is included as a surrogate for external economies and for urban size variations in non-basic employment[32] multiplier effects. The model assumes that assisted establishments contain basic employment, which is reasonable considering that truly non-basic employment does not require, by definition, abnormal conditions for its existence. Employment changes by urban hierarchy level are not distinguished in the model. However, any tendency for larger centres to generate bigger changes in response to a given stimulus (acting through the elements on the right hand side of (21)), because of import substitution possibilities and the like, would be reflected in the value of the population coefficient, $\underline{b}_{\underline{i}}$. As it stands the model is not identified,[33] but this could be achieved by aggregating the employment changes in each industry on the right hand side of (21) to a suitably small number of industry groups. The model is a fairly highly simplified representation of reality, and an expanded version could incorporate such additions as multi-period (distributed) lags, non-nearest competing centres, distance exponents other than unity, the division of non-assisted employment changes into basic and non-basic elements, additional explanatory variables such as unemployment (as in Bennett's (1975) model), further multiplicative and non-linear relationships, and so on.

Once the model is calibrated using data from past periods, the employment feedback of new government-assisted projects on existing assisted projects may be estimated.[34] The estimated change in employment in the new project during $\underline{t}$ is substituted in the appropriate $\underline{l}_{\underline{i},\ \underline{p},\ \underline{t}}$ or $\underline{l}_{\underline{i},\ \underline{p}\ +\ 1_{\underline{A}},\ \underline{t}}$ argument in each relevant equation from the set calibrated using the general form given by (8). These relevant equations comprise one for each industry in centre $\underline{p}$ containing the new project and one for each industry in centre $\underline{p}$ + 1, which contains the establishment(s) in the new project's industry category nearest to $\underline{p}$.[35] By assuming that the other $\underline{l}$ and $\underline{q}$ elements in each equation have values of zero, values of $\underline{l}_{\underline{i},\ \underline{p},\ \underline{t}\ +\ 1}$ and $\underline{l}_{\underline{i},\ \underline{p}\ +\ 1_{\underline{A}},\underline{t}\ +\ 1}$ can then be estimated from these relevant equations. Estimated $\underline{l}$ values in centres which contain no assisted establishments in industry $\underline{i}$ at the end of period $\underline{t}$ must be ignored since these will be estimates of employment generated by new establishments whereas the employment effects on existing projects are the concern here. Similarly, the (exogenously) estimated employment increase from the new project itself during period $\underline{t}$ + 1 must be subtracted from the value of $\underline{l}_{\underline{i},\ \underline{p},\ \underline{t}\ +\ 1}$. The values of $\underline{l}_{\underline{i},\ \underline{p},\ \underline{t}\ +\ 2}$ and $\underline{l}_{\underline{i},\ \underline{p}\ +\ 1_{\underline{A}},\ \underline{t}\ +2}$ can be estimated by substituting the estimated $\underline{l}_{\underline{t}\ +\ 1}$ values into the appropriate versions of (21). Values for subsequent periods can be estimated in analogous fashion.

The aggregate employment impact of the new project in each period is given by the sum of the various 1 estimates yielded by the model and of the estimated employment change from the project itself, but excluding values in centres with no existing assisted establishments in industry i.[36] The aggregate employment change in each period is then discounted back to t by applying the discounting factor $e^{-\alpha t}$ as in the original programming utility function, (8).[37]

While the above paragraphs have outlined an approach by which feedback effects may be identified and incorporated into the basic programming model, this is not applied empirically in the present study for two main reasons. First, the possibilities for the occurrence of the more critical feedback effect, employment reductions in existing assisted firms, are considerably reduced by the Department's decision rule that new projects should not be sponsored where they will compete with existing industries. Second, interviews with approximately 100 country industrial firms in New South Wales carried out by the author during 1966 and 1967 (the middle of the period covered by the present study) indicated that input-output linkages with other country firms were generally insignificant in terms of potential employment effects.

The final way in which the basic model can be extended is both conceptually clearer and potentially more significant than feedback analysis. This is the incorporation of variables reflecting a non-normative, behavioural, approach to the decision-making process.

The most well-known of such approaches is Simon's (1957) satisficing model, with its associated concept of subjective (bounded) rationality, which has already been mentioned.[38] The central idea, that outcomes (projects) are classed simply as satisfactory or unsatisfactory, can be built into the present programming model by adding constraints requiring that requests are either fully met by government assistance or not at all. Satisficing with regard to a particular goal simply requires an appropriate constraint specifying the minimum satisfactory goal payoff, per unit of government expenditure, which must be achieved by successful requests. Alternatively, if lack of satisfaction on a particular goal is not binding (that is, if it can be countered by satisfactory payoffs on other goals), the goals in the objective function can be defined so that goal payoffs take values of either + 1 (satisfactory) or 0 (unsatisfactory). The latter method is potentially more realistic because it allows satisficing goals to be included in the utility function and "traded off" with other goals. As such it has been preferred when applying the model to the New South Wales decentralisation programme. Subjective rationality can also be modelled in a number of other general ways. These range from "short cut" methods of estimating uncertain payoffs (for example, using the estimates of applicants themselves) to ignoring "external" constraints (such as threshold population) or payoffs (such as feedback employment changes).[40]

APPLICATION OF THE MODEL

The initial application of the model attempted here is based on semi-normative rather than fully normative assumptions in order to relax the more unrealistic tenets of the classical "economic man" model. This application, using New South Wales decentralisation programme data for the 1965/66 to 1968/69 period, is presented in the next three chapters. The possibilities for applying the model to non-normative decision-making are explored in Chapter 7.

Footnotes

1. This assumption is relaxed in the analysis of Chapter 7.

2. Except, of course, where a sufficient number of goals have the same patterns of goal outcomes.

3. Presthus' evidence on this point is inconclusive (Presthus, 1974, 290). About half of the United States and Canadian civil servants in his sample considered that the "public interest" was the major single factor guiding their policy decisions. Downs (1967) has shown that the officials who make and interpret public policies act at least partly in their own interests.

4. Two caveats should be made here. The first is that certain studies (in particular, those of Friedman and Savage, reported in Hoffman, Festinger and Lawrence, 1954, and of van Praag and Kapteyn, 1973) have suggested that this relationship only holds over a certain range in regard to money incomes. The second is that governments may regard the total social welfare which can be derived from spending a given proportion of society's income as constant over time. This arises from the view that social welfare in a certain period depends on the utility of consumption per head (c.f. Layard, 1972, 41). This would mean that expenditures would have to be standardized for year-to-year variations in the proportion of community income spent on the programme concerned.

5. The latter condition, together with the multiplication of each second order expression by ½, ensures that the marginal rate of substitution between goals (indicated by $\frac{\partial \underline{g}_1}{\partial \underline{g}_2}$ in the substitution of goal 1 for goal 2, for example,) is diminishing, since $\partial \underline{g}_1$, etc must be less than zero. Arrow (1965) and others have shown, however, that the quadratic form of the utility function can lead to paradoxical results, such as implying that risky investments will tend to diminish as a nation becomes wealthier.

6. This can be demonstrated easily in the simplest case in which all requests are of the same value, when the utility function can be written: $\log \underline{E}=\underline{w}_1\underline{g}_1 + \underline{w}_2\underline{g}_2$ where $\underline{E}$ represents the value of government expenditure. Taking antilogs, this gives the exponential form $\underline{E}=10^{\underline{w}_1\underline{g}_1 + \underline{w}_2\underline{g}_2}$.

7. One such form is the Cobb-Douglas specification (multiple power function), which has been suggested for a social welfare function by Nijkamp and Paelinck (1973) and used in a spatial utility problem by Fingleton (1976). Another is the exponential function (for a discussion of linear, power and exponential decision functions, see Ostresh, Louviere and Gaeth, 1977). Other possibilities are raised by evidence that individuals "trade off" decision variables not according to Euclidian space but, rather representations such as the more general "Minkowski" space (Shepard, 1964).

8. Another possibility is to make $\underline{t}$ a polynomial function.

9. Theil's (1964, 53) equivalent point is that there may be uncertainty as to the way in which the marginal utilities are affected by changes in controlled variables.

10. The possible reflection of increasing knowledge of risk situations in the time parameters included in equation (4) is the only concession already given in this regard.

11. See Yamane (1964, 252). Where the sample size is less than 50, Student's t statistic should be used instead (Yamane, 1964, 470).

12. De Neufville and Stafford (1971, 129-131), for example, point out that because the values of regrets are strictly relative to the other alternatives considered, the regret criterion may be intransitive and thus violate the conditions assumed for rational decisions.

13. An appropriate technique here would be integer programming (see below).

14. One approach to the multidimensional goal problem is to use factor analysis to "collapse" the number of criteria into a lesser number of representative factors, although the criteria weightings which are thus implicitly derived may not correspond with those of the decision makers.

15. One possible alternative to multiple regression as a method for the statistical explanation of weights is Bayesian analysis (Edwards and Phillips, 1964). It is not an operational method in the present study, however, because of lack of requisite data concerning prior probabilities. Another possible method is logit analysis, which McFadden (1976) has in fact used to analyse highway location decisions of the California government. But this technique is not particularly suited to continuously distributed dependent variables such as the measures of utility suggested in this chapter. A further method involves the use of matrix algebra in conjunction with quadratic programming, as used by Nijkamp and Somermeyer (1971). The complexity of the method does not appear to offer compensating advantages in the present case, however.

16. Money values have throughout been adjusted to levels which would have prevailed in June, 1969, based on changes in the Consumer Price Index between the calendar quarter in which the assistance was approved and the June 1969 quarter.

17. It may be observed that the influence of request value on assistance levels could also be modelled by including a measure of this value in the set of independent variables ("goals") used in the regression analysis to predict $\underline{U}$, rather than directly standardizing assistance values as above. This would mean, however, that the dependent variable in such a model would not be equivalent to $\underline{U}$. In the strict sense, then, the model would be "explaining" the determinants of expenditure rather than utility, and the earlier discussion indicated that this is conceptually less satisfactory. It would also mean that the potential statistical problem of collinearity between request value and the other independent variables is introduced.

18. One further methodological problem arises from the limitation on assistance imposed by the size of each

request, namely that the index of utility is constant for all projects in which the assistance given equals the value of the request. However, the actual utilities (per assistance unit) of these projects will vary unless the government adopts a satisficing decision philosophy by which all such utilities are regarded as equally satisfactory. If this is not the case, these projects can be visualized as being ranked in descending order of utility per unit of assistance, with only the last project's utility being equal to the assistance given. The utility to the government of the other projects will exceed the assistance given. This can be illustrated by reference to Figure 1.2 (Chapter 1), taking the MR line as representing utility per unit of assistance for each project, and the dotted line as denoting the level at which assistance given equals the full value of each request. For projects with utilities above this dotted line the government would have been willing to give assistance greater than the amounts requested, thus yielding a "development surplus" to the government equal to the area below the MR line but above the dotted line at P. (This notion is analogous to the consumer surplus concept, which is discussed in Dasgupta and Pearce (1972), for example.) Thus theoretically, in the absence of satisficing, projects receiving all the assistance requested should be excluded in calibrating utility functions based on an expenditure definition of utility, as is used here. In practical terms, though, this raises a further difficulty. The New South Wales decentralisation programme has a decision rule that only projects in certain areas are normally eligible to have their requests fully met (see Chapter 2). The exclusion of such projects would therefore mean that the calibrated utility function, and thus the whole model, was not applicable to them. Because these are such a major part of the programme, and because of the theoretical possibility that satisficing could exist for these projects, they were retained in the utility function calibration (see Chapter 5). Nevertheless, the potential for calibration errors in the absence of satisficing must be recognized.

19. Johansen also notes that difficulties may arise because the pattern of response to changes in the economic-political decision environment may be ill-defined. The present model is therefore applied only to a narrow time period (1965/66 - 1968/69) during which government policies did not appear to

change significantly. Within this period, an instantaneous response (or virtually so) to newly perceived relevant information has been assumed. In particular, information has been considered to be perceived from the time it was first recorded on departmental files, or, in the case of population census information, with a lag of about one month from the date of publication (see Chapter 4).

20. It need hardly be added that preference parameters should not be extrapolated to cases lying outside the range of values defining the population sample used to estimate such parameters. In the present study, for example, it is not possible to say whether the utility functions derived in the ensuing analysis are applicable to enterprises which had their requests totally rejected.

21. An example in regional planning is Nijkamp's (1975) multicriteria analysis which derives a "nondominated" set of admissable decision solutions based on successive comparisons of each pair of plans, and which requires criteria weights to be derived by "confrontation with decision makers".

22. That is to say, overall payoff variance will become endogenously determined.

23. For one of the rare spatial examples of a linear programme using objective function coefficients derived by regression, see Brzoza (1965). Nagel (1975) is the only work known to the author, besides the author's own earlier contribution (Searle, 1971), in which this method is suggested for public policy analysis.

24. For a stochastic programming analysis which incorporates a full range of probabilistic values for objective function coefficients, see Tintner and Farghali (1967).

25. Another programming technique for analysing risky situations is quadratic programming. Its applicability is limited, though, because it is restricted to cases in which variance is the sole measure of risk.

26. Although varying returns to scale and external economies are not specifically included in the formal version of the model given in this chapter,

variables acting as surrogates for these influences are included in the employment payoff analysis in the next chapter.

27. The independence of inter-period decisions means the model is a "stationary decision rule" case of the general dynamic programming problem (Beckmann, 1972).

28. Another general approach toward solving constrained maximization problems is the use of steepest ascent (hill climbing) methods (Mulligan, 1965). These are used in particular in general convex programming problems (Hillier and Lieberman, 1967, 587-589), although Mulligan's typology of techniques suggests that a programming framework is not strictly necessary for the application of these methods in constrained maximization situations.

29. The other main types of goals analysed in the regional development literature are target goals and satisficing goals. The model described below can be modified to incorporate either of these types, and satisficing goal modifications are in fact discussed in the penultimate section of this chapter. For a general discussion of the programming of the various types of multiple goal decision-making, see Eilon (1972).

30. On the notion of threshold population in relation to secondary industries, see Development Corporation of New South Wales (1969, Chapter 11).

31. It is assumed that projects involving the (*in situ*) expansion of existing enterprises do not violate threshold populations or minimum plant size constraints.

32. For a discussion of the concept of basic and non-basic employment, see Isard (1960, 189-205).

33. The concept of identification is discussed in Christ (1966, 300 and 304).

34. Multiplier effects on non-assisted establishments do not directly affect the payoffs from existing government decentralisation assistance and therefore pose fewer conceptual problems (c.f. the methodology

for estimating such effects used in the next chapter). As such, they are not separately considered here.

35. In practice separate equations would not be required where coefficients $\underline{c}_i$ or $\underline{d}_i$ for employment changes in the new project's industry were not, upon calibration, found to be significantly different from zero.

36. In theory, employment changes in each assisted establishment (including that of the new project) should be weighted to reflect their utility to the government. However, the utility function parameters themselves should theoretically reflect in turn the feedback effects. A possible solution to this co-determination problem would be to calibrate the utility function without allowing for feedback effects, use this version of the function to weight the feedback changes, and recalibrate the utility function incorporating these weighted changes. The process would be reiterated until there was no further significant change in the values of the utility function parameters.

37. The latter also requires project payoffs to be expressed in terms of per unit value of government expenditure. This is achieved simply by dividing the discounted value at $\underline{t}$ of aggregate employment changes by the value of government assistance to the project concerned.

38. The satisficing model is discussed further in Chapter 7.

39. In addition, the modelling of satisficing goals via constraints would have required data for firms not receiving assistance; such data was not available in the present study.

40. It might be noted that while Simon has queried whether the idea of social welfare function maximization can be made operational (March and Simon, 1958, 157), the suggestion made previously that the maximand of the programming model may be viewed as the Department of Decentralisation and Development's decision function is closer to Simon's own behavioural approach.

41. Other frameworks, however, are also used in that and the following two chapters to reflect the variety and number of potentially relevant non-normative influences on decisions within the decentralisation programme.

CHAPTER 4

IDENTIFICATION OF CRITERIA FOR DECENTRALISATION GOALS

The next three chapters investigate the extent to which the distribution of New South Wales decentralisation expenditure can be explained under semi-normative conditions, that is, under all but the most unrealistic conditions of traditional location theory. The model developed in the previous chapter is used as the framework. This chapter and the next describe the estimation of parameter values of the model's utility function. The first stage of such estimation is the identification of suitable goal criteria to use as independent variables in the functions; this is described in the present chapter, while the estimation itself is discussed in the proceeding chapter. In Chapter 6 the complete model is empirically specified and tested.

Estimation of the parameters of the model requires an analysis of past patterns of decentralisation expenditure. For this procedure to be valid, conditions in the period to which the model applies should be substantially the same as those in the period used for parameter estimation (Haggett, 1973, 231-232). This implies, in particular, that the decentralisation goal weightings used by the government should be similar in both periods. The main factor altering governmental goal weightings is probably a change in the party in power. In New South Wales the accession to power of the Liberal-Country Party Government in 1965 was accompanied by a significant modification and expansion of the decentralisation programme (see Chapter 2). Consequently the analysis in this and succeeding chapters has been mainly limited to firms assisted in the period between the change in government in 1965 and 30th June 1969, the cut-off point for firms included in a survey carried out by the Department of Decentralisation and Development and from which essential data were obtained.[1] The particular analytical strategy used here will be to estimate the parameter values from 1965/66, 1966/67 and 1967/68 data,[2] incorporate the estimates into the programming model, iterate the model using information on firms seeking decentralisation assistance in 1968/69, and compare the pattern of governmental expenditure thus predicted with the actual distribution of expenditure in 1968/69.

A SEMI-NORMATIVE FRAMEWORK

Normative location theory is built on a number of assumptions, the most important being that the locator is trying to maximise profits, that he has perfect powers of knowledge, reasoning and computation, and that there is complete certainty. The rigidity of these assumptions, inherent in the classical location theories of Von Thunen, Weber, Losch and others, has in recent years led to a serious questioning of their validity under real world conditions. Webber (1972, 105-110), for example, identifies three main strands of criticism associated with the maximization concept. The first is that, in practice, many firms consider "non-economic" location factors. The second is that most decision making is concerned with obtaining satisfactory, rather than maximum, outcomes. This criticism is also related to attacks on the unrealistic nature of the other normative assumptions, which reduce to "omniscient rationality" (Simon, 1957a, xxiii) and perfect knowledge. The third criticism of the maximizing concept is that real world location patterns are stochastic, not deterministic as they should be if traditional location models applied. But the normative conditions of traditional theory, or at least a slightly enlarged version of them, may still provide a starting point for analysing spatial patterns. Again Webber (1972, 106-107), for instance, has argued that non-economic location factors are either usually over-rated in importance, or else cause firms to suffer lower profits and tend to make them go out of business, thus exerting no long run locational effect. He also points out that *ex post* satisficing may actually result from *ex ante* maximizing decisions, once the amount and cost of information available at the time the decisions were made is taken into account. Moreover, a significant proportion of location decisions from even an *ex post* viewpoint may be of the optimizing (maximizing) kind, as Townroe's empirical study of industrial location decisions in England indicates (Townroe, 1971, 90).

These considerations suggest that a framework based on the normative conditions of traditional location models may still provide a useful initial frame of reference for analysing the location pattern of the New South Wales Government decentralisation programme. What is required here is that normative conditions which are unrealistic are replaced by feasible semi-normative equivalents which modify the original conditions as little as possible. The assumptions which result if this approach is applied to an analysis of the decentralisation programme in New South Wales can be developed as follows:

1) Knowledge is limited to information which is available at the time a decision is made. This assumption thus accommodates Webber's concept of optimization with respect to available information.

2) Since the decision unit is governmental, rather than a private enterprise one, the overall goal is the maximization of social welfare, instead of profits. Social welfare has a number of different components which appear as separate goals. Social welfare can thus be viewed as a varying function of these goals, and the government's objective re-interpreted as the maximization of the relevant social welfare function.

3) The financial viability of enterprises applying for assistance is an explicitly stated criterion

upon which departmental decisions have been said to be based,[3] and is essentially a response to the risk and uncertainty attached to selecting different enterprises. The usual normative assumption of certainty must therefore be replaced by a condition in which there is uncertainty about the potential viability of enterprises.[4] Greenhut's semi-normative location theory has a similar allowance for uncertainty (Greenhut, 1963 and 1966).

Each of 1), 2) and 3) are assumed to apply in the analysis of Chapters 4, 5 and 6. Assumption 2) provides the central framework of the analysis. 1) is used primarily in the formation of the goal indices from which the social welfare functions are derived, and secondarily in the specification of constraints in the linear programme. Assumption 3) is met by incorporating risk reduction as a separate goal in the manner outlined in Chapter 3.

DECENTRALISATION GOALS IN THE PERIOD 1965-69

The central requirement needed to construct a semi-normative version of the programming model described in Chapter 3 is the construction of appropriate utility functions, one for each possible functional type. The first stage in deriving such functions is the formulation of quantitative indices for each of the hypothesized goals. Before this can be done, however, it is necessary to define these goals.

The *ex post* identification of government goals presents obvious difficulties. The chief of these is that at least some of the goals actually used in a programme may be implicit and unstated, or not known outside the relevant government department. Bearing in mind this problem, there are several sources from which the more important goals for the New South Wales decentralisation programme between 1965 and 1969 can probably be deduced. The first is the second reading speech of the Minister for Decentralisation and Development when introducing the State Development and Country Industries Bill (later Act) (NSW Parliamentary Debates, 1st March 1966), by which the Country Industries Assistance Fund - the primary source of the decentralisation programme's funds after 1965 - was established. The second is the application form which is filled out by companies seeking decentralisation loans. The nature of the questions on the form is presumably indicative of the inter-company criteria (and therefore the goals relating to company variables) by which each request is assessed. The most common of the three such forms used is shown in Appendix 1. The third source consists of the reports and recommendations contained in the departmental file on each company. The author had access to these as an employee of the Department of Decentralisation and Development. The information contained therein on assessment criteria and other matters has only been used in aggregated form in this thesis so as to preserve the confidential nature of the original material on individual companies.

These three sources have been used to compile a set of goals hypothesized as having been used in the New South Wales decentralisation programme between 1965 and 1969. The departmental files reveal a sizeable number of possible goals. To reduce the analysis to manageable proportions only those goals listed more than once have been included here, with the principal exception of the goal of obtaining political advantage, which was not mentioned on file. Its existence was, however, mentioned in an interview by the then Minister for Decentralisation.[5] In practice, a hierarchy of goals is evident. The hypothesized goals used by the Department of Decentralisation and Development and set out below generally represent operationalized versions of more fundamental goals such as efficient development, equity and stability, representing direct expressions of social welfare. For convenience, however, the second level "operational" goals are those used in the subsequent analysis of utility functions. The hypothesized goals are as follows:

1) To increase total employment in country industries as efficiently and rapidly as possible.

2) To avoid decreases in employment in country industries and, in particular, to stop country enterprises from closing. This goal is a natural corollary of goal 1).

3) To provide employment opportunities to counter those lost in declining industries in specific areas, notably mining in Maitland, Cessnock, Lithgow and Broken Hill, and dairying on the North Coast (these are the 100% assistance areas - see Chapter 2). This is an equity goal, in that it is designed to give special preference to less advantaged areas.

4) To increase industrial employment opportunities in towns with a poorly developed manufacturing base.

5) To increase female employment opportunities in towns with a preponderance of male-employing industries, or with high female unemployment. Goals 4) and 5) are further equity goals, with increased stability also being part of the aim of goal 5).

6) To conserve decentralisation assistance funds.

7) To lessen the risks involved in pursuing other goals.

8) To obtain political advantage. Although political advantage is not usually strictly considered as a component of social welfare, the fact that it may be part of the decision process (see footnote 5) suggests that it should be included. In these terms the utility function being measured is very much a "decision function" rather than a strict "social welfare function".

SELECTION OF GOAL INDICES

The listing of goals 1) to 8) above represents the starting point for developing a decision function(s) applicable to the New South Wales decentralisation programme between 1965/66 and 1967/68. The next step is to construct indices which quantify the degree to which each goal can be achieved in every case. Under the semi-normative conditions of the present model, the problem is to derive indices which represent the best possible estimates of potential goal attainment, given available knowledge. This section describes the selection of suitable indices for each goal. The remainder of the chapter is devoted to the derivation of values for the proposed indices of the first goal (increasing total country employment), since these generally required econometric estimation, unlike the indices of the other goals.

Goal 1 - Increasing total country employment

The goal of increasing total employment in country areas as efficiently and rapidly as possible has several dimensions. In the first place, it is apparent that the most efficient way of increasing employment, given limited assistance funds, is to favour applications which have the highest expected increase in employment per unit of assistance.[6] Secondly, because assistance can increase country employment both directly and indirectly[7] it is necessary to take indirect, or multiplier, increases per unit of assistance into account. Thirdly, the Department has concentrated assistance on industries which would not establish or expand in the country without external inducement.[8] The line between such industries and those "naturally" located in country areas will not always be a sharp one. The most efficient way of pursuing the goal of increasing employment here would be to vary assistance according to the degree to which the enterprise assisted is a "natural" country industry. In contrast to these three "efficiency" dimensions of the objective of expanding employment, the sub-goal of increasing employment as rapidly as possible will not be related to the unit effectiveness of assistance, but to its total impact, that is, to the total expected employment in each case.

The four indices chosen to represent the respective dimensions were:

a) Estimated employment change per unit of assistance, in the applicant establishment;

b) Estimated employment change in other basic industries and in non-basic industries in the locality concerned, per unit change in a) (assistance is assumed to have been restricted to basic industries - the notion of basic and non-basic industries is discussed later in the chapter);

c) Whether the Department regarded the applicant establishment as having an advantage (value, one) or a disadvantage (value, zero) because of its country location;

d) Total estimated employment in the applicant establishment, given by the estimated employment change per unit of assistance multiplied by the value of the request, added to existing employment (since the present significance of the establishment was also considered important: this is an objective related to goal 2) but it is more conveniently incorporated here);

The development of these four measures is discussed in the subsequent sections of this chapter.

Goal 2 - Avoiding decreases in country employment

While the primary thrust of the New South Wales decentralisation programme between 1965 and 1969 was the establishment or expansion of country industries, this did not preclude some assistance from going to country establishments threatened with contraction or outright closure. In virtually all such cases, however, prospective closure rather than contraction was the criterion for assistance, probably due in large part to the more visible nature of the impact and the consequently greater political repercussions. Therefore the criterion used for this goal was the binary one of whether the Department considered that, in the absence of assistance, the establishment concerned would close (value, one) or not (value, zero). This criterion was not used in the case of grants, since there was only a single case in which the value would not have been zero and the variable would therefore have merely acted as a dummy for that case.

Goal 3 - Increasing employment in areas of economic difficulty

The particular importance of generating new jobs in country areas where employment in staple primary or mining industries was declining was recognised by the Department in the creation of the so-called "100 per cent" areas, embracing the Far North Coast, Maitland, Cessnock, Lithgow and Broken Hill (see Chapter 2). In these areas, loans equal to the full value of the amount requested (rather than the usual 60 per cent) were made available by the Department. Hence, a sufficient criterion for this goal is whether the particular establishment is in a "100 per cent" area (value one) or not (value zero). Although this admittedly reflects the Department's judgement of the spatial extent of particular need, rather than any objectively derived index of need, the broadness of the concept of "economic difficulty" used by the Department for defining "100 per cent" areas[9] makes such a criterion preferable. In particular, the large number of possible variables and variable weightings which could be used to develop an index of areal economic need makes it quite probable that at least one combination of variables and weightings could be developed to produce the same areal division as the Department's.

Goal 4 - Increasing manufacturing employment in areas of low industrialisation

Despite an apparent similarity, this goal is conceptually separate from goal 3). Towns with little or no industrial base, except for rudimentary processing plants such as dairy factories or sawmills, appeared to be favoured for assistance by the Department independently of whether they were considered to be in areas of economic difficulty. The criterion developed for this goal was the percentage of the work force in the urban area concerned employed in manufacturing, excluding the food, drink and tobacco, and sawmilling and wood products (not furniture) Census groups. The latter were omitted because the Department's view seemingly downgraded the role of local raw materials processing (which the two groups principally comprise), possibly because it is a more "natural" country manufacturing activity. Census data for 1961 were used, as this was the latest published information on work force structure available to the Department in the 1965-68 period.

Goal 5 - Increasing female employment in areas with low female job opportunities

An area's lack of female job opportunities was considered by the Department to be primarily reflected by a dominance of male-employing industries. Hence, establishments with predominantly female employees in towns with dominantly male employment would be expected, all else equal, to be favoured for assistance by this goal. Accordingly, the main criterion used here was the 1961 female work force as a percentage of the male work force in the urban area concerned, multiplied by the 1961 New South Wales male work force as a percentage of the female work force in the Census industry group to which the establishment belonged. Low values for each component of the criterion would thus indicate high potential for realisation of goal 5). The Department also recognised that actual female unemployment was an additional indicator of lack of female employment opportunities.[10] Therefore a secondary criterion was also used, namely, females not at work in the 1961 Census as a percentage of the total work force in the urban area concerned, multiplied by the 1961 New South Wales female work force as a percentage of the male work force in the appropriate Census industry group. High values for each component of the criterion would indicate high prospects for realisation of goal 5).

Goal 6 - Conserving decentralisation assistance funds

Total annual funds available to the Country Industries Assistance Fund are fixed at the start of each financial year, and the Department has rationed amounts provided to country enterprises not only by rating them against the more publicly expressed goals such as goal 1), but also by apparently preferring loan requests for moderate amounts and short repayment periods (the latter leading to faster recycling of loan funds back into the CIAF). The two criteria selected for goal 6) were thus the value (in terms of June, 1969 price levels) of the request in each case,[11] and whether, in the case of loans, the repayment period was less than eight years (value one) or not (value zero). The second criterion is the benchmark which was used by the Department to judge whether a given loan period was short enough to be significant for conserving funds. While it appears that such a binary classification causes a loss of information and therefore violates the semi-normative framework of the present chapter, in practice the bulk of loans in the 1965-68 period were of a standard length and only a few were for short (non-standard) periods. Hence the two-fold division does not in practice result in a significant information loss.

Goal 7 - Reducing risks

One of the most explicit and publicized criteria for granting decentralisation assistance has been the condition that the enterprise concerned should be viable in the location chosen.[12] The basic measure of viability used by the Department has been the financial history and present position of the enterprise applying for assistance, as reflected on its balance sheets and profit and loss statements. Of all the possible criteria which could be developed from such information,[13] the following were selected because they appeared to summarise the most common ways in which balance sheet and profit and loss data were analysed by the Department:

a) Current assets as a proportion of current liabilities;

b) Current assets minus current liabilities, adjusted to June, 1969 price levels;

c) Pre-tax profits as a percentage of shareholders' funds;

d) Long term liabilities (including the prospective value of any departmental and local council loans), net of shareholders' funds, as a percentage of shareholders' funds; and

e) Working capital (defined by b) above) minus prospective annual loan repayments to the Department (and local council, where applicable).

Criterion e) was obviously not applicable in cases involving grants. For each criterion, the most recently available figures (relating either to a financial year or to a balance sheet date, as appropriate),were used.

Another viability criterion used generally by the Department was an assessment of the quality of management in the applicant firm. There appeared to be little in the way of objective measures available to guide the Department here, and it relied on ad hoc information such as the credit rating given by bank managers. The measure used here for this criterion was simply whether the Department rated management favourably (value one) or unfavourably (value zero).[14]

A further viability criterion mentioned in departmental reports was whether the firm seeking assistance had just been established. This reflects the tendency for business failures to be more frequent for younger firms (Negus, 1975). Although an index of the length of time the applicant enterprise had been established could have been used, the simpler criterion of whether the firm was new and about to commence operations (given a value of one) or whether it had a previous operations history (given a value of zero) was adopted instead. It was felt that this would reflect the important qualitative risk differential existing between completely untried enterprises, and those which had previous operations and therefore historical data which could be used in assessment. None of the firms included in the sample of those receiving grants were newly established, so this criterion was not used in the analysis of grants.

The influence of geographic factors on viability appears to have been acknowledged by the Department in the application form completed by applicant enterprises, in which there are questions concerning the location of markets for output, and the type of transport used for both raw materials and finished goods (Appendix 1). There appears to have been no systematic attempt within the Department to relate this information to potential viability, but there is evidence that two other spatial variables were considered to be important by the Department in assessing the riskiness of a venture: the size of the town concerned, and its distance from the metropolitan area. Smaller and more remote centres were considered to be more risky locations.[15] Hence two further criteria for goal 7) were added: the population size of the town proposed for location, using the most recently available official published estimate,[16] and its road distance to the appropriate metropolitan area.[17] Another viability factor mentioned on the application form, the availability of sufficient working capital, seems to have been judged satisfactory for all applicant enterprises sampled, and was thus not a relevant variable for present purposes.

Finally, greater risk seems to have been attributed to machinery loans as against other loans, with fewer requests being approved. One reason is probably that machinery is a less secure form of collateral than factory buildings, for which most loans were given. To reflect possible bias against machinery loans, a criterion was included in the case of loans which indicated the percentage value of the total request which was desired for machinery.

Goal 8 - Obtaining political advantage

The two working hypotheses used to develop criteria for this goal were that the Department would be biased toward requests from electorates with a Government member, and toward requests from marginal electorates in which a small voting swing would unseat the sitting member. These led to the adoption of the following criteria:

a) Whether the State electorate in which assistance was desired had a Government member (value one if yes, and zero if no); and

b) Whether a voting swing from the previous election of 5.9 per cent or less would unseat the sitting member in the same electorate (value one if yes, zero if no).[18]

Although only two political criteria were thus included, the stepwise multiple regression analysis subsequently used ensured that each political criterion would not be statistically overwhelmed by the non-political criteria when determining the importance of the various goal criteria in actual decision-making.

As well as the goal criteria developed above, further criteria were specified in the case of grants to distinguish between different types of grants, since there seemed a strong theoretical possibility that the Department could have favoured some types more than others although there was no written evidence of this. In this case it might have been theoretically preferable to have carried out a separate analysis for each grant type. However the relatively small size of the total grant sample would have meant that such separate analyses would not have had sufficient degrees of freedom for the testing of all the goals. Two dummy variables were therefore used as criteria distinguishing the following types of grants, with a value of one being awarded in each instance if the request was for the type of grant concerned and a value of zero if not: freight subsidies on inward raw materials or on finished products; and labour training subsidies. Rebates on costs of freighting machinery required for establishment or expansion, and rebates of road co-ordination taxes were both excluded as data from the sample firms indicated that requests for these types of grants were always fully met by the Department, or very nearly so. The subsequent identification of goal weightings, via the analysis of variations in the proportion of each request approved by the Department, would thus not have been possible. The full list of criteria developed in the preceding pages is shown in Table 4.1.

Table 4.1

Hypothesized Decision Criteria of Department of Decentralisation and Development

Goal	Criteria	Symbol
Goal 1		
Increasing total country employment	Estimated direct employment change per $1,000 of assistance (loans only)	$\underline{x}_1$
	Whether extension of previous grant (grants only)	$\underline{x}_2$
	Estimated indirect employment change per $100 of assistance: 0.534$\underline{N}$ for establishments in "other" group, zero for others (loans only)	$\underline{x}_3$
	Whether advantage in country location (loans only)	$\underline{x}_4$
	Estimated total employment following assistance (loans only)	$\underline{x}_5$
Goal 2		
Avoiding decreases in country employment	Whether establishment would close if no assistant	$\underline{x}_6$
Goal 3		
Increasing employment in areas of economic difficulty	Whether located in "100 per cent" area	$\underline{x}_7$

Goal	Criteria	Symbol
<u>Goal 4</u>		
Increasing manufacturing employment in areas of low industrialisation	Percentage of 1961 work force in urban area employed in manufacturing, excluding food, etc and sawmilling etc groups	$\underline{x}_8$
<u>Goal 5</u>		
Increasing female employment in areas with low female job opportunities	(1961 female work force in urban area as percentage of male work force) x (male work force as percentage of female work force in industry group in NSW)	$\underline{x}_9$
	(Females not at work as percentage of total 1961 work force in urban area) x (female work force as percentage of male work force in industry group in NSW)	$\underline{x}_{10}$
<u>Goal 6</u>		
Conserving decentralisation assistance funds	Value of request at June 1969 price levels	$\underline{x}_{11}$
	Whether loan repayment period less than 8 years (loans only)	$\underline{x}_{12}$
<u>Goal 7</u>		
Reducing risks	Current assets: current liabilities	$\underline{x}_{13}$
	Current assets minus current liabilities at June 1969 price levels	$\underline{x}_{14}$

Goal	Criteria	Symbol
Goal 7 (cont)		
	Pre-tax profits as percentage of shareholders' funds	$\underline{x}_{15}$
	Long term liabilities (including prospective value of Department loan), net of shareholders' funds, as percentage of shareholders' funds	$\underline{x}_{16}$
	Working capital minus prospective annual loan repayments to Department (loans only)	$\underline{x}_{17}$
	Whether favourable rating of management	$\underline{x}_{18}$
	Whether newly established firm (loans only)	$\underline{x}_{19}$
	Population size of urban area	$\underline{x}_{20}$
	Road distance from metropolitan area	$\underline{x}_{21}$
	Percentage of value of request desired for machinery (loans only)	$\underline{x}_{22}$
Goal 8		
Obtaining political advantage	Whether State electorate returned Government member	$\underline{x}_{23}$
	Whether rating swing less than or equal to 5.9 per cent required to unseat sitting member of State electorate	$\underline{x}_{24}$

Goal	Criteria	Symbol
Non-goal criteria	Whether grant for freight subsidies on inward materials or finished products (grants only)	$\underline{x}_{25}$
	Whether grant for labour training subsidies (grants only)	$\underline{x}_{26}$

DERIVATION OF EMPLOYMENT INCREASE INDICES

Four indices have been defined for the first goal, increasing total country employment. These are the estimated a) direct and b) indirect employment change per unit of assistance, whether establishments have an advantage in locating in the country, and estimated total direct employment change. The calculation of sample values for all criteria except the third required econometric estimation, and the remainder of this chapter describes for each criterion how values were derived.

Estimated employment change per unit of assistance

This criterion was estimated by multiple regression analysis, using variables which were both internal and external to applicant firms as the explanatory variables. Three preliminary stages were required first, however. A questionnaire survey was conducted which identified employment changes in previously assisted firms, providing the raw material for the dependent variable input of the multiple regression. The next stage was to test whether the various types of assistance had different per unit effects on employment, necessitating separate multiple regression analyses. The third preliminary stage was to find whether any allowance had to be made for the effect of time elapsed since assistance on the size of employment change in each establishment.

Questionnaire survey. The questionnaire survey was carried out by the Department of Decentralisation and Development in the second half of 1969. A questionnaire was sent to all companies which had received decentralisation assistance (excluding companies receiving just housing assistance) between the time of establishment of the original Decentralisation Fund and the end of June 1969. The questionnaire sought details concerning location factors and current size and operational details.[19] Usable replies were received from 99 of the total of around 275 establishments which had received non-housing assistance (including assistance for the setting up of new establishments) during the period concerned.

The extent to which the respondent establishments constituted a true sample may be gauged by comparing their location and size of loan received (where applicable) with those of all 275 establishments. The location of the respondent establishments is slightly biased towards the North Coast and away from the Central Western and Hunter/Illawarra/Outer Sydney regions. The respondent establishments received relatively more small loans and relatively fewer medium-sized loans than establishments as a whole. While the respondent establishments are inevitably not perfectly representative of the total population of assisted establishments, the fact that all regional and loan size groups have a response rate of between 28 per cent and 49 per cent indicates a lack of blatant response bias. A stratified sample would perhaps have minimized any

Table 4.1a

Location and Loan Size of Respondent and Total Establishments Receiving Non-Housing Assistance to 1968/69

	Respondent Establishments	Total Establishments	Response Rate (per cent)
	Location		
North Coast	24	50	48.0
New England	11	28	39.3
Orana	11	24	45.8
Far Western	0	0	-
Murray	4	10	40.0
Riverina	6	20	30.0
Central Western	12	43	27.9
South Eastern	13	35	37.1
Hunter/Illawarra/ Outer Sydney	18	65	27.7
Total	99	275	36.7
	Loan Size (i)		
Less than $20,000	57	117	48.7
$20,000 to $99,999	24	78	30.8
$100,000 and over	9	21	42.9
Total	90	216	41.7

(i) Indicates total number of loans in those establishments receiving loans.

bias, but this was precluded by the necessity to obtain sufficient total responses, given the constraint of the relatively small total population of establishments to which questionnaires could be sent.

The sample (or part thereof) thus yielded by the questionnaire response was the one used in all the statistical analyses in this thesis.[20] Included among the questions was one asking the size of work force before assistance was granted, the present level of employment and any proposed increases. This yielded the employment information required in the multiple regression analysis. The corresponding financial data required for the multiple regression analyses below and later were obtained from current balance sheets and profit and loss accounts supplied to the Department by each firm when applying for assistance. Accounts for some firms were not retained on Departmental files, thus reducing the available sample of firms. The location of establishments included in the final sample of firms assisted before 1968/69 (that is, excluding sample establishments assisted in the prediction year of 1968/69) is shown in Figure 4.1.

It could be argued that since the survey was not carried out until the latter half of 1969, data supplied therefrom should not be used as inputs in a semi-normative model designed to predict 1968/69 patterns with information available at the start of the period. But the Department would also have had this information earlier, through the regular follow-up visits of Departmental officers to assisted establishments. This study uses employment data from the survey, however, since the reports of officers' visits were not particularly accessible to the author.[21]

Employment variations due to assistance type. The next stage was to determine whether the specific form of assistance given affected the size of the resulting employment increases. If there were differential effects, a separate multiple regression analysis would be required for each form of assistance. *A priori*, the different nature of the three broad types of aid, viz factory and general (mainly machinery) loans, housing loans, and grants, could be expected to result in varying employment changes per unit value of assistance. Factory and general loans must be eventually repaid by each company, and involve an extra payment in the form of interest. Housing loan costs can be passed on by

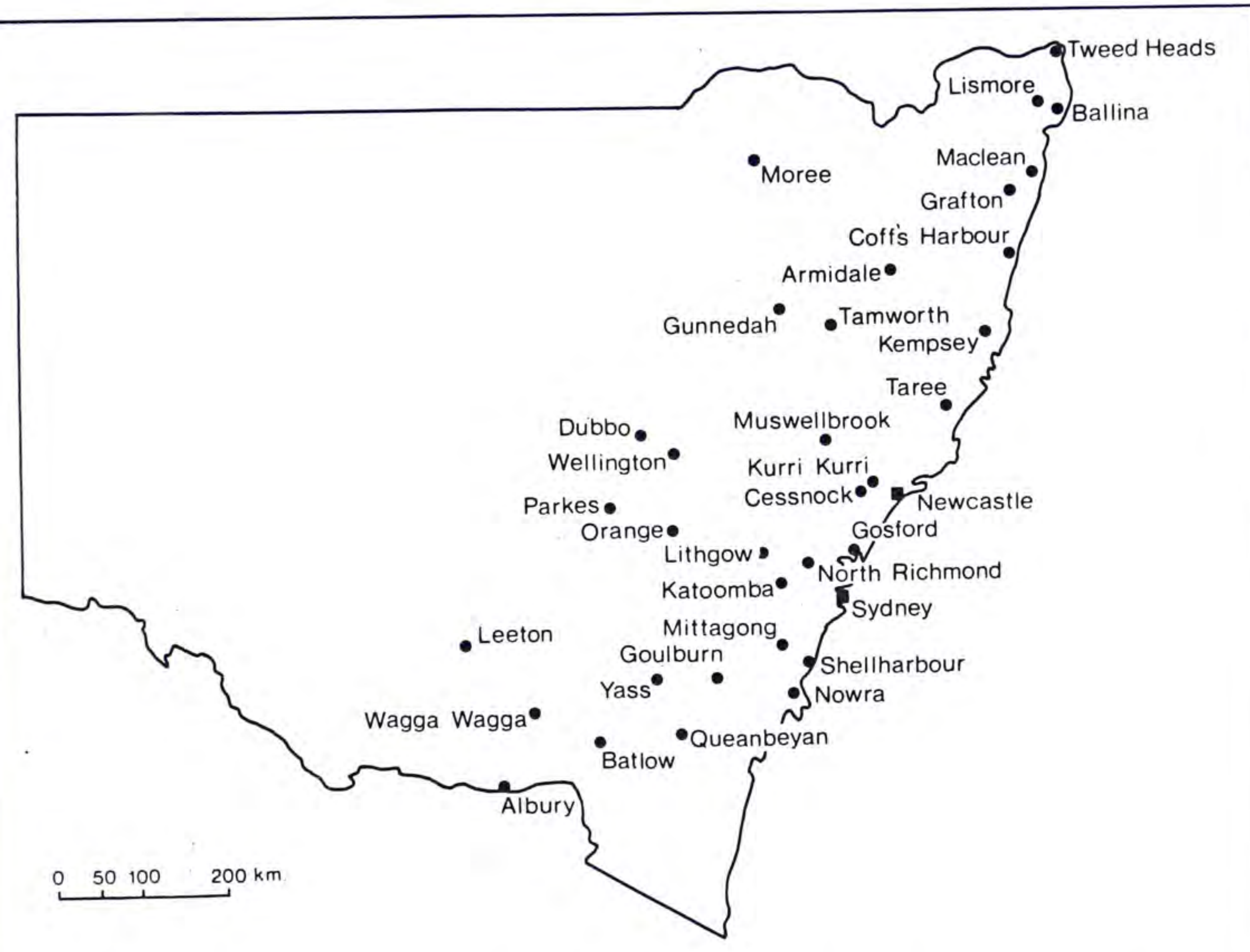

Figure 4.1 Location of Sample Establishments Assisted Before 1968/69

companies to the employees who occupy the new accommodation, so that the net financial effect on each firm is probably fairly neutral.[22] Regardless of differences in relative financial costs, the non-productive nature of housing loans could in itself be expected to produce lower employment increases than factory and general loans. Grants, unlike loans, do not have to be repaid to the Government, and are paid for current rather than capital expenses.

A partial correlation analysis was used to determine the relationship between employment increases and the size of each main form of assistance, since there were insufficient samples of firms to perform simple correlation analyses for grants and housing loans.[23] Using Lambe's test of normality,[24] the sample establishments' employment increases ($\underline{M}$) between initial assistance and 30th June 1969, the value of factory and general loans ($\underline{F}$), and the value of grants ($\underline{G}$) proved to have skewed distributions, while the value of housing loans ($\underline{H}$) was shown to be approximately normal. Logarithmic transformations (to base 10, as in the rest of this thesis) of $\underline{M}$, $\underline{F}$ and $\underline{G}$ produced the (approximately) normal distributions required for product moment correlation analyses (Yamane, 1964, 404-406 and 653). The partial correlations between log ($\underline{M}$ + 7)[25] and the value of each form of assistance (holding the values of the other two types of assistance constant in each case) are given in Table 4.2.[26]

Only the partial correlation between log ($\underline{M}$ + 7) and log $\underline{F}$ was

Table 4.2

Partial Correlations Between Employment Changes and Value of Each Assistance Type

Assistance Variable (transformed where necessary)	Partial Correlation with Log ($\underline{M}$ + 7)
Log $\underline{F}$	0.860*
$\underline{H}$ Log	0.449
Log $\underline{G}$	- 0.539

* Significant at the five per cent level

significant at the five per cent level, suggesting that grants and housing loans had no significant effect in generating employment increases.[27] Because only factory and general loans produced a significant partial correlation, this was the only category of aid for which employment increase indices (and therefore also multiplier indices) were calculated.

Although only the logarithmic relationship between the value of factory and general loans was shown to be significant, the interpretation of an employment increase index of the form $\frac{\log (\underline{M} + 7)}{\log \underline{F}}$ would have posed difficulties because it is different from the Department's actual criterion of expected employment increase per unit of assistance.[28] The Department's own criterion was therefore also used here. A scatter diagram (Figure 4.2) showing the relationship between employment increases since assistance and the value of factory and general loans in each establishment receiving only that form of assistance, excluding establishments assisted during 1968/69, suggested that a strong relationship between the two variables does indeed exist, even though this could not be tested statistically.[29]

Effect of time elapsed since assistance. The final preliminary stage involved determining whether an adjustment had to be made to actual employment increases to allow for the effect of time on growth. It might be expected that there would be a gestation period between the initial receipt of loan funds and the eventual full operation of the resulting new production capacity, during which time employment would built up to planned levels. In large plants full utilization may take several years if the design has allowed for future increases in market demand.

To determine the relationship between the length of time since assistance was first granted and the size of employment increases, a simple correlation analysis was carried out. The sample of observations consisted of all establishments which had received only factory and general loans, excluding those received during 1968/69. This yielded 51 observations.

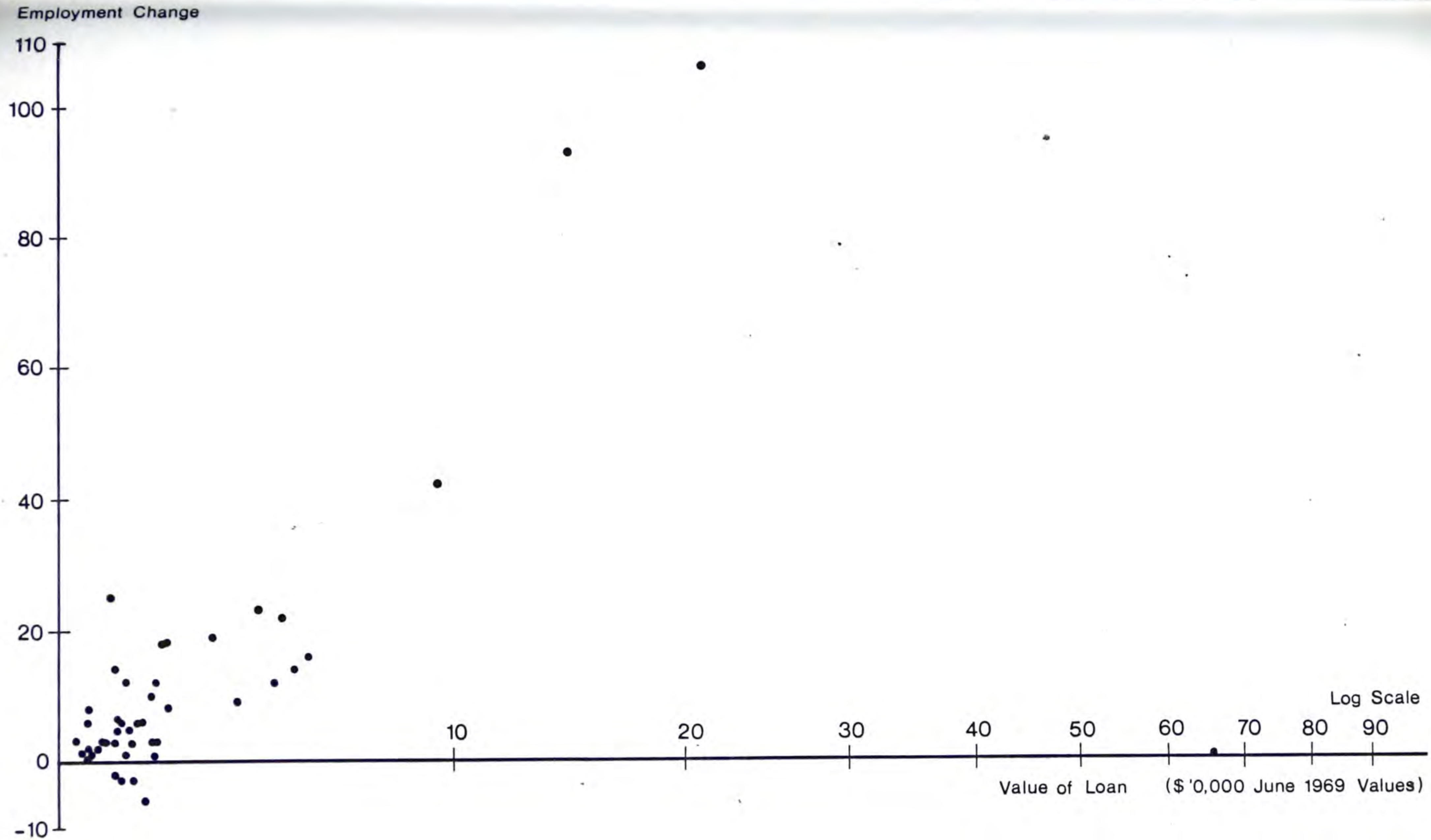

Figure 4.2 Employment Change vs Value of Factory and General Loans in Sample Establishments Receiving No Other Assistance (Excluding 1968/69 Sample)

Employment changes were first divided by the value of factory and general loans in each case so as to allow for the significant positive relationship between the value of loans and the level of employment, as discussed above. Both the time variable $\underline{T}$ (the number of months between the approval of initial assistance and June, 1969) and the employment variable $\underline{N}$ (the change in employment over the same period, divided by loan value in thousands of dollars) proved to have skewed distributions using Lambe's test. The transformation log $\underline{T}$ proved to be approximately normally distributed, but both log ($\underline{N}$ + 1) and log log ($\underline{N}$ + 2) were slightly skewed, the latter less so.[30] The correlation coefficient for log $\underline{T}$ versus log ($\underline{N}$ + 1) was 0.090, and for log $\underline{T}$ versus log log ($\underline{N}$ + 2) it was 0.064. Neither was significant at even the 10 per cent level. Thus it was concluded that there was no significant relationship between $\underline{T}$ and $\underline{N}$, even allowing for possible error caused by slight skewness in the data.

A possible reason for the lack of significant correlation is that the relationship between $\underline{T}$ and $\underline{N}$ is significant only for a short period, such as the time between the approval of the loan application and the completion of the resulting factory building. A scatter graph plotting $\underline{T}$ against $\underline{N}$ suggested in fact that values of $\underline{N}$ may have been lower where $\underline{T}$ was five (months) or less. To determine whether this relationship was significant, a 2 x 2 chi square test was carried out. The average value of N for the six establishments where T was five or less was 0.295. Of the establishments with values of T above five, 26 had N values above 0.295 and 19 had N values below this. The chi square value produced by this comparison (following Yamane, 1964, 587) was 0.800, which is not significant at the five per cent level. Thus the hypothesis that employment increases per unit loan value were significantly greater six months or more after the loan approval was rejected.

It is perhaps somewhat puzzling that there should be no significant relationship between N and T. One possible reason is that, prior to the date of final approval, the Department often unofficially indicates to the applicant that the loan is likely to be approved. Another is that loans are frequently given to purchase existing factories or machinery, so that there is no employment hiatus dur to time required for construction. As a result of the analysis in this and the preceding paragraph, employment increases were not adjusted for the time elapsed since the initial loan approval.[31]

Multiple regression analysis. The third, and main, stage in calculating expected employment increases per unit loan value, N, consisted of actually predicting N values using multiple regression analysis. A regression approach was chosen because it was considered to represent the best method available to the Department for predicting employment increases, and therefore most closely approach the normative ideal of perfect computational abilities.[32]

All sample establishments receiving factory and general loans from the Department up to the beginning of 1968/69 were initially included in the analysis. A number were later omitted because the financial data required in the analysis (see below) were not available for them. Where establishments received more than one loan, each loan for which the employment level at the time of approval was known was treated as another observation. In these cases employment increases during periods when loans overlapped were divided on a *pro rata* basis according to the value of each loan. Where separate employment figures were not available in respect of each loan in a multi-loan enterprise, loans were aggregated and treated as a single observation.

A total of 48 observations was thus obtained. In order to predict N, defined as the employment increase between the approval of the loan and 30th June 1969, divided by the size of the loan in thousands of dollars, hypotheses concerning variations in employment increases per unit loan value between manufacturing establishments were formulated. A proxy variable for each hypothesis was then formulated to yield the independent variables used in the prediction, with the exception of the hypothesis that N would vary according to industry group.

Since inter-industry differences are extremely difficult to quantify in a convenient form, observations were divided into industry groups. In defining industry groups a compromise had to be made between ensuring that each group contained a substantially homogeneous industrial grouping, and attempting to include sufficient observations in each group to eliminate the possibility of chance predictions (that is, ensuring sufficient degrees of freedom). Seven groups were finally chosen, largely on the basis of differences in type of output, although an orientation to raw material sources was a major characteristic of one group,[33] and the importance of female labour supplies was dominant in another group.[34] The seven industry groups, together with the number of observations in each, are given in Table 4.3. Establishments producing food and timber products for non-local markets were grouped together because of the importance, to both types of plants, of locations near raw material supplies, as well as the similarity of the location of their markets. Although the printing and packaging group contains only three observations, it was decided not to include them in the miscellaneous group because most establishments in the latter were of the footloose variety with high value added and non-local markets, in contrast to the

Table 4.3

Industry Groups Used in Employment Analysis

Group Number	Group Name	Number of Observations
1	Building materials (local markets) (i)	4
2	Food and timber products (non-local markets)	6
3	Engineering (non-local markets)	6
4	Engineering (local markets)	12
5	Printing and packaging	3
6	Textiles, clothing and shoes	7
7	Miscellaneous	10

(i) The distinction between local and non-local market orientations is based on whether more than half of the sales of finished products usually goes directly to locations within a 150 mile radius of the plant (excluding the metropolitan area). If this is the case, the plant is deemed to have a local market; if not, it is deemed to have a non-local market.

Source: Department of Decentralisation and Development questionnaire survey (see Appendix 2).

heavily local orientation of the printing and packaging plants.

The independent variables used to predict N in each industry group, together with reasons for the choice of these variables, are contained in Appendix 3. Where binary-valued variables registered the same score for all observations in a group, or all except one observation, the variables concerned were eliminated, since the use of identical values is meaningless in regression analysis while the occurrence of only one different value means that the variable concerned simply becomes a dummy variable for the deviant observation. To maintain the semi-normative condition that knowledge is limited to information available at the time of a decision only data sources published at least one month before the data of approval of the loan were used in the case of time-varying variables, with the most recent of such sources being preferred. In all groups the number of variables significantly exceeded the number of observations, with the total reaching 13 as against three observations in Group 5, and 26 as against seven observations in Group 6, for example. The use of such large numbers of variables in relation to the number of observations available could have produced spurious correlations. Accordingly, factor analysis was used to reduce all the variables in each group to a small number of common dimensions or factors. The scores of each observation on the various factors were then used as surrogate independent variables in the regression analysis. Besides reducing the number of variables to a more suitable total, this method has the advantage that the factor scores produced are normally distributed and independent, thus meeting two of the requirements for linear regression (Romsa, Hoffman, Gladin and Brunn, 1969, 344).

One possible difficulty in the use of a factor analysis approach was the use of binary variables, although these have previously been used in factor analysis by Berry (1967), inter alia. Horst notes that the normal binary concept, that all items in a set should be of equal difficulty or preference, may not be valid, but that if a Guttman type binary matrix, allowing for discrimination at a number of different levels, is used instead, communality problems in the factor analysis may result (Horst, 1956, 514-515). In the present case, however, the assumption that establishments within each of the industry groups are relatively homogeneous should mean that scores of 1 or 0 for particular variables indicate a similar degree of importance in each establishment.

In cases where the factor analysis results are to be used in statistical inference, as here, it is necessary that included variables be normally distributed (Goddard and Kirby, 1976, 17). Most of the variables met Lambe's normality criterion, and those that did not were logarithmically transformed or, if necessary, subjected to a log log transformation (after adding constants in each case where required to avoid zero or negative values).[35] Despite this, three variables from Group 7[36] still failed to meet the criterion and were therefore excluded from Group 7.[37] The remaining variables, appropriately transformed as necessary, yielded the raw data for the factor analysis of each group.[38]

An orthogonal rotation was performed on the factor matrices to emphasize differences between the factors and thus aid their interpretation. This is because one of the criteria which can be used to test whether a particular factor represents a significant dimension of the overall variance is the interpretability of the factor. Other criteria are whether the actual proportion of total variance seems to be significant, whether eigenvalues are greater than one, and whether rank-size distribution of eigenvalues contains a marked discontinuity. Factors with eigenvalues of less than one or below the rank-size discontinuity would not be favoured for retention. The factors in each group conforming to these criteria are indicated in Appendix 4. A summary of Appendix 4 is shown as Table 4.4. The interpretation of the rotated factors was guided by the nature of the variables with high loadings. To indicate how the final interpretations were reached, all variables with loadings above 0.7 in each factor, together with the actual values of the loadings, have been set out in the Appendix.

Table 4.4

Factor Analysis of Establishment Variables: Factor Interpretations, Eigenvalues and Proportion of Total Variance

Factor Interpretation	Eigenvalue	Proportion of Total Variance
Group 1		
1. Low working capital associated with location in large town and close to metropolitan area	6.186	0.516
2. Profitable, small establishment in slow-growing area	3.454	0.287
3. Location remote from Sydney	2.360	0.197
Group 2		
1. North Coast location	8.486	0.447
2. Non-local, public timber company	4.945	0.260
3. High working capital ration associated with small town location	2.666	0.140
4. High working capital	1.818	0.096
5. High gearing of funds	1.086	0.057
Group 3		
1. Economically disadvantaged remote location with high unemployment	8.203	0.357
2. Local company in non-industrial service centre	6.377	0.277
3. Small company	4.228	0.184
4. High working capital associated with small town location	2.760	0.120
5. High profitability	1.433	0.062

Factor Interpretation	Eigenvalue	Proportion of Total Variance
Group 4		
1. Location in large town with poor transport services and associated high working capital needs	8.471	0.292
2. Remote location but in town containing suitable technical college courses	5.194	0.179
3. Established, large company	3.915	0.135
4. Company which is not engine repairer	3.113	0.108
5. Well-managed company in rapidly growing town	2.264	0.078
6. Location in mixed cereal/ sheep area	1.681	0.058
7. High gearing of funds	1.300	0.044
Group 5		
1. Location in small, slowly growing district close to metropolitan area	8.953	0.689
2. New branch plant of public company (see text)	4.047	0.311
Group 6		
1. Location in small, remote town	8.690	0.334
2. Company in weak financial position	6.435	0.248
3. Low working capital	4.473	0.172
4. Location in town with high unemployment	3.216	0.123
5. Location in town with low economic specialization, usually associated with private companies	1.972	0.076
6. Textile establishment	1.214	0.047

Factor interpretation	Eigenvalue	Proportion of Total Variance
Group 7		
1. Company in weak financial position (see text)	4.252	0.304
2. Location in large town close to Sydney	3.183	0.227
3. Non-branch plant	2.387	0.171
4. New non-local establishment	1,438	0.102
5. Location in rapidly growing town (see text)	1.054	0.076

The interpretation of most of the factors was relatively straightforward. Several of the interpretations, however, require comment. A feature of three of the factors (Factor 1 in Group 1, Factor 2 in Group 2, and Factor 4 in Group 3) is the inverse association between town size and the current assets: current liabilities ratio. While at first glance this is an odd relationship, one explanation may be that it is a reflection of the need to hold higher stocks (which are included in current assets) in smaller towns because of greater uncertainty of supply (Webber, 1972, 211-212).[39] In Factor 1 of Group 4, the situation is to a certain extent reversed, with working capital (the surplus of current assets over current liabilities) being positively associated with town size. The high negative loading of the number of economy rail services per week, however, suggests poor transport and resulting high supply uncertainty as a possible reason for the high working capital loading. The high negative loading of current assets: current liabilities in Factor 3 of Group 4, interpreted as an "established, large company" factor, is because companies which are new and have no production history at the time of the loan application accordingly have no current liabilities. In two cases, Factor 2 in Group 5 and Factor 1 in Group 7, several of the variables appear to be related to each other for no apparent reason. An inspection of factor scores, however, indicated that the emergence of those factors was largely due in each case to the uniqueness of one particular firm. Only those variables which best reflected this uniqueness were included in the interpretation. In Factor 5 of Group 7 the association of good management with a location in a rapidly growing town may reflect the recognition by better managers of the advantages of such places for plant locations. To conclude this discussion, it should be mentioned that a major reason why the interpretability of the factors has been stressed is because the semi-normative conditions of this chapter assume rational decision-making, and this in turn implies that the Department would probably have rejected, as a tool of analysis, factors with no apparent meaning. The factors shown in Table 4.4 do appear to be meaningful, so that from this point of view it is valid to use them in a regression analysis such as the one described below.

As mentioned, the scores of the observations for each of the factors have a normal distribution and the factors themselves are statistically independent of each other, so that the regression assumptions of normality and non-collinearity are met.[40] It was assumed that another requirement, an absence of measurement errors in both independent and dependent variables, was also met.

The assumption that the relationship

between the dependent variable and each independent variable is linear, was tested by regressing N values for each group on the scores of each factor and carrying out a runs test on the signs of residual N values (regression estimates minus actual values) ranked in order of factor score values. Significantly fewer sequences (runs) of residuals of one sign than randomness would suggest, because of too many long sequences,[41] might have indicated the existence of a non-linear function. None of the factors, however, produced a lower number of residual sequences than random at the five per cent level of significance. The consequent assumption of linearity was confirmed by inspection of plots of residual values against factor scores.

Another basic assumption of the regression model is that the residuals should be randomly distributed. With primarily spatial data such as used here this means in particular that the spatial distribution of the residuals should be random. Figure 4.3 shows the least apparently spatially random set of standardized residuals in any of the three largest industry groups (4, 6 and 7). The pattern of the residuals, however, is largely mirrored by the equivalent scores of a combination of other factors for Group 6, notably factors 2 (financially weak companies) and 4 (high unemployment towns). Thus the error terms in the multiple regression model itself, which uses all factors in Group 6 (see below), will not be subject to the same potential bias.[42] Furthermore, given that the factors are orthogonal to each other and therefore largely spatially independent, any spatial non-randomness in the multiple regression residuals is not likely to lead to serious bias (see Johnston, 1972, 245).

The other regression assumption tested was that of homoscedasticity, that is, constant variance

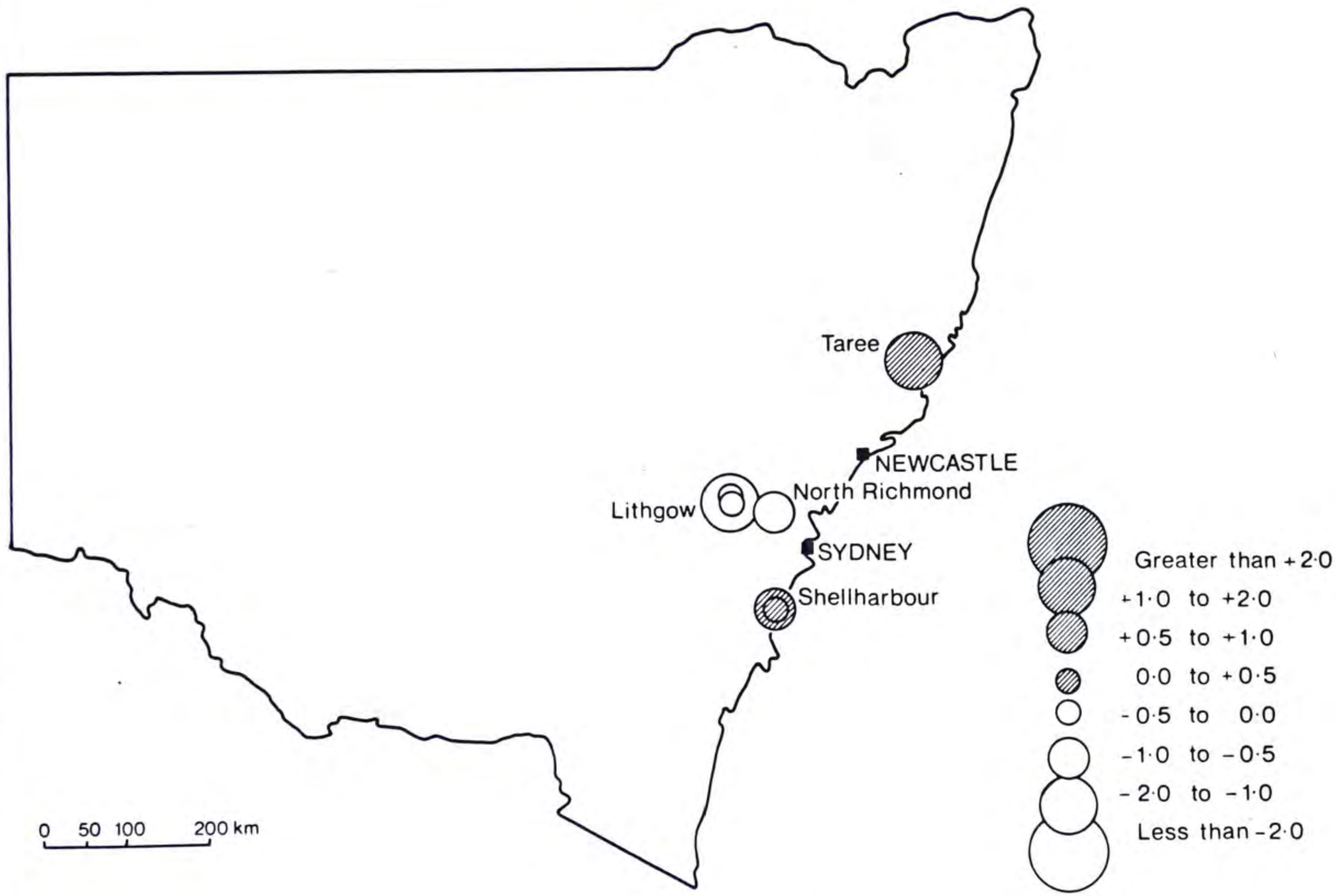

Figure 4.3 Residuals from Regression of Group 6 N Values on Scores for Factor 6

Factors were initially added to the estimating equation if they produced F values which were significant at the five per cent level.[44] If no factors in a group were significant at this level, F values significant at the 10 per cent level were then specified as the minimum for inclusion. In Groups 4 and 5, the level of significance had to be raised to the 20 per cent level before any of the factors were included. These varying significance levels reflect the fact, inter alia, that in practice better information will be available to predict employment increases in some industry groups than in others.[45]

The resulting regression equations produced for each group were as follows:

Group 1[46]

$$N = 0.7675 - 0.2586^{**}\underline{F}_1 + 0.6533^{***}\underline{F}_2 \qquad ; \underline{r}^2 = 0.999$$
$$\qquad (0.0266) \qquad (0.0266) \qquad SE = 0.046$$

Group 2

$$N = 0.4650 + 0.3567^{***}\underline{F}_1 - 0.1159^{***}\underline{F}_4 + 0.3346^{***}\underline{F}_5 \; ; \underline{r}^2 = 0.997$$
$$\qquad (0.0184) \qquad (0.0184) \qquad (0.0184) \qquad SE = 0.041$$

Group 3[47]

$$N = 0.2400 - 0.0938^{***}\underline{F}_4 - 0.0759^{**}\underline{F}_5 \qquad ; \underline{r}^2 = 0.876$$
$$\qquad (0.0262) \qquad (0.0262) \qquad SE = 0.059$$

Group 4

$$N = 0.5908 + 0.3194^{*}\underline{F}_4 \qquad ; \underline{r}^2 = 0.178$$
$$\qquad (0.2171) \qquad SE = 0.718$$

Group 5

$$N = 0.5567 - 0.3599^{*}\underline{F}_2 \qquad ; \underline{r}^2 = 0.940$$
$$(0.0907) \qquad SE = 0.128$$

Group 6

$$N = 1.0486 - 0.9819^{**}\underline{F}_6 \qquad ; \underline{r}^2 = 0.499$$
$$(0.4404) \qquad SE = 1.079$$

Group 7

$$N = 0.4790 - 0.1433^{***}\underline{F}_1 + 0.1848^{***}\underline{F}_2 - 0.1384^{***}\underline{F}_4 \quad ; \underline{r}^2 = 0.823$$
$$(0.0532) \qquad (0.0513) \qquad (0.0535) \qquad SE = 0.155$$

*** Significant at the 5 per cent level
** Significant at the 10 per cent level
* Significant at the 20 per cent level

where $\underline{F}_i$ represents factor $\underline{i}$ in the group concerned, values in brackets give the standard errors of coefficients, $\underline{r}^2$ is the coefficient of multiple determination, and SE denotes the standard error of estimate.

In general, the factors selected explained an encouragingly high proportion of the variance in N. Only in Groups 4 and 6 did the value of $\underline{r}^2$ fall below 0.82, being 0.178 and 0.499 in the respective groups. The very low degree of explanation in Group 4 (engineering -local markets) is perhaps indicative of the importance of the qualitative factor, entrepreneurship, in operating in an industrial group such as this with its emphasis on innovation and non-standardised outputs. The same is true to a certain extent of the clothing and shoe sectors of Group 6. It is perhaps meaningful that the only significant factor in the equation for Group 6 is one which distinguishes these sectors from the remaining sector, textiles, which is more capital intensive (thereby giving rise to lower values of N, as reflected in the negative coefficient sign) and standardized in output.

The equations for other groups also embrace factors which, in conjunction with their coefficient signs, represent plausible predictors of N. As such, they represent a potentially acceptable method of N estimation to the Department. In the equation for Group 1 (building materials - local markets), the disadvantage of expansion in areas close to competitors (F_1) is combined with the advantage of being in slow-growing areas (F_2). While at first sight F_2 may be considered to be a disadvantage, the positive coefficient sign could in fact indicate an over-estimation by producers of the lack of opportunities in these areas in the manner originally suggested by Hirschman (1958). This appears to be validated by the high loading of profits on F_2.

The Group 2 (food and timber products - non-local markets) equation shows that N is positively associated with F_1 (North Coast location) and F_5 (high gearing of funds), and negatively with F_4 (high working capital). The high unemployment and limited range of jobs on the North Coast would obviously be attractive to a potential manufacturer. The processing of local raw materials for metropolitan markets would be encouraged by the region's distance from Sydney and the especially perishable/high bulk nature of its principal raw materials - milk and timber - used in this industry group. The signs of coefficients for $\underline{F}_4$ and $\underline{F}_5$ together indicate the advantages of stretching limited shareholders' funds by outside borrowing in order to maximise expansion, particularly since outputs in this industry group are likely to be fairly standardised and stable in demand, thus reducing the need for liquid assets.

The next equation, that of Group 3 (engineering - non-local markets), indicates that $\underline{N}$ is negatively related to both high working capital associated with a small town location ($\underline{F}_4$) and high profitability ($\underline{F}_5$). The first represents an obvious cost penalty to the firm. The reason why high profitability should be a disadvantage is not clear. It may be that the advantages of large size in this industry induce smaller firms to incur abnormal loan and other costs in order to expand quickly, an interpretation which is supported by the high negative loading on $\underline{F}_5$ of the company contribution to total loan funds used.

For Group 5 (printing and packaging), $\underline{N}$ has a weak negative association with $\underline{F}_2$, representing a new branch plant of a public company. Since there are only three establishments in this group, generalisati is hazardous. In this particular situation, there was obviously more incentive for the two single plant, local companies concerned to expand their only operation than there was for the national, multi-plant company to substantially duplicate activities it already carried out elsewhere. The greater bargaining power of the latter may also have enabled it to secure a larger loan for the employment expansion involved, resulting in a lower $\underline{N}$ value.

The equation for Group 7 (miscellaneous) shows that $\underline{N}$ is higher in large towns close to Sydney ($\underline{F}_2$), and lower for companies in a weak financial position ($\underline{F}_1$) and for new, non-local establishments ($\underline{F}_4$). The rationale for the advantage of the external economies in $\underline{F}_2$ is indicated by the footloose nature of most of the establishments in this industry group. The negative association with $\underline{F}_1$ is obviously to be expected. The relatively greater uncertainty about optimal locations which characterises many footloose firms is perhaps associated with the negative coefficient of $\underline{F}_4$, which suggests that local knowledge and experience is a useful input.

Plots of standardized residuals from the above equations did not suggest that any important explanatory variables had been omitted. Only three groups (4, 6 and 7) contained residuals with standardized values outside the range - 1.0 to + 1.0 (Figure 4.4). An inspection of file data for the

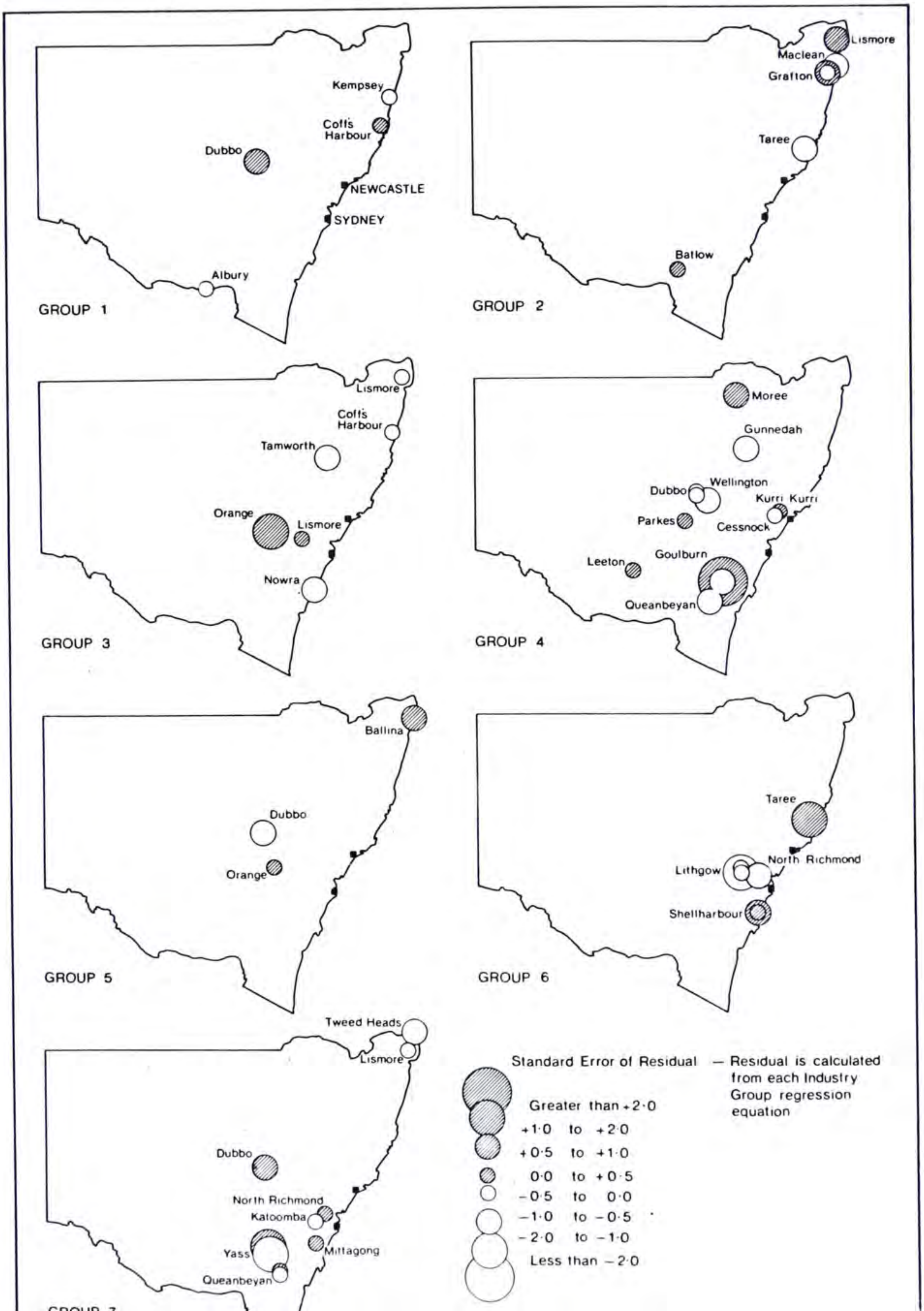

Figure 4.4 Residuals of Regressions of N on Employment Factor Scores

deviant Group 4 manufacturer and the two deviant Group 6 producers (one in clothing and one in shoes) indicates that non-quantifiable entrepreneurial factors, already suggested as potentially significant for local engineering, clothing and shoe factory expansion, were probably the cause of the misestimates. The two residuals outside the ± 1.0 limits in Group 7 both involved the same establishment (separate loans to the same establishment at different times were treated as separate observations): the second loan, given to prevent closure, bolstered what proved to be an inadequate original loan. In the sense that the two loans can therefore be regarded as one, the deviations cancel out. The residuals from the regression analyses for Groups 3 and 6 show some spatial bias. However, to the extent that the analyses also use other factor scores which reflect the values of the residuals (notably scores for factor 1 in Group 3 and factors 2 and 4 in Group 6), and since the factors in each group are largely spatially independent, the bias is not likely to have caused mis-specification of the equations.

The analysis of standardised residual values thus confirmed that all important quantifiable explanatory variables had been included in the multiple regression estimation of $\underline{N}$ values. The resulting estimates of $\underline{N}$ were therefore accepted, with two sets of exceptions, as measures of the estimated direct employment increase per unit of assistance. The exceptions relate to the Department's 1972 acknowledgement that the employment it expected to achieve per unit of loan was greater in more labour-intensive industries such as clothing (one job per $1,000-2,000) and less in less labour-intensive industries such as precision engineering (one job per $10,000-15,000) (Department of Decentralisation and Development, 1972, 40). Using a standard of one job per \$6,000 of loan assistance, the amount of employment per unit loan, expected to be generated in clothing and related industries would on average have been (6,000 ÷ 1,500), or four, times the standard levels while for precision engineering it would have been (12,500 ÷ 6,000), or 2.083, times less than the standard level. In order to standardize N values to accord with this expectation, the N estimates for those enterprises in Groups 3 and 4 identified as precision engineers were multiplied by 2.083, while N estimates for Group 6 were divided by 4.

While the significant differences in explanatory factors between groups lend support to the decision to identify and analyse seven separate industry groups, the low number of observations in each casts some doubt on whether they represent valid samples. Hence a second set of estimates of N was generated from a single analysis of all 48 observations. In order to make some statistical allowance for inter-industry effects, dummy variables were created to record whether each case belonged to one of four selected industry groups (a value of one being given if so, and zero if not). The groups were chosen on the basis of distinctive labour/capital ratios or employment growth rates. Three groups: clothing and shoes, engineering (local markets), and engineering (external markets), were chosen by dint of the first criterion, and one group: footloose industries (consisting of the external market establishments in Group 7 above) on the second criterion. The other independent variables selected were those from the initial N analysis (listed in Table A.1) which were considered potentially applicable to all industries. Thus all of the internal variables were included in the second N analysis, as well as the following external variables: urban area population, percentage change in urban area population, index of national market potential, road distance to metropolitan area, rail freight cost to Sydney, percentage of urban area work force unemployed, percentage of urban area work force in same industry group, the index of urban area industrial specialization, and whether the urban area is on the north coast. The variable denoting the population not nearer to other similar establishments was not considered meaningful in the absence of separate industry analyses, and was therefore omitted. There was a case for including several of the variables denoting engineering facilities, but to preserve sufficient degrees of freedom only the two more general structural variables (same industry percentage and specialization index) were chosen. Because the number of variables chosen was significantly less than the number of observations, the use of factor analysis to produce a reduced number of independent variables was not required.

The second analysis also used a different definition of N. In the first analysis, N was defined as employment change per $1,000 of assistance. Using the value of assistance as the measure of standardization was considered valid since this yields a literal expression of the corresponding goal of the Department. It means, however, that N tends to vary inversely with the dependent variable to be used to analyse the pattern of decentralisation assistance, namely the percentage of each request granted. Thus N as previously defined is likely to be statistically deficient as an independent variable in such analysis. Accordingly, the second set of estimates of N use a different definition, which is the estimated employment change per $1,000 requested, designated N_r. This definition has the required independence property.

Once again, multiple linear regression analysis was used to derive employment change estimates (this time using the N_r definition) from the explanatory variables. The sample values of the latter (excluding binary-valued variables) were first tested to see whether the regression assumption of normality was met. Values of the market potential, metropolitan distance, Sydney rail cost, unemployment, specialization, and current ratio variables proved to have approximately normal distributions, using Lambe's test. Values of the population change and same industry work force variables (after adding 3 to all values of the former), and the internal variables long term liabilities and establishment employment (after adding 1 to the latter's values) were all approximately normally distributed after logarithmic transformation. A normal distribution was obtained for the urban population variable after double logarithmic transformation. The distributions of three internal variables, working capital, profitability, and working capital minus repayments, were still skewed after double logarithmic transformation, so values of each variable were recoded in binary format (with a value of 1 given to negative original values and 0 given to positive values). The appropriate log, log log, or binary transformations for each variable were used in the subsequent multiple regression analysis.

All of the non-binary explanatory variables (transformed as necessary) met the regression assumption of linearity; a plot of their values in each case against corresponding values of $\underline{N}_r$ indicated no obvious non-linearity. However, the plots for two of these variables - market potential and establishment employment - as well as plots for the binary-valued variables engineering (external markets), footloose industries, profitability, new company, and management quality, displayed some evidence of heteroscedasticity. Bartlett's test was used in the first five cases to determine whether the regression assumption of homoscedastic residuals was met. The employment and profitability residuals failed to meet this assumption at a significance level of 5 per cent or better, but the variables were retained in the regression analysis subject to the proviso that a higher than normal $\underline{F}$ level would be required for their inclusion as significant explanatory variables. The new company and management variables did not have enough non-zero sample values to yield sufficient degrees of freedom to carry out Bartlett's test, but were also kept in the regression analysis with the same proviso. Pearson product moment correlation coefficients were calculated for all pairs of explanatory variables (using transformed values where appropriate) to test the regression assumption of non-collinearity between independent variables. The only coefficient above $|0.80|$ was between the metropolitan distance and Sydney rail freight variables ($\underline{r}$ = -0.91) which were therefore virtual surrogates for each other. The latter variable was therefore omitted from the regression analysis, since the metropolitan distance variable was more potentially pervasive as an employment change factor.

The multiple stepwise regression analysis of $\underline{N}_r$, using the explanatory variables above (excluding Sydney rail freight) as the independent variables, and a 5 per cent level of significance for inclusion and retention of variables in the estimating equation, resulted in the following equation:

$$\underline{N}_r = -0.1654 + \underset{(0.2264)}{0.6123}\ {}^{**}\text{CLOTHING} + \underset{(0.0622)}{0.1352}\ {}^{*}\text{UNEMPL}; \quad \underline{r}^2 = 0.193, \quad SE = 0.467$$

**Significant at the 1 per cent level

*Significant at the 5 per cent level

where CLOTHING denotes whether the establishment belonged to the clothing or shoe industries, and UNEMPL denotes the urban area unemployment rate. The positive signs of both CLOTHING and UNEMPL coefficients are in the hypothesized direction. Thus the greater labour: capital ratios in the clothing and shoe industries and greater labour availability in areas of high unemployment are both predicted to lead to higher employment increases per $1,000 requested. Nevertheless the total variance explained by the equation is less than 20 per cent, which suggests the strength of factors specific to each establishment, and/or an insufficient sample size.

The residuals produced by subtracting sample $\underline{N}_r$ values from the corresponding values predicted by the equation were mapped to see whether they exhibited any spatial autocorrelation. There was a tendency for cases located on the north coast to be underpredicted, but the variable included to reflect this was not significant at the 5 per cent level. There was also some evidence of consistent over-prediction in the central west area covering Lithgow, Organge, Parkes, Wellington and Dubbo. Ten of the 11 cases in these towns had positive residuals, although only one of these (a clothing factory in Lithgow) yielded a residual greater than one standard error. The three Lithgow examples could be explained by the Department's greater willingness to lend here to establishments with lower employment potential because of the town's depressed economy. This is essentially an endegenous factor (which is included, as the "100 per cent area" variable, in the analysis of the percentage of request granted in the next chapter), and not directly relevant to the present analysis, in which the aim is to identify exagenous factors the Department could have used to predict $\underline{N}_r$. The cases in the other four centres may be at least partly accounted for by the fact that these towns are important service centres for the central west's agricultural and pastoral industries which were starting to experience a severe drought at the time when the sample employment figures were collected in late 1969. The significance of this is suggested by the uniform overprediction of the six sample establishments in the four towns which relied on local markets. It could be argued that a short term factor such as this would tend to have been discounted by the Department, since its objective was the long term growth of the state's non - metropolitan areas.

In sum, the spatial autocorrelation revealed by the mapping of residual values could be satisfactorily accounted for, and did not appear to warrant a revision of the multiple regression analysis. Hence the estimates of $\underline{N}_r$ produced by the above equation were accepted as the second set of values measuring the criterion of direct employment change per unit of assistance (after standardizing, in similar manner to the initial $\underline{N}$ estimates, clothing/shoe and precision engineering establishment values by dividing by 4 and multiplying by 2.083, respectively).

Although $\underline{N}$ values were not calculated in the case of grants, an analagous objective can be seen in the emphasis placed by the Department on grants for the establishment, rather than continued operation, of country enterprises.[48] For grants, therefore, a goal (1) criterion was included denoting whether the grant concerned was an extension for a further period of a previous grant (if so, a value of zero was given), or whether it was a separate new grant (value, one).

<u>Estimated indirect employment change per unit of assistance</u>

The employment multiplier, per unit of assistance, is the second criterion of the goal of increasing employment. It can be divided into two components (Massey, 1973, 5-6):

a) Employment increases generated via input-output linkages in other [49] basic industries (that is, industries which have non-local markets) in the locality concerned; and

b) Employment increases generated in non-basic industries in that locality, via spending by new basic employees.

Increases of type b) could be expected to be a function of the sum of the original increase in employment in assisted enterprises and multiplier increases of type a). This is essentially an economic base approach to multiplier estimation. It has been preferred here because of the lack of the disaggregated small area data required by more comprehensive approaches such as input-output analysis and inter-sectoral flows analysis. Although the economic base approach contains certain difficulties,[50] some of these are probably not significant in the context of New South Wales country towns,[51] while others are met by the particular methodology used here. The need for data which are disaggregated at the sub-regional level is important, since it is multiplier differences between localities (and industries) which are required. If no such differences exist, government decision makers could ignore multiplier effects as an inter-enterprise assistance criterion.

It is possible that the initial increase in assisted employment could also generate more employment in other localities, and that this has a feedback effect on employment in the original locality, as noted in the last chapter. An investigation of data supplied by the sample establishments on their input sources revealed, however, that the local area or Sydney, Newcastle or Wollongong were usually the main origins. Output destinations showed a similar pattern, with interstate markets also being important. It was, therefore, assumed that employment increases in assisted establishments generated no significant increases in other New South Wales country towns,[52] although this assumption was at least partly tested by the inclusion of a nearest competing centre distance variable in the non-basic employment increase analysis below, and checked by an investigation of possible spatial autocorrelation in residuals from the estimating equation of that analysis. It was also assumed, following McColl and Throsby (1972, 210), that feedback effects from other areas to localities of the relatively small population involved here would not be important.

The sample used in the analysis of type a) and b) increases was limited to the urban areas[53] (and their hinterlands) containing the enterprises used in the employment increase analysis of the previous section. The Canberra and Gold Coast urban areas (which contained enterprises located in Queanbeyan and Tweed Heads, respectively) were excluded from the sample because the principal basic employment in these centres is tertiary industry, and it was felt that the method used here for distinguishing basic from non-basic employment would be less reliable for the tertiary sector. For the same reason Wellington was also excluded when it became apparent that the major source of urban growth during the period of analysis came from an influx of construction employees working on a major dam project nearby. This left 24 urban areas in the sample.

Unlike usual basic/non-basic studies, the present analysis includes figures for the hinterlands of the respective urban areas in the bvsic and non-basic employment totals for each centre, since in the New South Wales country context an urban area and its hinterland form essentially a single economy. With the local economy defined in this manner, non-basic activity in a service centre can obviously be generated by increases in basic employment in agriculture or mining if these increases are within the town's hinterland. In addition, central place theory suggests that lower order centres within higher order hinterlands, together with their trade areas, also need to be included in totals for higher order centres. This is because non-basic increases in a major centre can be generated both directly by the spending of new basic employees in low order trade areas within the major centre's hinterland and indirectly by new spending from the low order towns' non-basic sector, which has expanded as a result of the basic employment increase.

The areas of urban hinterlands were taken as comprising all those local government areas (the smallest units with published data) closer by road to the centre concerned than to competing centres of approximately the same or greater population size.[54] The rationale for the criterion of approximate, rather than exact, population equality as the minimum requirement for the existence of competing centres is found, for example, in the fact that the same number of central functions can be found in towns of differing populations, while in turn a given order of the settlement hierarchy generally contains so me variation in numbers of functions and functional units (Haggett, 1965, 115-118). The definition of "approximately equal" followed that developed by Tiedemann (1968). His method calculates the standard errors of standardised percentile urban area rankings (by size), and uses these as the basis of defining lower and upper bounds for the percentile ranks. The populations of the towns of the nearest rank to these bounds are then found, and these form the limits of permissible population variation for the centre concerned. This method was applied to the 1961 populations of all New South Wales urban areas over 1,000 persons, of which there were 141.[55] Competing centres were then defined as those centres with populations equal to, or greater than, the lower permissible population bound for the urban area in question.

In the absence of an expensive and time-consuming firm-by-firm survey of multiplier effects from the expansion of assisted industries, the usual alternative approach - identifying basic/non-basic benchmarks from national census data - was used. The two benchmark techniques normally considered are the location quotient method, in which all study area employment in a given industry above the national or regional average workforce proportion in that industry is considered as basic (Isard, 1960), and the minimum requirements method, in which basic employment in a particular industry in the study area is the extra employment above the level expected if the proportion of the workforce in that industry equalled the lowest proportion found in any of the nation's or region's urban areas [56] (Alexandersson, 1956; Ullman and Dacey, 1962). Both these methods, however, do not address themselves to the fact that some goods may be both exported and imported, a tendency which is more significant within highly aggregated industry categories such as those used here (Isserman 1977). The expectation that in such cases the location quotient method will under-estimate basic activity (Isard, 1960, 196) has been confirmed in practice (Braschler, 1972, 46). The minimum requirements method, however, has been found to over-estimate basic employment (Braschler, 1972, 463), probably because in most industries the number of exporting centres is far from ubiquitous. Indeed, in the case of manufacturing in New South Wales country towns, the most common industry situation is one where there are a few centres with a significant proportion of the workforce employed in that industry, with nearly all production for non-local markets; while the great majority of centres have either no employment in the industry, or else employment which is restricted to non-standardized, bespoke production for local customers. This leads to employment frequency distributions which are strongly skewed toward higher workforce proportions, a tendency which was confirmed when 1954 and 1961 data for the eight manufacturing groups used in the national population census[57] were plotted for the sample urban areas. In this case the mode of the distributions could be expected to provide a reasonable benchmark for dividing basic employment (above the mode) from non-basic employment (equal to or below the mode). This approach was adopted here for employment in the census manufacturing groups, using frequency intervals of one per cent of the total urban area workforce to identify the respective modes.[58]

All primary employment (including mining and quarrying) was regarded as being basic. In most areas the only noticeable violations of this assumption concerned dairying and gravel and sand quarrying carried out for local markets, but in nearly all cases such activity was an insignificant part of total primary production. All tertiary employment was assumed to be non-basic. It was considered that any over-estimation of non-basic employment which thus resulted would be slight in view of the exclusion of the three urban areas where basic tertiary activity was known to be a significant proportion of the total work force, and given that services to hinterlands are defined as non-basic.

Type a) multiplier increases. The effects of employment changes in one type of basic industry on employment in other basic industries in the same locality were analysed by testing whether basic employment increases per capita (using the 1954 population of each urban area and its hinterland) between 1954 and 1961 in each manufacturing group were significantly related to similar increases in the other manufacturing groups. The period concerned was the last for which published census employment data would have been available to the Department between 1965 and 1968. While it would perhaps have been preferable to have used a lag formulation of half to two years (Weiss and Gooding, 1968; Sazaki, 1963) instead of a simultaneous formulation, no inter-censal data were available to make this possible. Primary industries were not included in the analysis since the focus of attention here is the multiplier effects of secondary industries of the type assisted by the Department of Decentralisation and Development, and significant backward linkages from secondary to primary industries were not considered probable.

The use of a per capita standard for measuring bvsic heteroscedasticity and skewness which could have been produced by raw data for an urban system as centralised as that of New South Wales. The transformed data, however, still exhibited considerable skewness, with a number of the smaller towns showing no employment change in most groups. It seemed likely, therefore, that any type a) multiplier increases would be restricted to the larger centres. The 24 urban areas were thus divided into those above and below a 1954 population of 10,000, a level which broadly distinguished whether most groups had shown any basic employment change or not.

For the 11 urban areas above the 10,000 population level, a product moment correlation matrix was prepared using basic employment changes per capita in the eight manufacturing groups as variables. In two groups - founding, engineering, etc, and textiles and fibrous materials - logarithmic transformations were required to produce normal distributions[59] so transformed values were used in the correlation calculations for these two groups.

The next step was to select those coefficients in the matrix which were statistically significant, and determine whether they remained significant after partial correlation analysis. Of the three coefficients significant at the five per cent level or better, the highest was that between the paper, printing, etc group and the "other" group, with a value of 0.71. The partial correlation analysis of values for the two groups, holding constant the values of the groups[60] with the two next largest correlations with either of the paper, printing, etc or "other" groups, yielded a coefficient which was still in excess of the 0.55 value corresponding to the five per cent significance level. The next highest matrix coefficient value was -0.66between the clothing, knitted goods, boots, etc group and the logarithmically transformed textiles and fibrous materials group. Such an inverse relationship is to be expected because both groups compete for a largely similar type of labour. It was considered that the more likely sequence was a decline in activity in one group leading to an expansion in the other group via an increased availability of labour, rather than the alternative of expansion followed by decline.[61] Since the concern here was to establish multiplier effects resulting from the initial expansion of assisted industries, the relationship between these two groups was not regarded as relevant. The other significant correlation coefficient was between the food, drink and tobacco groups and the logarithmically transformed textiles and fibrous materials group, with a value of 0.55. The statistical relationship proved to have to significance for this study, however. Of the centres with the seven biggest increases in the food, etc group, only two showed an increase in textiles, etc while three had no basic employment in the latter. On the other hand centres with the four smallest increases in food, etc showed three decreases in basic textile, etc activity. The high correlation coefficient thus reflected a relative rather than an absolute relationship. In no real sense was an expansion of one group associated with an expansion of one group associated with an expansion of the other, in the manner which would have been of interest to the Department. In view of this, and the barely significant value of the correlation coefficient, the relationship between these two groups also was regarded as not relevant.

In order to express the relationship between basic employment changes in the paper, printing, etc and "other" groups in multiplier terms, a linear regression analysis of the two groups was carried out. The paper, printing, etc group was made the dependent variable as it was considered that expansion of the group's principal components of printing, publishing and packaging were likely to follow, rather than lead, expansion of industries in the "other" group such as chemicals, cement and rubber products. The following equation was produced:

$$\underline{G}_7 = 0.2678 + \underset{(0.1754)}{0.5344^*}\ \underline{G}_8 \quad ; \qquad \underline{r}^2 = 0.508, \quad SE = 0.743$$

* Significant at the five per cent level

where $\underline{G}_7$ and $\underline{G}_8$ are basic employment increases between 1954 and 1961, per 1,000 population in 1954, in Group 7 (paper, printing, etc) and Group 8 ("other") respectively, and other notation is as before.[62] The positive constant in the equation was interpreted as being a reflection of the secular expansion of the paper, etc group over this period. For multiplier purposes, therefore, only the coefficient of $\underline{G}_8$ was considered. This yielded the type a) multiplier criterion: a value of 0.5344 $\underline{N}$ (where $\underline{N}$ is as estimated in the previous section) in the case of assisted establishments in the "other" Census manufacturing group located in urban areas above a population of 10,000, and a value of zero for all other assisted establishments. The criterion was not applied in the case of grants, since no $\underline{N}$ values were calculated for grants.

In order to test the assumption that towns below a population of 10,000 generated no type a) multiplier increases, 2 x 2 chi square tests (preferred to correlation analyses because of the skewness of the data) were carried out on each pair of manufacturing groups, using the per capita basic employment increase data for the 13 sample towns with less than 10,000 people in 1954. Groups were divided into two cells, recording the number of urban areas with increases either above or below the mean increase for the group.[63] None of the 28 chi square values obtained were significant at the five per cent level or better, so the initial assumption was considered to have been validated.

Type b) multiplier increases. Two basic approaches for estimating the changes in non-basic employment resulting from changes in basic employment were available:

1) to estimate the non-basic increase: basic increase employment ratio as an additive function of different structural and locational variables;

2) to estimate the non-basic employment increase per capita using a multiplicative function

$$S = f(\underline{x}_1 \cdot \underline{x}_2 \cdot \ldots \cdot \underline{x}_{\underline{n}} \cdot \underline{B})$$

or, more conveniently

$\log S = f/\log \underline{x}_1 + \log \underline{x}_2 + \ldots + \log \underline{x}_{\underline{n}} + \log \underline{B})$,

where $\underline{S}$ and $\underline{B}$ are non-basic and basic employment increases per capita, and $\underline{x}_1, \underline{x}_2, \ldots \underline{x}_{\underline{n}}$ are the values of the explanatory structural and locational variables 1, 2, ...$\underline{n}$.[64]

Approach 1) is closer to the original basic/non-basic ratio emphasis of urban multiplier analysis, and was therefore tried first. As in the analysis of type a) multiplier increase basic and non-basic increases were calculated for the 1954-1961 period. However the analysis did not generate any explanatory variables which were significant at the five per cent level, while the one variable significant at the 10 per cent level was intuitively unsatisfactory in isolation.[65] One reason for the poor performance of this approach appears to be that the value of the non-basic : basic increase ratio is very unstable where small changes in non-basic and basic employment are involved, as is frequently the case for small centres of the size of most of the 24 urban areas analysed. For example, an increase of one basic employee and a decrease of one non-basic employee yields a ratio value of -1, whereas if both decrease by one, the value becomes +1.

The alternative approach in which log <u>S</u> is estimated as an additive function of the logarithm of <u>B</u> and certain locational and structural variables, promised more stable results. Seven other independent variables besides <u>B</u> were chosen. The first was the 1954 population (coded as POP) of the urban area[66] in question. This derives from threshold population considerations suggesting that increasing urban size serves to increase the basic: non-basic ratio, and the empirical demonstration of this by Alexander (Alexander, 1954, 99). The next three variables are closely related to the first. The concept of distance decay as embodied in gravity models suggests that leakages of basic employees' expenditure outside the local area will partly depend on the distance to other competing centres.[67] The two variables used to embody this idea were the square of the road distance[68] to the nearest competing centre (as defined previously) (DISCOM) and the square of the road distance[68] to the metropolitan area within whose hinterland the basic increase had occurred.[69] (DISMET). The general absence of functional linkages from Australian country centres to regional centres other than the metropolitan areas themselves (Rose, 1966, 18-19; Smailes, 1969) did not point to the inclusion of other distance variables. The use of a distance exponent of two was based on Isard's (1960, 508-509) survey of empirical interaction studies, which found a wide range of exponent values which were, however, generally nearer to two than to one, and on the more formal relationships developed by Reilly (1929) and Stewart (1947). Threshold and central place considerations suggest that expenditure linkages to other centres will also partly depend on the number of functions the latter perform, and thus on their overall size, in relation to the functions and size of the original centre. To reflect this, the next variable added was the ratio of the population of the nearest competing urban area to that of the urban area in question (POPCOM).[70, 71, 72].

Variations in local spending and employment according to the direction of basic activity change have sometimes been suggested (for example, Brook and Hay, 1974, 60). Two variables were included here. The first, the percentage of the 1954 centre and hinterland workforce which was not at work[72, 73] (UNEMP), was to test whether local spending remained relatively steady in the face of unemployment, thus producing a higher non-basic: basic ratio (Harvey 1973, 472). A related variable, whether the change in basic employment represented a decrease (BASDEC) (recording a value of one if this was so and zero otherwise), was used to see if non-basic employment was "sticky" in the face of declining basic employment because of the fact that existing businesses can ignore fixed costs in the short run in considering whether to close.

Finally, since the extent to which the initial increase in income is spent locally will depend on the nature of the increase in basic activity (Richardson, 1969, 338), the inclusion of a series of variables identifying the size of components of basic employment change, as done in the approach (1) analysis, was considered. This would have effectively turned the estimating equation, like that in the first approach, into a highly simplified input-output model (Meyer, 1963, 36), thus "combining the operational feasibility of the economic base model and the sectoral detail of the input-output model" (McColl and Throsby, 1972, 211). But the inclusion of such separate, additive variables in a multiplicative model such as that of the second approach would have posed difficult computational problems in a regression analysis. In addition, the nature of the component changes in basic manufacturing employment, which were frequently either "lumpy" or non-existent in all but the largest centres, suggested that some of the relationships between the manufacturing variables and the dependent variable may have been unstable and not have been valid for prediction over the 1965-68 period. Hence a SHIFT variable, denoting the relative structural shift of basic employment toward manufacturing, was substituted because the focus of interest here is the effects on S of the manufacturing part of the basic sector, and because the main difference within this sector with regard to potential non-basic multiplier effects is between manufacturing and non-manufacturing activity. SHIFT was defined as manufacturing employment change (1954-1961) minus non-manufacturing employment change (1954-1961), both adjusted to a per 1,000 population (1954) figure.[74, 75]

Of the eight independent variables thus selected, logarithmic transformations of DISCOM, POPCOM, DISMET and B had approximately normal distributions using Lambe's test (after adding constants equal to 1,000 and 40 to DISMET and B respectively). A double logarithmic transformation was required in the case of POP. Because of an extremely skewed distribution, UNEMP was converted into a binary-valued variable UNEMB, taking a value of one if the corresponding value of UNEMP was greater than the sample mean UNEMP, and zero otherwise. The logarithmic transformation of SHIFT proved to be highly skewed, due principally to the extremely low value for Batlow. Part of the reason for this particular value may have been measurement error due to the fact that this was the only centre for which no hinterland figures were added, because the presence of a larger competing centre in the same shire meant that the standard allocation of whole or half a local government area to a particular hinterland was not possible. Hence it was decided to omit Batlow from the sample. This produced the required normality in the distribution of log SHIFT.[76] Logarithmic transformations were not carried out for BASDEC and UNEMPB because of their zero values and the fact that the addition of constants to all values to overcome the log zero problem would have been as equally arbitary as leaving the values untransformed (the latter meant that the one/zero values of BASDEC and UNEMPB were viewed as log 10/log 1 values).

To avoid having to take the logarithm of negative numbers, the dependent variable was taken as log (<u>S</u> + 60). When regressed against log (<u>S</u> + 60), the variables log POPCOM and log (DISMET + 1,000) produced residuals which were heteroscedastic at the five per cent significance level. The two variables were, however, left in the analysis in case they produced regression coefficients with a sufficiently high degree of significance to outweigh the heteroscedasticity.[77]

All the independent variables satisfied the linearity, spatial autocorrelation and non-collinearity regression assumptions.[78]

A stepwise multiple regression analysis making log ($\underline{S}$ + 60) an additive function of the eight variables produced the following estimating equation:

$$\log(\underline{S} + 60) = 0.8056 + \underset{(0.4730)}{1.6769^{*}} \log\log POP \; ; \quad r^2 = 0.374 \quad SE = 0.144$$

* Significant at the one per cent level

where symbols and notation are as previously defined.

The structure of the equation points to the importance of larger populations in generating non-basic activity through greater economic diversity even in the absence of increases in basic activity. Service employment change was influenced weakly by basic employment change, the F value of $\underline{B}$ being sufficient for $\underline{B}$ to have entered the regression equation if the significance level for inclusion had been lowered to 10 per cent. Mapping of the residuals from the estimating equation (Figure 4.5) confirmed this influence. Of the four residuals greater than +1 standard error, three (Wollongong, Nowra and Maclean) came from the five centres recording an increase in $\underline{B}$, while two of the three residuals of less than -1 standard error (Lismore and Yass) came from the four towns with the greatest decreases in $\underline{B}$.

In view of the suggestion of Daly (1940), Blumenfeld (1955) and others that the tendency for urban size _per se_ to generate non-basic activity is a feature

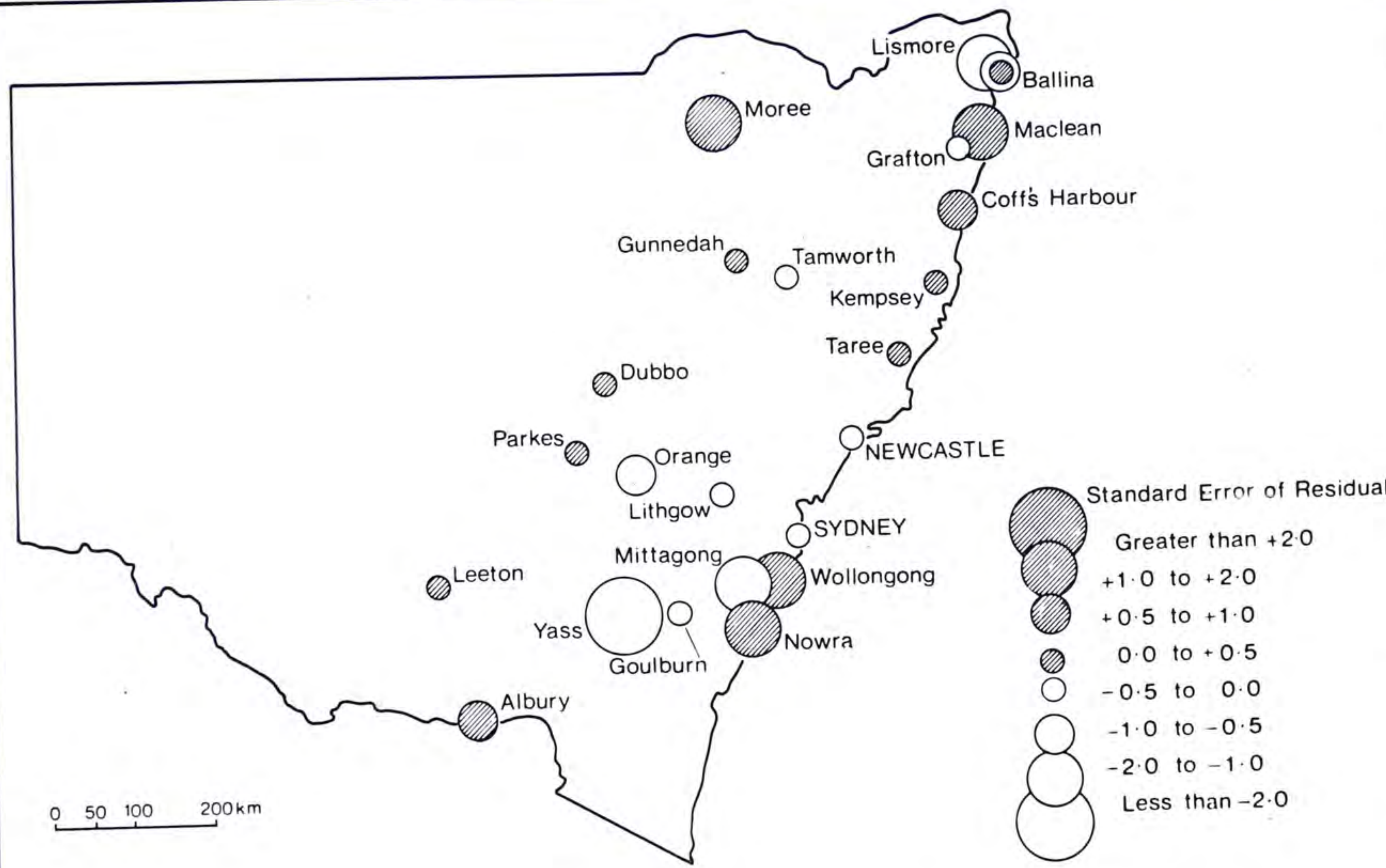

Figure 4.5 Residuals of Regression of Increase in Service Employment (log [S+60]) on Population (log log POP) (Sydney, Newcastle and Wollongong included in sample)

of metropolitan areas rather than smaller centres, the analysis was repeated for all centres except the three cities with populations over 100,000 (Sydney, Newcastle and Wollongong) in order to test whether the hypothesis that S is a function of B was still valid for just smaller urban areas. It was assumed that the 20 values for each variable had the same aggregate statistical properties as the original 23 values, so the same transformation of each variable was used again.[79]

The following equation was produced:

$$\log (S + 60) = 1.4423 + \underset{(0.0476)}{0.1097^{*}} \log \text{DISCOM} \; ; \; \underline{r}^2 = 0.228 \quad SE = 0.140$$

*Significant at the five per cent level

The results suggest that greater isolation from competing centres was the most important factor in producing higher increases in S in smaller centres during 1954-1961. Thus spending leakages to competing areas were obviously lessened where greater travelling was involved. The explained variance of 22.8 per cent is low, however, and significantly less than that for the previous equation, pointing to the greater influence of unique factors on the multiplier values of smaller urban areas. The residuals from the equation (Figure 4.6) show a similar pattern to that of residuals in the 23 centre case in Figure 4.5, but Wollongong has now been excluded from the analysis; Moree, Mittagong and Maclean no longer have residuals outside the ± 1 standard error range; and Albury now has a residual slightly

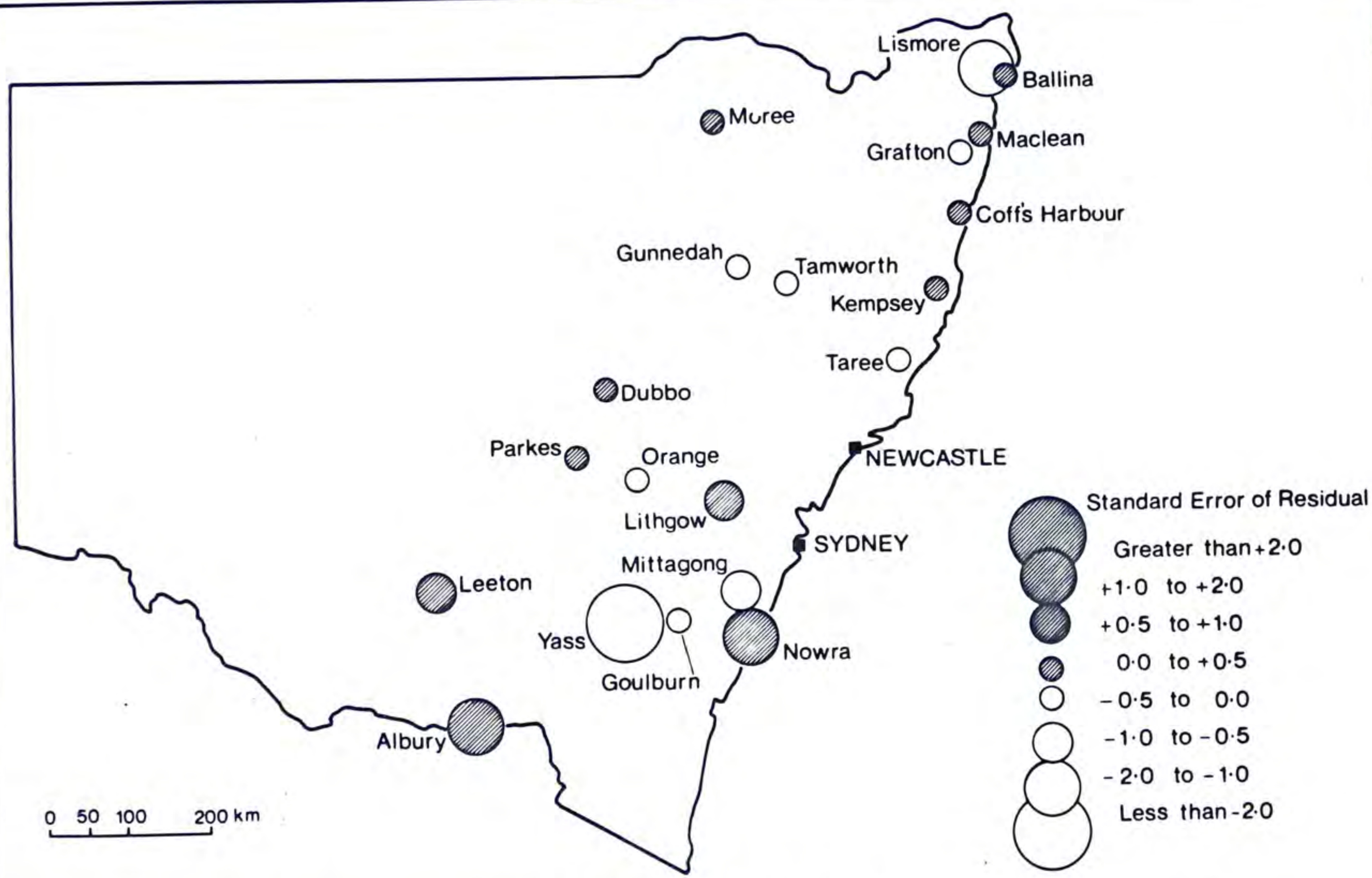

Figure 4.6 Residuals of Regression of Increase in Service Employment (log [S+60]) on Distance to Nearest Competing Centre (log DISCOM) (Sydney, Newcastle and Wollongong excluded from sample)

greater than one standard error. Again, variations in B are probably the main factor behind the pattern of residuals, but although B itself is correlated with S in the hypothesized direction (that is, positively) the association is not significant even at the 10 per cent level.

Finally, to see whether the aggregation of the various basic manufacturing groups hid different multiplier effects between groups, 2 x 2 chi square tests were carried out for each group.[80] Columns in each matrix showed the number of sample urban areas with per capita (1954) basic employment changes above and below the mean in each group, and rows indicated the number with per capita non-basic employment changes above and below the mean non-basic change. Only one chi square statistic, that for the clothing, etc/non-basic relationship, was significant at the five per cent level. The actual relationship, however, was in the opposite direction to the one hypothesized, with changes in clothing, etc employment being negatively related to non-basic employment changes. The apparent reason is that clothing, etc, an industry group in decline during the 1954-1961 period in New South Wales, was only rarely found in the smaller urban centres. These in turn tended to have lower non-basic employment increases per capita. Hence the associated chi square statistic could be regarded as reflecting common secular influences rather than the inter-centre basic/non-basic variations of concern here. Thus it was concluded that there were no significantly different multiplier effects on non-basic activity from one basic manufacturing group to another.

The failure of the regression analysis of the second approach to non-basic multiplier estimation to demonstrate statistically that changes in basic employment had an influence on non-basic employment levels in smaller centres suggests the strength of various local factors not modelled here, such as local wage levels and the nature of the commercial sector in each town, in modifying an "average" linkage pattern between basic and non-basic employment change. Because of this result, type b) multiplier effects were assumed to be non-existent for predictive purposes, or at any rate non-predictable. No related criterion was therefore developed.

Advantage in country location

It might be expected that the third dimension of the employment goal, whereby industries which are normally disadvantaged by country locations are favoured, would lead to a criterion that the extent of assistance given varies with the degree of disadvantage. In practice, the policy followed in this respect appears to have been more simply structured. In general, the Department made no distinction between naturally disadvantaged industries. Sometimes, however, assistance was given to establishments suffering no locational disadvantage (such as soft drink factories and joineries) but whose existence or expansion would have helped to achieve goals other than that of increasing country employment generally. In such cases assistance was not given as readily as to locationally disadvantaged establishments. Hence the criterion used here for this sub-goal is the binary one of whether the establishment concerned was regarded by the Department as having an advantage (value, one) or a disadvantage (value, zero) by virtue of its country location. No establishment included in the grants sample was considered to have had a locational advantage in the country, so this criterion was not applied to grant decisions.

Estimated total direct employment change

The last dimension of the goal of increasing total employment, concerning the rapidity of employment increase, has been included because it seems to have been implicit in the number of favourable references on file to large employment increases *per se*. The size of the potential increase in employment in each case is thus an appropriate criterion for this sub-goal. Using this criterion, the objective is related to the Department's stated aim of having regard to an enterprise's regional or State significance when assessing a request (Department of Decentralisation and Development, 1970, 8). In general, though, the Department appears to have also assessed significance in terms of existing employment size, a consideration more related to goal 2), avoiding decreases in country employment. Employment changes are likely, however, to have been fairly highly correlated with existing employment since larger factories would have tended to have had bigger expansion schemes (more loans were given for factory expansions than for new establishments). Because of the potential multicollinearity problem, therefore, together with the nature of the assessment of "significance", existing employment was added to estimated employment change to produce a single criterion, total estimated employment after assistance. The potential increase in employment has been calculated here by multiplying the value of N previously estimated for each request by the value (in June 1969 terms) of the request itself. Once again, since estimates of N were not made in the case of grants, no calculations of potential employment increase were made where grants rather than loans were involved.

Criteria to reflect the New South Wales Government's decentralisation goals have now been developed and measured. The next chapter describes the calibration, using these criteria as explanatory variables, of alternative semi-normative decision functions hypothesized to have been applied by the Department of Decentralisation during 1965/66 - 1967/68.

Footnotes

1. Pre-1965 decisions have been included in the analysis of long-term, exogenous employment increase factors and also for purposes of comparison with post-1965 decisions where desirable.

2. Except in the derivation of employment increase indices, where pre-1965/66 data have also been used.

3. For example, see the second reading speech of the Minister for Decentralisation and Development when he introduced the State Development and Country Industries Assistance Bill in 1966 (New South Wales Parliamentary Debates (Third Series) Session 1965-66, Vol. 60, 1st March 1966).

4. As well as financial variables, departmental files suggest that the remoteness and population size of enterprise locations may be other uncertainty criteria.

5. The Minister was reported as saying in February 1969: "At present the Country Party holds both Orange and Bathurst. If we give Orange the go ahead (as a centre for the decentralisation of industry) we lose Bathurst and vice versa" (Webb 1971, 18).

6. The Department of Decentralisation and Development has stated that "the matter of the level of assistance required in relation to the job opportunities created is a matter of substantial significance" (Department of Decentralisation and Development, 1972, 40).

7. This is recognised by the Department, as the following quotation indicates: "through the 'multiplier effect' direct assistance to manufacturing industry will indirectly assist the expansion of ancillary service industry" (Department of Decentralisation and Development, 1970, 8).

8. Ibid., 8.

9. For example, see Department of Decentralisation and Development (1970, 7).

10. For example, this indicator was a principal reason for establishing a special fund to aid new or expanded industries employing more than 75 per cent female labour in the City of Wollongong.

11. Where annual grants were awarded with no specified time limit, they were assumed to run for a five year period. This is because it has been stated that Departmental policy in regard to one of the main types of annual grants, freight rebates on inward raw and basic materials to manufacturers supplying local and neighbouring markets, is to grant them over an establishment period of up to five years (Australian Government Publishing Service, 1972, 75).

12. For example, see Department of Decentralisation and Development (1972, 40).

13. The criteria actually considered for selection were primarily the 10 financial ratios discussed in Carroll (1973), although the chosen criteria b) and e) were added separately.

14. Where there was no file evidence as to the Department's rating, it was assumed that a favourable rating applied.

15. This subjective assessment of risk with respect to the two variables finds objective support in the empirical study of Webber (1972, 218-20), which found that industries with risky characteristics required locations in larger urban areas and closer to the metropolis.

16. The figure used was the latest available from the Bureau of Census and Statistics in the month before the ministerial decision on the application. The Bureau's annual estimates of local government area populations were used for inter-censal years. Where an urban area was part of a larger local government area, the population was extrapolated from the level at the last Census by adding the change which would have occurred if the average annual rate of change in the previous inter-censal

period had continued. A straight line rate of increase or decrease was assumed in these cases. This was considered more appropriate than an assumption of exponential change because most centres were losing part of their natural increase in population through emigration.

17. Unmade roads were excluded from the calculations. The same metropolitan hinterlands as those defined in Appendix 3 were used here.

18. Source of electoral data: Mackerras (1973). The voting swing required for the loss of each seat was calculated using Mackerras' estimates of "preferred votes" for the Liberal - Country Party coalition or the Australian Labor Party.

19. A copy of the questionnaire is reproduced as Appendix 2. Trading, manufacturing, profit and loss accounts and balance sheets for the year 1967/68 were also requested.

20. Some of these establishments received housing assistance in addition to other types of assistance.

21. It has been assumed that the employment change parameters derived from the survey data did not change between the end of 1967/68 and the end of 1968/69. It has also been assumed that the employment information obtained from the survey was not significantly greater than that provided by the officers' reports.

22. In the case of housing for employees provided by loans from the Department to the Housing Commission, the effect on the employees' companies is obviously zero.

23. Firms assisted during 1968/69 were excluded from the analysis, since data relating to this period would not have been available to the Department on 30th June, 1968 (the cutoff point under the assumptions of this chapter). To avoid skewness toward zero values, firms not receiving all three types of assistance were excluded, leaving nine firms in the analysis. To allow for changes over time in the real value of given money values of assistance, the original value of assistance in each case was adjusted in accordance with changes in the Sydney "All Groups" Consumer Price Index

between the calendar quarter in which assistance was given and the June quarter, 1969 (Source: Commonwealth Bureau of Census and Statistics: Consumer Price Index, various issues, quarterly (Canberra, the Bureau).) These adjusted values have been used throughout this chapter. Factory leases were included in factory and general loans, with the loan being assumed to equal the value of the factory being leased. Houses built by the Housing Commission with funds provided from the Country Industries Assistance Fund were valued at \$8,000. This figure was the usual value of direct loans from the Department for single houses during this period.

24. A population sample can be considered to be approximately normally distributed if $\frac{\eta}{\sigma} - 0.7979 < \frac{0.4}{\sqrt{n}}$, where η is the mean deviation, σ is the standard deviation, and n is the number of observations (Lambe, 1967, 36-37).

25. Seven was added to each of the M values to avoid having to take the log of zero or negative employment changes. This is styled on Bartlett's suggestion for adding 1 to distributions containing zero values when using a logarithmic transformation (Bartlett, 1947, 52; Teekens and Koerts, 1972; Hu, 1972).

26. The partial correlations were calculated using the formula given in Anderson (1958, 34).

27. In the case of housing loans this is probably because the basic criterion for assistance is the need of key workers such as foremen rather than the likely size of increases in employment generally.

28. Department of Decentralisation and Development (1972, 40). Ratios may vary according to the nature of the industry concerned.

29. Housing loans and grants would probably still not have produced significant partial correlations if actual employment increases had been used rather than log (M + 7). The distribution of employment increases in the nine sample establishments almost passed Lambe's test of normality, and if it is assumed that the distribution is in fact sufficiently

normal, a partial correlation between M and H of 0.325 is obtained. This is still not significant at the five per cent level. It is highly unlikely that the relatively high negative correlation of -0.539 between log (M + 7) and log G would be changed to a significant positive correlation using untransformed data, if this could be calculated.

30. One and two were added to each value of N in the log and log log transformations respectively, to avoid zero values. The value of -0.7979 for log (N + 1) was 0.07871, and for log log (N + 2) it was 0.07357. The value required for approximate normality was 0.06576

31. Conversely, employment increases were not discounted to present values, as would be required by the full model in Chapter 3.

32. It has been shown in fact that econometric techniques such as this do not necessarily provide more accurate forecasts than purely judgmental methods (Stekler, 1968). For the purposes of this chapter, however, regression analysis is assumed to be superior.

33. Group 2 - Food and timber products (non-local markets) (see Table 4.2).

34. Group 6 - Textiles, clothing and shoes (see Table 4.2).

35. Binary variables were not tested since the one/zero nature of their values precludes skewness.

36. The variables were the value of working capital, pre-tax profits as a percentage of shareholders' funds, and the value of working capital minus the value of annual repayments of decentralisation loans from the government and the local council.

37. This did not appear to significantly distort the analysis because the remaining variables, via factor analysis, still eventually yielded a significant statistical explanation of N values in Group 7.

38. Factor analysis also requires that the data for the difference variables are standardised into

similar units. This standardisation is effected in computer programs like the one used here when product moment correlations between all variables are computed as an intermediate stage (Goddard and Kirby, 1976, 17).

39. In Factor 1 of Group 1 a contributory factor to the high loading of current assets: current liabilities is probably remoteness (indicated by the high negative loading of metropolitan road distance), which also leads to greater uncertainty of supply and hence higher stock levels (Webber, 1972, 212-214).

40. For discussions of the statistical assumptions of multiple regression analysis, see Poole and O'Farrell (1971) and Keeble and Hauser (1972). In practice, collinearity is not a problem in situations such as the present one where the purpose is only to predict the dependent variable, assuming that any inter-correlations continue unchanged into the future (Poole and O'Farrell, 1971, 155).

41. The method by which the statistical significance of low numbers of runs can be determined is given in Hoel (1954, 340-341). It assumes that there are the same number of residuals of each sign. Where this was not the case in practice, the signs of sufficient of those residuals with the predominant sign were changed so as to meet the assumption, commencing with the residual with the smallest absolute value and moving on to successively larger absolute values. This adjustment has the effect of shifting the regression line slightly without upsetting the basic pattern of the residuals. Where there was an odd number of observations the smallest residual was given two signs and the runs test statistic accordingly calculated twice.

42. In fact the multiple regression analysis for Group 6 produced an identical pattern of residuals to that for factor 6 (see below, Figure 4.4), since the step-wise regression procedure did not include any other factors which were significant at the chosen level.

43. For an account of stepwise multiple regression analysis, see Draper and Smith (1966).

44. The procedure for calculating levels of significance in stepwise regression analysis is given by Draper and Smith (1966, 172).

45. While the use of a five per cent or better level of significance has been traditional in geographic research, a more flexible use of significance levels in stepwise regression situations has been advocated (Hauser, 1974, 155). The ten per cent significance level, for example, has been used in regression analysis by Draper and Smith (1966, 400) and Beesley and Dalvi (1973). It is conceptually possible that a trade-off between increasingly higher levels of significance and increasing levels of explanation (as measured by the coefficient of multiple determination, $\underline{r}^2$) could be made. For example, although a particular group may have had one or more factors included in the estimating equation at the five per cent significance level, the increase in the value of $\underline{r}^2$ caused by raising the level to 10 per cent may be sufficient to outweigh the lower significance of newly-included factors. If this applied to most groups, there would be a strong case for setting a common level of significance as 10 or 20 per cent. In practice, however, there generally proved to be little necessity for, or possibility of, such a trade-off among the relevant groups. In group 2 for instance, the factors included at the five per cent level gave a value of $\underline{r}^2$ of 0.9973, while in group 7 no further factors were significant at either the 10 or 20 per cent levels.

46. When just $\underline{F}_2$ was included in the equation it was only significant at the 10 per cent level with a coefficient standard error of 0.184. The above equation was therefore preferred, even though it did not strictly conform to the factor selection procedure previously outlined.

47. A situation similar to that in group 1 existed here. When just $\underline{F}_4$ was included it was only significant at the 20 per cent level, with a coefficient standard error of 0.044, so the above equation was preferred.

48. See, for example, Australian Government Publishing Service (1972, 74-75).

49. The use of the word "other" here implies that assisted enterprises are basic rather than non-basic. This is not always true, however: the enterprises in group 4 are the principal exception although in fact much of the output of this group is import-replacing in character and thus quasi-basic.

50. See in particular the references in Isard and Czamanski (1965, 21).

51. Weiss and Gooding (1968, 237), for example, point out that for small regions autonomous investment is usually a minor growth factor in relation to exports; local inter-industry linkages are not as important; and import substitution is limited by the size of the local market.

52. It was assumed that multiplier increases generated in Sydney, Newcastle Wollongong or interstate would have been ignored by the Department (excluding increases generated locally by establishments situated within the Statistical Divisions/Districts of the three cities mentioned).

53. Urban areas within the Sydney, Newcastle and Wollongong Statistical Divisions/Districts were considered as part of the major urban area concerned, and data used in these cases therefore related to these larger areas.

54. Unmade roads were excluded from the distance calculations. Distances were measured from the approximate centre of gravity of population (usually the main settlement) of each local government area. Where a local government area was equidistant from two competing centres, or very nearly so, its population and employment were divided equally between the respective hinterlands. Urban areas within such local government areas for which separate data was available (viz, the "unincorporated urban areas" category of the Census Bureau) were, however, excluded from this division and allocated separately.

55. These were the last Census figures available before the 1965-66/1967-68 period under review (the full 1966 Census figures were not published until late in 1969). Figures for complete Statistical Divisions or Districts were used where appropriate. The populations of urban areas straddling the state's borders included the interstate components.

56. In practice, the definition of "lowest" has traditionally been set in terms of the level applying to the area at the five percentile mark in a ranking of all areas according to the

proportions of their workforce employed in the industry concerned.

57. The eight groups were founding, engineering, etc; ships, vehicles, etc; textiles and fibrous materials (not dress); clothing, knitted goods, boots, etc; food, drink, tobacco; sawmilling and wood products (not furniture); paper, printing, etc; other. The sources of all employment and population data were the 1954 and 1961 Australian census volumes (Commonwealth Bureau of Census and Statistics, 1955 and 1963).

58. Isserman (1977, 39) has in fact recently suggested the use of a benchmark between the average and minimum employment shares. The model criterion is not quite as suitable where industry groups are reasonably heterogeneous. In the case of the food and drink group, for example, the number of industries included meant that a fair proportion of all urban areas contained at least one export industry. To the extent that this was so, food and drink basic employment was under-estimated. A study of the results for individual centres did not, however, suggest that this factor led to any significant mis-classification of basic or non-basic employment.

59. In fact the original per capita data were multiplied by 1,000 for all groups for greater ease of computation, and six was added to the resulting figures in the case of the two groups mentioned prior to transformation to avoid negative or zero values.

60. Ships, vehicles etc, and the logarithmically transformed founding, engineering, etc group.

61. This was borne out by analysis of the two centres, Goulburn and Lithgow, which had the greatest combined change in the two groups. The long-established shoe and wool textile factories in the respective centres cited freight and communications costs as the main disadvantages of their locations in 1967, whereas the textile factories in Goulburn and the clothing factories in Lithgow mentioned good female labour supplies in those centres as a prime advantage at that time (source: interviews with managers conducted by the author).

skewness even after double logarithmic transformations). The estimating equation which was produced using a significance level of 10 per cent as the criterion for inclusion was:

$$\underline{S}/\underline{B}=1.0495 - \underset{(1.1031)}{2.2472^{*}}\ \text{Food} \quad ; \quad \underline{r}^2=0.159 \quad \overline{SE}=2.210$$

*Significant at 10 per cent level

where $\underline{S}/\underline{B}$ is the ratio of changes in non-basic employment to changes in basic employment during 1954-1961, ood is the basic employment change in the food etc, group as a percentage of total basic employment change, and other notation is as previously described. There was some possibility that collinearity could have caused mis-specification of the equation, the correlation coefficients between food and the equivalent variables for the clothing, etc, and total manufacturing groups being -0.77 and 0.78 respectively

66. Or Statistical Divisions/Districts in the case of Sydney, Newcastle and Wollongong. Source of population figures: Bureau of Census and Statistics (1955).

67. See also Richardson (1969, 272-73).

68. Unmade roads were excluded from the calculations.

69. The same metropolitan hinterlands as those defined in Appendix 3 were used here.

70. Since the analysis here was carried out, Bannister (1976) has published a method for empirically determining the relevant number of competing centres and the size of the distance exponent.

71. It was assumed that metropolitan areas exerted equal attraction ceteris paribus, and that any difference in their relative attraction would be reflected in the DISMET variable.

72. Source of data: Bureau of Census and Statistics (1955).

73. It would have been preferable to have used an index reflecting average unemployment during the 1954-1961 period, but no published figures of unemployment by local government areas in intercensal years were available. 1961 data was not

used as figures were atypical because the economy was in recession.

74. This definition was preferred to a measure of the change in the ratio of manufacturing to total basic employment because of certain anomalies in this latter measure created by positive versus negative numbers.

75. Another structural variable, the percentage of the 1954 work force in the centre and its hinterland which was female, was also considered for inclusion. The hypothesis here was that the non-basic: basic ratio would be lower where there were fewer females available to be employed or, alternatively, where a large female work force lessened the average spending power of employees. This variable may not have been strictly independent, however, as higher non-basic increases could conceivably lead to higher female work force percentages as well as be caused by the latter.

76. It was assumed that the distributions of the other variables (after transformation, where applicable) remained approximately normal after excluding values for Batlow.

77. See Frank (1971, 283).

78. Runs tests and plots of residuals respectively, were used to check the linearity and spatial correlation assumptions. In regard to the multicollinearity assumption, all simple correlation coefficients between independent variables were less than 0.7 , which is well under Keeble and Hauser's (1972, 13) suggested "excessive" level of 0.85 denoting collinearity which might influence the structure of a regression equation.

79. The exclusion of the three largest centres did, however, cause one of the coefficients of correlation between the independent variables to increase above 0.7 . But the two variables concerned, log (B+40) and log SHIFT, both yielded F values in the ensuing regression analysis well under the level required for significance even at the 20 per cent level, and it was concluded that any collinearity between the two would not have affected the choice of variable(s) included in the regression equation.

80. Yates' correction was used.

81. Wollongong was excluded from the sample because it had originally been intended at this stage to carry out a regression analysis making S an additive function of B and associated spatial and structural variables. For this purpose it had been found that the inclusion of Wollongong caused marked skewness in the distributions of several independent variables. Hence it had been decided to omit Wollongong to reduce the skewness problem.

CHAPTER 5

ESTIMATION OF ALTERNATIVE SEMI-NORMATIVE DECISION FUNCTIONS FOR THE DECENTRALISATION PROGRAMME

This chapter describes the estimation of alternative decision functions hypothesized to have been applied in the New South Wales decentralisation programme between 1965/66 and 1967/68, using the various functional forms suggested in Chapter 3, and embodying the semi-normative goal criteria developed in Chapter 4. This calibration of decision functions is the main analysis required to make operational the programming model of decentralisation decisions described in Chapter 3, and leads into the operation of the model itself in the next chapter.

The first part of the chapter describes the estimation of decision functions for loans, while the second part covers the estimation of grant functions. For loans, the best results were achieved using a standard function with additive goal criteria and utility linearly related to expenditure. The inclusion of multiplicative relationships did not improve the specification of functional structure, while non-linear utility/expenditure formulations were not as successful as the linear version. The goal criteria relating to maximum assistance area, potential closure, and profitability emerged consistently as being significant. A disaggregation of the standard function into large and small loan cases served to increase the degree of explanation. Another disaggregation, by year of loan, suggested that the standard function was partly dynamic. The analysis of grants was less satisfactory. No significant results were obtained with any of the three additive versions using one linear and two non-linear utility/expenditure formulations which were tried. However, the difference in the results between loans and grants validated the decision to do a separate analysis of each.

As suggested in Chapter 3, the method used here to estimate the parameters of decision functions is multiple regression, with the goal criteria being the independent variables and expenditure (or its square root or logarithm) ÷ request value the dependent variable. From a conceptual viewpoint there are certain problems in applying this method to binary-valued variables, such as a number of the goal criteria included here. For practical purposes, however, this technique cannot be distinguished from such alternatives as logit and probit analysis and is superior to a further alternative, discriminant analysis (Watson, 1974, 199). The particular regression technique employed below and throughout the study as a whole was stepwise multiple regression analysis. In this chapter, independent variables have been included in each regression equation if they are significant at the 5 per cent level.

Not all observations in the original samples of loan and grant decisions could be used because of the unavailability of data for some independent variables (principally the financial ones) in a number of cases. The number of observations actually used in the analyses of loans was 52, while in the analyses of grants it was 25.

ESTIMATES OF THE DECISION FUNCTION: LOANS

This section describes the estimation of various versions of the decision function for loans. The standard version (with additive goals and a linear utility/expenditure relationship) is discussed first, including a disaggregation into large and small loan cases. Then analyses using non-linear utility/ expenditure variants are described, followed by estimation of a multiplicative goal version. Finally, an attempt to produce a dynamic decision function is discussed.

Standard decision function

The standard formulation of the decision function contains additive goal criteria and a measure of utility which is linearly related to expenditure. The goal criteria used were those relating to loans shown in Table 4.1. As discussed in Chapter 3, the limitation of expenditure in each case to the value of the request means that a definition of utility in unit value terms is required. In the linear situation, this can be expressed as the government loan value as a percentage of the request value, or $\underline{p}$ (the definition being given in percentage terms for convenience).

The 23 goal criteria to be used as the independent variables were first tested to see if they met the assumptions of the linear regression model. Sixteen of the variables had approximately normal distributions of values, using Lambe's test.[1] Six others, variables $\underline{x}_5$, $\underline{x}_9$, $\underline{x}_{10}$, $\underline{x}_{11}$, $\underline{x}_{16}$ and $\underline{x}_{20}$, were found to be approximately normally distributed after logarithmic transformation of values,[2] so these transformed versions were used in the regression analysis. The values of variables $\underline{x}_3$, $\underline{x}_{13}$, $\underline{x}_{14}$, $\underline{x}_{15}$ and $\underline{x}_{17}$ failed to achieve approximately normal distributions after both logarithmic and double logarithmic transformations. Variable $\underline{x}_{14}$ (current assets minus liabilities) was then excluded, since it was considered in retrospect that a suitable surrogate variable already existed in $\underline{x}_{13}$ (current assets: liabilities). Variable $\underline{x}_3$ (indirect employment change per $1,000 of assistance) was eliminated by adding the values of $\underline{x}_3$ in each case to the corresponding values of $\underline{x}_1$ (direct employment change/$1,000), thus producing a variable denoting the estimated total employment change per $1,000 of loan assistance. With variables $\underline{x}_{13}$, $\underline{x}_{15}$ (profit percentage) and $\underline{x}_{17}$ (working capital minus annual loan repayments) the problem was overcome by adopting binary-valued forms in each case, with values of one and zero being assigned to original values less than one and greater than one, respectively, for $\underline{x}_{13}$ and to original values which were negative and positive, respectively, in the cases of $\underline{x}_{15}$ and $\underline{x}_{17}$. Although this procedure involves some loss of information and is not therefore strictly in accordance with the semi-normative conditions of this chapter, it was considered preferable to include reduced-information versions of the variables rather than exclude them entirely.

In a similar manner to Chapter 4, a runs test together with visual inspection of residuals from the regression of $\underline{p}$ on $\underline{x}_i$ (where $\underline{i}$ denotes the independent variable in question) were used to determine whether a linear relationship existed between $\underline{p}$ and each non-binary $\underline{x}_i$. All the independent variables thus tested were found to be linearly related to $\underline{p}$.[3] Some heteroscedasticity was apparent in the pattern of residuals for the urban population variable, but it was left in the regression analysis with the acknowledgement that an F value higher than the usual level would be required for it to be finally included as a significant explanatory variable. Spatial autocorrelation corresponding to the distribution of values of the "100 per cent area" variable, which was already in the analysis, was generally evident in maps of residuals outside the $\pm$ 1 standard error range. Similar tests of normality, linearity, homoscedasticity, and spatial autocorrelation, besides one for non-collinearity as described below, were carried out in the subsequent regression analyses described in this thesis, but for economy are discussed only where the corresponding regression assumption was not found to be met.

The analysis which produced the eventual regression equation below excluded the total estimated employment and management quality variables from the set of independent variables. A prior analysis in which both variables were included had shown both to be significant at the 5 per cent level or better.[4] However, the sign of the total employment coefficient was negative, which was opposite to the hypothesized direction. This was probably because of the variable's high correlation with request value, for which a negative coefficient sign had been postulated. Since request value was the more appropriate variable to reflect this relationship, the total employment variable was omitted.

A comparison of regression equation (L1) below with that produced by the prior analysis (see footnote 4) suggested that the retention of the management quality variable in the analysis caused it to be included in the regression equation at the expense of the profit/loss variable. This was supported by the relatively high coefficient of correlation ($\underline{r}$ = -0.51) between the two variables. On the other hand profitability, as an objective measure, more closely fits the semi-normative framework of this chapter. Hence it was preferred and the management quality variable excluded.

The stepwise regression analysis of $\underline{p}$ and the remaining goal variables (transformed where necessary) produced the following equation:

$$\text{(L1)}\quad \underline{p} = \underset{}{57.2885} + \underset{(9.3671)}{39.5224^{**}}\underline{x}_6 + \underset{(5.4736)}{35.0392^{**}}\underline{x}_7 - \underset{(7.2710)}{26.0313^{**}}\underline{x}_{15}\ ;\ \underline{r}^2 = 0.550,\ SE = 18.427$$

** Significant at the 1 per cent level

Excess multicollinearity, as indicated by the previously suggested criterion of a product moment correlation coefficient ($\underline{r}$) above 0.85, existed between the two female employment variables, $\underline{x}_9$ and $\underline{x}_{10}$ ($\underline{r}$ = -0.89). Both, however, had F values for inclusion in (L1) of less than 1, so that it was very unlikely that the multicollinearity would have caused the omission of either variable from the equation.

The value of $\underline{r}^2$ indicates that the three variables included in the equation (denoted (L1)) explained over half of the variation in $\underline{p}$. The equation states that the estimated percentage of a request met by a government loan is a function of the likelihood of closure ($\underline{x}_6$), location in a "100 per cent assistance" area ($\underline{x}_7$), and profitability ($\underline{x}_{15}$). The coefficient signs in each case were in the direction hypothesized. The most important of the three variables (as indicated by the ratio of the regression coefficient to the standard error[5]) is $\underline{x}_7$, whether the establishment is located in a "100 per cent area". The equation indicates that in such a case the proportion of the loan request approved by the Department could be expected to increase by about 35 per cent.

Similarly, it indicates that the likelihood of closure ($\underline{x}_6$) would on average increase the proportion approved by about 40 per cent, while an unprofitable applicant ($\underline{x}_{15}$) would receive about 26 per cent less, all else equal. Perhaps as noteworthy as the particular variables included is the value of the constant. Its relatively large value suggests a fairly inflexible response by the Department to requests with different characteristics.

The inclusion of the "100 per cent area" variable in equation (L1) is entirely predictable, given the existence of a rule for giving bigger loans in such areas. Moreover, the coefficient is close to the expected value. During the period concerned, the basic rule outside maximum assistance areas was to give loans equal to 60 per cent of the requested value, but the average proportion actually given in the 35 sample cases included in the (L1) analysis and lying outside a "100 per cent area" was 57 per cent, or 3 per cent less than the basic rule. On this basis the average given in cases lying within maximum assistance locations might have been expected to be ($40 \times {}^{57}/60$), or 38 per cent above the basic 57 per cent, whereas the equation predicts an increase of 35 per cent.

The second most important variable in equation (L1) is the variable denoting whether closure would occur in the absence of assistance. Together with the non-inclusion of any variables coming under the Department's supposedly basic goal of increasing total country employment generally, this points to the political significance, and perhaps the effect on the confidence of potential country manufacturers, of a factory closure. From the spatial point of view it is of interest to note that, although the closure variable is not a specifically locational one, there was some tendency for enterprises in danger of closing to be located further from the metropolitan area than the average distance for firms of that type. Thus the one case of potential closure in Group 2 enterprises was some 70 miles further away than the next furthest enterprise. In Group 6 there was only one enterprise further from the metropolitan area than the potential closure case, and in Group 7 the potential closure cases were the most distant of the non-local market enterprises. A 2 x 2 χ^2 analysis comparing, in each group containing a potential closure case, the number of sample cases facing closure or otherwise in the most distant quartile of cases with the number in the other three quartiles and aggregating the results for all such groups, yielded a value of 4.0, significant at the 5 per cent level.[6] This statistically confirms the tendency. It means that the potential closure component of (L1) is to a certain extent a "centre-periphery" variable, and that the decision function thereby at least partly conforms to the hypothetical spatial pattern of government expenditure suggested originally by Hirschman (1958).

The inclusion in the equation of the profit/ loss variable, as a measure of viability, in preference to the other potential financial criteria, is not surprising in view of the central importance of profits to the long-run survival of the firm. To the extent that profits were used as a criterion, the decisions of the Department reinforced the pre-existing (capitalist) locational pattern of industrial growth in N.S.W. country areas, if the maximisation of profits is assumed to be the dominant goal of the firm.

The values and locations of residuals of the regression estimates from actual values are shown in Figure 5.1. The negative residuals at Maclean, Kurri Kurri, Orange, Grafton and Batlow can be almost entirely explained by the high proportion of machinery in the total value of each request concerned, and the Department's greater reluctance to make loans in such cases. In other cases involving machinery requests included in the sample, the proportion of each request approved differed little from the proportions for land and buildings requests. The lack of any consistent trend therefore meant that the machinery variable ($\underline{x}_{22}$) was not included in the regression equation, although it was significant at the higher 10 per cent level and had a negative coefficient sign, in accordance with the original hypothesis for its inclusion.

The positive residual at Yass is associated with a loan to a company on the verge of closing, where the need for assistance was extremely urgent. The closure variable, however, did not distinguish between varying

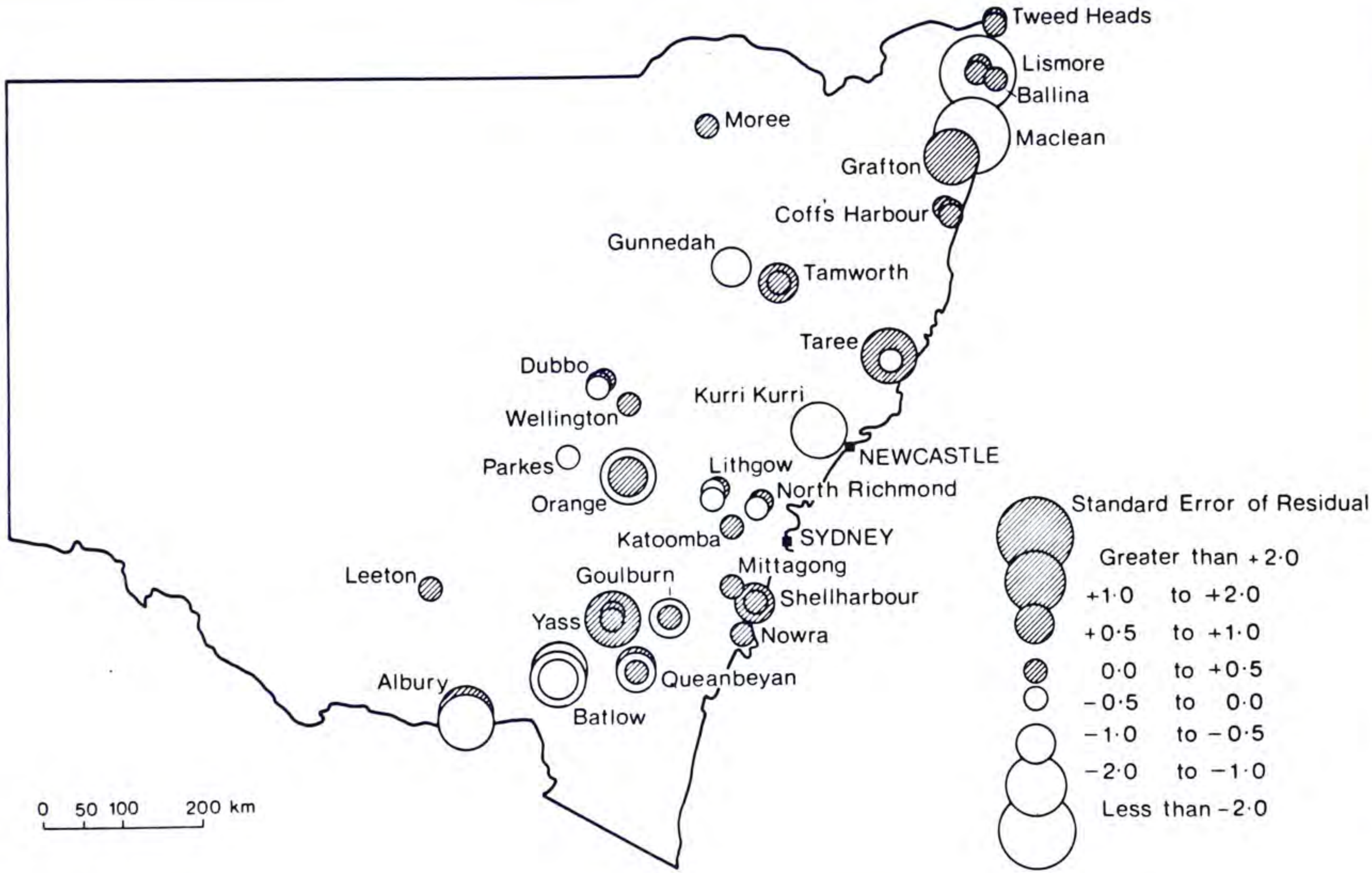

Figure 5.1 Residuals from Preferred Semi-Normative Estimates of Percentage of Loan Request Granted (Aggregated Analysis)

degrees of urgency and was thus unable to predict the high degree of assistance here. The high negative residual at Lismore is due to the over-prediction of assistance to a wholesaling establishment, arising because the Department's policy was to approve only 50 per cent of such requests even in "100 per cent areas". Another high negative residual, that at Albury, is associated with the complete refusal of a request from an enterprise which had previously been successful in obtaining a loan, and seems to have resulted from a lack of co-operation from the company and a reluctance by the local council to contribute its share of the loan. The large positive residual at Grafton resulted from a request by a company which made a loss in the previous year. The risk otherwise indicated by a loss situation, however, was regarded by the Department as being offset here by the firm's status as a public company, its size, and planned restructuring and relocation of operations. To conclude, the factors causing loan approvals to be seriously under - or over-estimated generally seem to have either already been incorporated in the analysis as hypothesized variables which proved to be non-significant, or to have involved reasons of the once-only kind.

The above stepwise regression analysis of $\underline{p}$ and the different goal variables (transformed as necessary) was then repeated, this time using $\underline{N}_r$ (estimated employment change per \$1,000 of requested loan) instead of $\underline{N}$ (measuring change per \$1,000 of loan assistance). The sample values of $\underline{N}_r$ had an approximately normal distribution using Lambe's test. Residuals from the regression of $\underline{p}$ values on corresponding $\underline{N}_r$ values did not suggest any obvious non-linearity or heteroscedasaticity, and product moment correlation coefficients between sample values of $\underline{N}_r$ and the other independent variables indicated no significant multicollinearity (the maximum $\underline{r}$ value was 0.37). The new stepwise multiple regression analysis produced the following equation:

$$\text{(L1a)}\ \underline{p} = 57.7415 + 25.9203\ {}^{**}\underline{x}_6 + 35.9085\ {}^{**}\underline{x}_7 - 0.2644\ {}^{**}\underline{x}_{22};\ \underline{r}^2=0.527,\ SE=18.892$$

** Significant at the 1 per cent level

As in (L1), the two female employment variables, $\underline{x}_9$ and $\underline{x}_{10}$, had F values for inclusion of less than 1, and thus it was unlikely that their multicollinearity caused the omission of either variable from the equation.

The value of $\underline{r}^2$ is virtually the same as that produced by equation L1. The structure of the new equation, however, is different : variable $\underline{x}_{22}$ (percentage of machinery in the request) is included at the expense of $\underline{x}_{15}$ (profitability). The coefficient of $\underline{x}_{22}$ suggests that a request for a machinery loan only was likely to have had 26 per cent less of the requested value granted than a factory loan application. This is in the direction hypothesized. One reason for this discrimination by the Department is that loans for machinery were less secure because the value of machinery declines more rapidly than factory buildings over time with usage and obsolescence. Variables $\underline{x}_6$ (likelihood of closure) and $\underline{x}_7$ (location in maximum assistance area) are common to both equations, although the coefficient of $\underline{x}_6$ in (L1a) is only two-thirds of its value in (L1). The reason for the substitution of $\underline{x}_{22}$ for $\underline{x}_{15}$ is not clear. The slight collinearity between $\underline{x}_{15}$ and $\underline{N}_r$ ($\underline{r}$ = -0.30, significant at the 5 per cent level) may be a factor, when considered in conjunction with the relatively high F values (2.75 and 2.52 respectively compared with F = 4.05 required for significance at the 5 per cent level) produced by both variables in the second analysis.

Mapping of the residuals produced by subtracting values predicted by equation (L1a) from corresponding actual sample values revealed pattern fairly similar to that in Figure 5.1. The main differences, as expected, occur for cases involving negative profitability or requests for machinery loans. The former cases tend to be over-predicted because of the absence of the profitability variable from (L1a). On the other hand the tendency to over-prediction of the latter cases with equation (L1) is reduced when (L1a) is used. No significant spatial autocorrelation among the residual values was apparent.

<u>Disaggregation by loan size.</u> Although the standard functional form gave a reasonably high explanation of the total variance of the degree to which each loan request was met, the exclusion of criteria related to the basic goal of

employment likely to be generated in the applicant enterprise was not fully expected. When considered along with the exclusion of a second basic criterion of the Department (Department of Decentralisation and Development, 1970, 8), a project's regional or state significance, it suggested the hypothesis that the importance of employment generation per dollar of assistance varied inversely with the size of loan.[7] This hypothesis was tested by dividing the sample of 52 into two groups of 26 on the basis of the value of each request (in June, 1969 terms). The first group contained cases where the value of the request was $26,250 or more, and the second included cases with requests below this value. A stepwise multiple regression analysis was carried out for each group, using the same variables (and the same transformations) as the non-disaggregated analysis.

The analysis of the large loan group yielded the following equation:

$$\text{(L2)}\quad \underline{p} = 63.2760 + \underset{(5.8905)}{27.4471^{**}}\underline{x}_7 - \underset{(0.1106)}{0.5909^{**}}\underline{x}_{22}\ ;\quad \underline{r}^2 = 0.689,\ \underline{\text{SE}} = 14.611$$

** Significant at the 1 per cent level

where $\underline{x}_7$ denotes location in a "100 per cent area" and $\underline{x}_{22}$ is the percentage of the request desired for machinery.

The analysis of the small loan group resulted in the following equation:

$$\text{(L3)}\quad \underline{p} = 46.3101 + \underset{(6.2399)}{17.0444^{*}}\underline{x}_{1,3} + \underset{(9.2240)}{31.8837^{**}}\underline{x}_6 + \underset{(7.5373)}{39.0789^{**}}\underline{x}_7\ ;\quad \underline{r}^2 = 0.687,\ \underline{\text{SE}} = 16.945$$

** Significant at the 1 per cent level
* Significant at the 5 per cent level

where $\underline{x}_{1,3}$ is employment change per \$1,000 lent, $\underline{x}_6$ indicates whether the establishment would close in the absence of assistance, and $\underline{x}_7$ indicates a location in a "100 per cent area". In both analyses excess multi-collinearity ($\underline{r}$ = - 0.90 and - 0.88, respectively) existed between the two female employment variables ($\underline{x}_9$ and $\underline{x}_{10}$), but as their F values in each analysis were well below the 5 per cent level of significance the multicollinearity was unlikely to have affected the structure of the equations.

The first point to be made about the two equations is that they both give a higher degree of explanation ($\underline{r}^2$ = 0.69 in each case) than the aggregated version ($\underline{r}^2$ = 0.55). The second feature is that their structures are different to each other and to the aggregated structure in (L1). The "100 per cent area" variable is the only one in all three equations, although the potential closure variable is included in (L1) and (L2) and is only narrowly excluded from the small loans equation (L3).[8] Somewhat unexpectedly, the inclusion of the profit/loss variable in the aggregated version is not repeated in either of the disaggregated versions.

The disaggregated equations include two variables not in the original equation: the percentage of the request wanted for machinery in (L2), and employment change per \$1,000 lent in (L3). Equation (L2) predicts that large loans would have been reduced on average by nearly three-fifths of the percentage of machinery in the request value. Thus for a large request for machinery only, the proportion of the request agreed to is predicted to have been 59 per cent less than that for a factory loan request of the same size. The reason why this policy should only have applied to large loans was perhaps because large loans were generally given to larger firms which the Department felt would have been more easily able to finance machinery from internal or commercial sources, thus enabling loan funds to be released to other applicants.

The other new variable in the disaggregated equations is $\underline{x}_{1,3}$, estimated employment change per \$1,000 lent, in the small loans equation (L3). As the basic criterion of the efficiency with which total decentralised growth was attained, it might have also been expected to have featured in the aggregated and large loan equations. The significance of employment change/\$1,000 for small requests only, however, suggests that the Department was willing to fund larger projects without special regard to their employment: loan value ratio because of their greater impact.

In order to see whether this conclusion still held using the alternative set of employment change estimates defined in terms of $\underline{N}_r$, change per \$1,000 requested, the large and small loan analyses were repeated using estimated sample values of $\underline{N}_r$ instead of $\underline{N}$. The new large loan group analysis produced the same equation as before. The new small loan group analysis yielded the following equation:

$$\text{(L3a)}\ \underline{p} = 55.2828 + 40.4781^{**}\underline{x}_6 + 45.7643^{**}\underline{x}_7 - 23.9040^{*}\underline{x}_{15};\ \underline{r}^2 = 0.655$$
$$(10.6686) \qquad (8.1210) \qquad (10.9393) \qquad SE = 17.774$$

where $\underline{x}_6$ indicates closure in the absence of assistance, $\underline{x}_7$ denotes location in a "100 per cent area", and $\underline{x}_{15}$ measures profitability. As in the first analysis, multicollinearity between the two female employment variables did not appear to have influenced the structure of the equation.

The total variance explained by the new equation is virtually the same as for the original equation ($\underline{r}^2$ = 0.655 and 0.687, respectively). The closure and "100 per cent area" variables are common to both equations, although the respective coefficients are a little larger in (L3a). The variable denoting employment change per $1,000 assistance which is present in the original equation has, however, been replaced by the profitability variable ($\underline{x}_{15}$) in (L3a). The negative sign of $\underline{x}_{15}$ is in the direction hypothesized, and the coefficient indicates that loans to applicant companies which made a loss in their last reported financial year were on average 24 per cent lower than loans to profitable companies.

The inclusion of variable $\underline{x}_{22}$, denoting the machinery percentage of the overall request, in just the large loans equation in both sets of analyses is worth comment. Eight of the sample of large loan requests included machinery in the application, and in only one of these cases did machinery comprise the whole request. Thus in large loan cases, machinery was generally included as part of a package of requests, whereas there were only two small sample loan requests of this type (four other small sample loan requests were exclusively for machinery). Thus the Department probably felt that in such large loan cases the applicant company should finance the machinery component itself (this view is supported by one or two file comments), since rejection of this component did not necessarily mean rejection of the whole request. The latter suggests the possibility of a bargaining situation, and this is further explored in Chapter 8. The larger companies associated with the larger requests appeared to be considered able to finance the machinery themselves (although applicants' inability to finance requests was officially a prerequisite for departmental aid, this criterion was in practice usually given scant consideration in the case of large projects, presumably because of the "visibility" and demonstration effect of such projects).

In general terms, the results of the aggregated and disaggregated analyses provide partial support to the Department's public statements of factors influencing willingness to lend - the viability of the enterprise, the prospects of employment generation and its regional or state significance (Department of Decentralisation and Development, 1970, 8). Viability is reflected in the profit/loss variable included in the second small loans equation. A measure of the second factor is the employment change/$1,000 assistance variable in the first small loans equation, although this measure is probably less preferable than the $\underline{N}_r$ variable shown to the non-significant in the second analysis. The exclusion of the profit/loss variable from the large loans equation, and the corresponding inclusion of the machinery variable with its suggestion that larger companies could provide their own finance, both indirectly point to the third factor, large project size. The higher loans given to "100 per cent areas", another publicly stated policy, are also reflected in the equations. Nevertheless, the significance of the closure and machinery variables in the analyses is an example of the potential importance of non-public criteria in the location decision functions of governments.[9]

Inclusion of further measures of risk. The analysis of risk is an important element of traditional decision theory. The approach used in the above analyses, in which independent variables ($\underline{x}_{13}$ to $\underline{x}_{22}$) were used as risk criteria, differs from that of formal decision theory since it appeared to more closely represent the decision processes of the Department. Formal decision analysis uses as measures of riskiness the statistical properties of criteria of goals other than risk reduction. Although such measures were apparently less relevant in the New South Wales decentralisation situation, the testing of formal decision criteria of risk in the New South Wales decentralisation situation was warranted by their theoretical importance. Three separate analyses, two using formal risk criteria and one employing a variant of the formal approach, were carried out using the 52 sample observations in each case. Since the employment change/ $1,000 variable, $\underline{x}_{1,3}$, is the only criterion incorporating estimates derived from a range of possible values and thus having the necessary statistical properties, it was the only one to which the three analyses were applied.

The normative criteria suggested in Chapter 3 for measuring risk-aversion strategies were, in addition to the adoption of mean values,[10] functions of population variance (certainty-equivalent payoff strategy)[11] or standard deviation (maximin, maximax and Hurwicz strategies). Both of these criteria were tested separately (and not in a single analysis, since one is a transformation of the other). Because values of $\underline{x}_{1,3}$ were estimated from regression analysis, it was more appropriate to use the sample variance of regression ($\hat{\sigma}^2$) instead of population variance and the sample standard deviation of regression, or standard error of estimate ($\hat{\sigma}$) instead of standard deviation.[12]

In the analysis of the variance criterion, $\hat{\sigma}^2$ values were calculated for each of the seven industry groups used for employment estimation.[13] One of the seven values was allocated to each of the 52 sample observations according to the latter's industry group. The resulting set of values was designated variable $\underline{x}_{27}$. After double logarithmic transformation to overcome skewness,[14] $\underline{x}_{27}$ was then added to the independent variables used in the previous standard function analyses. The existence of a certainty-equivalent payoff strategy would have been suggested if loglog $\underline{x}_{27}$ had emerged as a significant explanatory variable along with the employment change/ \$1,000 variable itself, $\underline{x}_{1,3}$. The regression equation component $a(\underline{x}_{1,3} + b \text{ loglog } \underline{x}_{27})$ would comprise the certainty-equivalent (where a and b are positive constants). When the original (aggregated) regression analysis was repeated with loglog $\underline{x}_{27}$ added, however, equation (L1) was again generated. Thus the hypothesis that a certainty-equivalent form of the estimated employment change/\$1,000 criterion was used by the Department was rejected.

The second analysis used the standard error of estimate, $\hat{\sigma}$, as a measure of the risk attached to the employment change estimates. Three separate regression runs were employed. The same procedure as used for $\hat{\sigma}^2$ values was used to derive $\hat{\sigma}$ values for the sample observations. These $\hat{\sigma}$ values formed variable $\underline{x}_{28}$. In similar fashion to the certainty-equivalence analysis, the existence of a Hurwicz strategy (which represents a compromise between maximin and maximax strategies) would have been suggested if both the employment change variable ($\underline{x}_{1,3}$) and its standard error of estimate ($\underline{x}_{28}$) proved significant in the regression equation. The original regression analysis was again repeated, this time adding log $\underline{x}_{28}$ (transformed to overcome skewness)[15] as an extra independent variable. The same equation, (L1), was generated once more, pointing to the absence of a Hurwicz criterion in the Department's loan decisions. Two further regression runs were used to specifically test the presence of maximax and maximin strategies. Maximum possible values of employment change/\$1,000 were arbitrarily defined as being two standard errors above the employment change/ \$1,000 predicted by regression (that is, $\underline{x}_{1,3}$ values), while minimum values were defined as two standard errors below the regression prediction. Thus defined, only 5 per cent of real world values would be expected to fall outside these limits. Maximax or maximin strategies would have been indicated if the composite variables ($\underline{x}_{1,3} + 2\ \hat{\sigma}$) or ($\underline{x}_{1,3} - 2\ \hat{\sigma}$), respectively, had proven significant as independent variables. Repetitions of the original regression analysis, adding each of the composite variables in turn, showed however that neither reached the required 5 per cent level of significance. Hence there was no support for the hypothesis that the Department had implemented the employment change criterion using a maximax or a maximin strategy.

The third and final analysis used a modification of the decision theory approach of using formal statistical measures. The standard error measure used in the preceding analysis expresses the expected accuracy of an estimate, and this is in turn related to the level of significance of the predictive variables in the estimating equation. This suggests that one way of incorporating the preciseness of the formal standard error measure in a relatively easy manner would be to rate applications for assistance according to the degree of confidence with which their prospective employment change can be estimated. Accordingly, a binary-valued variable, $\underline{x}_{29}$, was defined separating estimates of employment change using predictive variables which were significant at the 5 per cent level of confidence or better (value one), from estimates using variables not significant at this level (value zero). Adding $\underline{x}_{29}$ to the other independent variables, however, did not produce any change in the structure of the original regression function (L1). The results of the three analyses, therefore, did not suggest that formal statistical risk measures or variants thereof were used by the Department in responding to applications for loans, although this conclusion must be qualified by the slightly arbitrary nature of several of the indicators used.

A multiplicative decision function

The additive structure of the standard decision function implicitly assumes that the goals in the function are independent of each other. In practice, however, governmental goals may often be interdependent. The simplest functional form which meets the interdependence condition of a diminishing marginal rate of substitution between goals is one which is quadratic and non-separable (see Chapter 3). Using the goal criteria in (L1) above, such a function would take the form

$$\underline{p} = a+\underline{b}_1\underline{x}_6+\tfrac{1}{2}\underline{b}_2\underline{x}_6^{\,2}+\underline{b}_3\underline{x}_6\underline{x}_7+\underline{b}_4\underline{x}_7+\tfrac{1}{2}\underline{b}_5\underline{x}_7^{\,2}+\underline{b}_6\underline{x}_6\underline{x}_{15}+\underline{b}_7\underline{x}_7\underline{x}_{15}+\underline{b}_8\underline{x}_{15}+\tfrac{1}{2}\underline{b}_9\underline{x}_{15}^{\,2}$$

The multiplicative relationships mean that the number of components in the function has an exponential relation to the number of variables included. Thus the actual number of variables which can be tested is limited, for otherwise the number of components would approach the number of observations and tend to give rise to chance correlations. The variables selected to test the existence of a multiplicative function were therefore limited to the three included in the hypothetical function above, since these appeared to be the most likely to be included in any decision function with interdependent components.

In order to use multiple linear regression analysis to specify the values of the constants in the above version of the function, each of the variable entities $\underline{x}_6$, $\underline{x}_6^2$, $\underline{x}_6\underline{x}_7$, etc. was regarded as a separate variable, with prior multiplication of the original values being carried out where necessary to yield a single observation value in each case. The entities $\underline{x}_6^2$, $\underline{x}_7^2$, and $\underline{x}_{15}^2$ were excluded from the subsequent analysis, being identical to $\underline{x}_6$, $\underline{x}_7$ and $\underline{x}_{15}$, respectively, because the latter could only take values of one or zero. Residual values from the regression of $\underline{p}$ on $(\underline{x}_7\underline{x}_{15})$ showed some heteroscedasticity, but $(\underline{x}_7\underline{x}_{15})$ was left in the analysis with the proviso that it would have to generate an F value of greater than normal significance to be included in the final regression equation.[16]

The stepwise regression analysis of the multiplicative function did not, however, generate any multiple variables which were significant at the 5 per cent level. The variables included in the regression equation were the same as the three in the first additive equation (L1), namely, location in a "100 per cent area", potential closure, and profit/loss.

A multiplicative formulation of the second additive equation (L1a) was also tested. This formulation had the same notional structure as that for (L1) (page 231), except that $\underline{x}_{15}$ was replaced by $\underline{x}_{22}$ (percentage of loan requested for machinery). The entities $\underline{x}_6^{\,2}$ and $\underline{x}_7^{\,2}$ were again excluded from the analysis. The entities $\underline{x}_6\ \underline{x}_7$ and $\underline{x}_6\ \underline{x}_{22}$ were also excluded because there was only one non-zero sample value for each. Sample values of both $\underline{x}_7\ \underline{x}_{22}$ and $\underline{x}_{22}^{\,2}$ were found to have skewed distributions using Lambe's test. They were retained in their original form, however, to preserve the decreasing marginal utility property of the formulation, with the analysis thereby being treated as experimental in the first instance. The product moment correlation matrix for the independent variables revealed very high multicollinearity between $\underline{x}_{22}$ and $\underline{x}_{22}^{\,2}$ ($\underline{r}$ = 0.98). Therefore $\underline{x}_{22}^{\,2}$ was also omitted. When a stepwise multiple regression analysis was performed on values of $\underline{p}$ and the remaining independent variables, the same equation as in the equivalent additive analysis, (L1a), was produced.

These results thus perhaps provide partial support to previous studies which have rejected inter-dependent utility formulations in favour of additive independent models (see Stanley, 1974, 331), although the inability to test several of the multiplicative variables means any conclusion must be tentative at best. The multiplicative analysis was not repeated for the disaggregated decision functions, partly because their higher level of explained variance suggested that further (multiplicative) variables were less likely to be significant than in the aggregated function.

Decision functions with non-linear utility

To this point it has been assumed that the government's utility from decentralisation assistance was linearly related to the value of the assistance. As pointed out in Chapter 3, however, this is contrary to the common economic assumption that extra (marginal) utility decreases as expenditure increases. Under this hypothesis, utility is commonly assumed to be related to the square root or the logarithm of expenditure. It was also argued that in the present context an allowance should be made for the fact that requests for assistance are of varying values, as otherwise estimates of the decision function would be biased in favour of large requests. Hence two non-linear versions of utility were defined:

as $\frac{100.\sqrt{(\text{value of assistance})}}{\text{value of request}}$, denoted here as $\underline{p}_{s}$; and

as $\frac{100.\log_{10}(\text{value of assistance})}{\text{value of request}}$, denoted here as $\underline{p}_{l}$.[17]

The original analysis using the standard decision function was repeated (using the same transformations of the independent variables except for $\underline{x}_{22}$ - see below), but using $\underline{p}_{s}$ and $\underline{p}_{l}$ in turn as the dependent variable (utility). The size of request variable ($\underline{x}_{11}$) was excluded from the analyses since an allowance for this factor is implicit in the definitions of $\underline{p}_{s}$ and $\underline{p}_{l}$. The estimated total employment variable ($\underline{x}_{5}$) was also omitted because of its high correlation with value of request.

Using utility as a square root function. When the square root version of utility, $\underline{p}_{s}$, was used the following regression equation was generated:

$$\text{(L4)}\quad \underline{p}_{s} = -\,1.784 + \underset{(0.181)}{0.654^{**}}\underline{x}_{6} + \underset{(0.240)}{0.964^{**}}\log \underline{x}_{9} + \underset{(0.248)}{0.842^{**}}\log \underline{x}_{10}$$

$$+ \underset{(0.139)}{0.283^{*}}\underline{x}_{12} - \underset{(0.141)}{0.465^{**}}\underline{x}_{15} + \underset{(0.000)}{.000212^{*}}(\underline{x}_{22})^{2}; \quad \underline{r}^{2} = 0.451,\ SE = 0.32$$

** Significant at the 1 per cent level
 * Significant at the 5 per cent level

where $\underline{x}_{6}$ indicates whether closure is likely; $\underline{x}_{9}$ is the town's female work force as a percentage of its male work force, adjusted for the industry male : female employment structure of the applicant; $\underline{x}_{10}$ is the town's female unemployment rate, again adjusted for industry employment structure; $\underline{x}_{12}$ denotes whether the loan repayment period is less than 8 years; $\underline{x}_{15}$ indicates profit or loss; and $\underline{x}_{22}$ is the percentage of the request value which is desired for machinery. Squared values of $\underline{x}_{22}$ were used to overcome non-linearity indicated by a U-shaped pattern of residuals when $\underline{p}_s$ was regressed on $\underline{x}_{22}$ for the sample observations.

The level of variance explained by the equation ($\underline{r}^2 = 0.45$) is lower than that of the original regression analysis (L1) where a linear version of utility was used ($\underline{r}^2 = 0.55$). Its structure also differs somewhat from that of (L1). The potential closure and profit/loss variables have been retained, but the omission of the "100 per cent area" variable is unexpected, as this criterion reflects a basic allocative rule of the Department. Four new variables are included in (L4): those denoting short loans, the percentage of the request desired for machinery, and female work force and unemployment levels. Since $\underline{p}_s$ is defined so that, for a given proportion of each request, its value increases as the value of loans decreases, a positive coefficient indicates that projects with higher values of the variable were favoured, but particularly so if the projects required only a small loan. The equation predicts that this would have been so in cases with a likelihood of closure, high female employment indices, short loan period and high machinery component. The negative coefficient of the profit/loss variable indicates a lack of preference, particularly for small loans, where a loss had been incurred by the applicant.

The existence of a different preference structure between large and small loans suggested by these results confirms the desirability of disaggregating the decision function in the manner already done. The higher explained variance achieved by the disaggregated equations in comparison with (L4) suggests that disaggregation is a better method than non-linear specification of utility for modelling the different preference structure between large and small loans.

The structure of the equation is not particularly satisfactory, however, as apart from the omission of the "100 per cent area" variable, two of the included variables - female work force level ($\underline{x}_9$) and the percentage of the request for machinery ($\underline{x}_{22}$) - have coefficient signs opposite to those hypothesized. In the former case, the equation predicts a preference for towns with a large female work force relative to male work force, and for applicants from industries with a large male work force. While this could indicate a policy of industrialization in towns with dominantly service economies (and thus high female employment), an inspection of values for the sample observations suggested a better explanation. The six lowest values of $\underline{x}_9$ all belonged to the six cases in the clothing/textiles/shoes group, which indicates the effect of the adjustment for industry employment structure, clothing etc. having very low male employment. The same six cases also had an average $\underline{p}_s$

value of only about a half the overall mean $\underline{p}_s$ value, caused by larger than average loan values for projects in the clothing etc. industry group. The conjunction of low values for $\underline{x}_9$ and $\underline{p}_s$ for this group would therefore help to explain the positive relationship in (L4). There may also be some statistical distortion caused by the high collinearity ($\underline{r}$ = -0.89) between the two female employment variables ($\underline{x}_9$ and $\underline{x}_{10}$) included in the equation.

The other included variable with the "wrong" sign, the percentage of the request for machinery ($\underline{x}_{22}$) may reflect mis-estimation of the true relationship with $\underline{p}_s$ because of the need to include the squared form of ($\underline{x}_{22}$) to satisfy the linearity condition of regression analysis. The same thing could be said of other transformed variables used to estimate decision functions, and illustrates the potential difficulties in using statistical models to estimate the true structure of preferences.

The pattern of residuals of actual values of $\underline{p}_s$ from those predicted by the equation had a simple interpretation. Those cases in which $\underline{p}_s$ was under-predicted by one standard error or more all involved loans much smaller than average, whereas cases of over-prediction by the same amount mostly involved larger than normal loans. The inclusion of a value of request variable would probably have largely eliminated such residuals, but this was precluded by the way $\underline{p}_s$ is defined.

The analysis was repeated using $\underline{N}_r$ instead of $\underline{N}$ as the independent variable denoting employment change. The initial equation produced by the multiple stepwise regression analysis incorporating $\underline{N}_r$ resulted in the transformed versions of both female employment variables being included as statistically significant at the 5 per cent level or better. Since the two transformed variables were highly collinear ($\underline{r}$ = -0.89), that relating to female unemployment was then omitted (since it had the lower $\underline{F}$ value) and the remaining independent variables once more regressed in stepwise mode against $\underline{p}_s$. This resulted in the following equation:

$$\text{(L4a)}\quad \underline{p}_s = \underset{}{0.3727} + \underset{(0.1842)}{0.4595^{*}\underline{x}_6} + \underset{(0.1079)}{0.2209^{*}\log \underline{x}_9} + \underset{(0.1276)}{0.3920^{**}\,\underline{x}_{12}}$$

$$- 0.4740^{**}\,\underline{x}_{15}; \qquad \underline{r}^2 = 0.305$$

$$SE = 0.35$$

** Significant at the 1 per cent level

* Significant at the 5 per cent level

Given the exclusion of the female unemployment variable, the equation is similar to the first equation, (L4), except that $(\underline{x}_{22})^2$ is no longer included. The variance explained by the second equation is, however, only two-thirds of that yielded by the initial equation.

In sum, it appears that making utility a function of the square root of expenditure means that it is less easily explained by hypothesized preference variables. Thus it is less applicable than the linear version of utility to the pattern of decentralisation loan decisions.

Using utility as a logarithmic function. Repeating the original analysis (with $\underline{N}$ as the employment change variable) using the logaritmic version of utility, $\underline{p}_1$, produced the following equation: [18]

$$\text{(L5)} \quad \underline{p}_1 = 0.0212 + \underset{(0.0085)}{0.0250^{**}}\underline{x}_{12} - \underset{(0.0093)}{0.0199^{*}}\underline{x}_{15}; \quad \underline{r}^2 = 0.186, \quad SE = 0.024$$

** Significant at the 1 per cent level

* Significant at the 5 per cent level

where $\underline{x}_{12}$ denotes whether the loan repayment period is less than 8 years, and $\underline{x}_{15}$ indicates profit or loss. Both variables were also included in equations (L4) and (L4a), and again the signs of the coefficients are in the hypothesized direction. None of the other variables in (L4) or (L4a) are included this time, however, and consequently the level of variance explained by (L5) is much lower ($\underline{r}^2$ = 0.19). The pattern of residuals from the values predicted by the equation follows a similar trend to those of (L4) and L4a). Under - and over-prediction of more than one standard error were again associated with cases involving small and generally large loans, respectively. The analysis was also carried out using $\underline{N}_r$ instead of $\underline{N}$, but the equation produced was identical to (L5).

In general, the comments regarding the applicability of the square root version of utility to decentralisation loan decisions apply to an even greater extent in the case of the logarithmic version. The steady decrease in the applicability of utility definitions from linear to square root to logarithmic versions conforms with the findings of Hamblin, Clairmont and Chadwick (1975), who found that individuals' money utility was better predicted by power functions than logarithmic functions, with the median power exponent of 0.87 being much closer to the linear exponent of 1 than the square root exponent of 0.5.

A dynamic decision function. In Chapter 3 the potential influence of time on the decision function was noted, pointing to the desirability of testing whether the coefficients of the goal criteria are indeed a function of time.[19] Within the semi-normative framework of this chapter, one reason why the value of goal criteria coefficients might vary over time is that certain goals are less "open-ended" than others; that is, their objectives can be set as fixed targets to a greater extent, so that as the objective is more nearly attained over a period of time, the relative importance of the goal for future expenditure purposes diminishes. In the present case, the "100 per cent area" criterion could have tended to follow this pattern, with its relative importance diminishing over time as such areas caught up to the rest of the state.

The other major reason, as far as this chapter is concerned, why the criteria coefficients might be time-dependent is that the relative importance of the various goals could vary with the total amount of decentralisation finance available from year to year. Thus risk criteria (such as the profit/loss variable in function (L1)) could receive a higher weighting in years in which available finance was lower, because of the greater need for secure loan repayments. More generally, lower availability of finance might be expected to have made the Department more selective in approving requests, by giving greater regard than usual to its decision criteria. If so, this would have resulted in larger criteria coefficients and a smaller constant in the decision function.

In order to test the possible effects of time, the 52 sample observations were divided into three groups according to the year in which the Department's decision was given. Fifteen observations were in the 1965/66 group, 12 were in the 1966/67 group, and 25 were in the 1967/68 group. A multiple regression analysis was then carried out on each group, using the three explanatory variables in (L1) as independent variables and making p the dependent variable again. The level of significance specified for the inclusion of variables in the estimating equation was set low enough in each regression to allow all three independent variables to appear. The following equations were produced:

1965/66:

$$\underline{p} = 57.9189 + \underset{(11.3309)}{26.6487}\underline{x}_6 + \underset{(9.6295)}{42.0811}\underline{x}_7 - \underset{(9.8129)}{26.1351}\underline{x}_{15}; \quad \underline{r}^2 = 0.771, \quad \underline{SE} = 14.069$$

1966/67:

$$\underline{p} = 53.3846 + \underset{(18.3849)}{44.8846\underline{x}_6} + \underset{(13.8348)}{30.4231\underline{x}_7} - \underset{(16.5181)}{26.9615\underline{x}_{15}} \; ; \quad \underline{r}^2 = 0.552, \quad \underline{SE} = 23.009$$

1967/68:

$$\underline{p} = 58.5569 + \underset{(24.0120)}{65.7968\underline{x}_6} + \underset{(8.1708)}{35.5935\underline{x}_7} - \underset{(14.3121)}{26.3537\underline{x}_{15}} \; ; \quad \underline{r}^2 = 0.526, \quad \underline{SE} = 19.320$$

The second stage tested whether there was a significant change in the coefficients of each independent variable over the three years. Accordingly, a linear regression analysis was carried out for each of $\underline{x}_6$, $\underline{x}_7$ and $\underline{x}_{15}$, making time the independent variable, $\underline{t}$ (setting 1965/66 equal to 1, 1966/67 equal to 2, and 1967/68 equal to 3) and making the coefficients from the above equations (for $\underline{x}_6$, $\underline{x}_7$ or $\underline{x}_{15}$ as appropriate) the dependent variable, $\underline{k}$. The following equations resulted:

$\underline{x}_6$ (potential closure):

$$\underline{k} = 6.6286 + \underset{(0.7726)}{19.5740\underline{t}} \; ; \quad \underline{r}^2 = 0.998, \quad \underline{SE} = 1.093$$

$\underline{x}_7$ ("100 per cent area" location):

$$\underline{k} = 42.5202 - \underset{(4.8579)}{3.2438\underline{t}} \; ; \quad \underline{r}^2 = 0.308, \quad \underline{SE} = 6.870$$

$\underline{x}_{15}$ (profit/loss):

$$\underline{k} = -26.2648 - \underset{(0.4140)}{0.1093\underline{t}} \; ; \quad \underline{r}^2 = 0.065, \quad \underline{SE} = 0.586$$

The hypothesis that the coefficients of $\underline{t}$ in the above equations equal zero was tested using

Student's t which had values equal to 25.335, -0.668 and -0.264 for $\underline{x}_6$, $\underline{x}_7$ and $\underline{x}_{15}$, respectively. The probabilities of selecting a sample with $\underline{t}$ coefficients less than 3.2438 (in the case of $\underline{x}_7$) or 0.1093 (in the case of $\underline{x}_{15}$) are high, and certainly greater than 0.25. On the other hand, the probability of selecting a sample yielding a $\underline{t}$ coefficient of more than 19.5740 for $\underline{x}_6$ is between 0.01 and 0.025. Thus there is a reasonable certainty that the time coefficient for $\underline{x}_6$, the potential closure criterion, is different to zero. The use of only three years' observations, and a total of five cases of pending closure, should produce caution in inferring the existence of a decision function that is dynamic with respect to the closure variable. But additional confidence in the time coefficient estimate for $\underline{x}_6$ can be gained from the fact that the coefficient of $\underline{x}_6$ in each one of the 1965/66, 1966/67 and 1967/68 equations was significant at the 5 per cent level.

In order to confirm that the time coefficient for $\underline{x}_6$ is significantly different to those for $\underline{x}_7$ and $\underline{x}_{15}$, a covariance analysis was carried out. Following Johnston (1972, 192-207), a combined regression was run for each pairing of the three variables, using the three coefficients for each variable (i.e. a total of six for each combined regression) as the dependent variable, and the year number ($\underline{t}$) and a 1-0 dummy (distinguishing between the variables in the pair) as the independent variables. The significance of differences between the time coefficients of each pair of variables is given by an F value obtained by finding the total of the residual sums of squares of separate regressions for each variable in the pair and comparing it with the reduction in the residual sum of squares to this total from that of the combined regression. The F values thus obtained from the pairing of coefficients for $\underline{x}_6$ and $\underline{x}_7$, and $\underline{x}_6$ and $\underline{x}_{15}$, are 21.518 and 504.281, both significant at better than the 5 per cent level. The F value of 0.413 obtained by pairing coefficients for $\underline{x}_7$ and $\underline{x}_{15}$ is not significant at the 5 per cent level. The covariance analysis therefore confirms the distinctive trend of the coefficients of $\underline{x}_6$ over the three years.

Why should there have been an increase through time in the importance to the Department of prospective closure? An inspection of the cases involved suggests that the proportion of establishments about to close which had been previously assisted by the Department tended to increase over time. This might be expected because of the increasing number of country manufacturers receiving assistance as the decentralisation programme continued, while such firms would have had a better knowledge of the programme and been more likely to turn to the Department for further help in a crisis. At the same time the Department might have rated such requests more highly than similar requests from firms not assisted in the past to help ensure the repayment of loans already made, and to avoid any adverse reflection on its past decisions. In the light of this hypothesis, it is possible that the inclusion of two closure variables - the first applying to previously assisted applicants and the second applying to others - may have adequately accounted for differences in the weighting given to closure in different years.

The objective of the above analysis has been to produce a decision function that is dynamic, if appropriate. In the light of the findings concerning the effect of time on the importance of the potential closure criterion, the following dynamic version of the original decision function (L1) may be tentatively suggested:

(L6) $\underline{p} = 57.2885 + (6.6286 + 19.5740\underline{t})\underline{x}_6 + 35.0392\underline{x}_7 - 26.0313\underline{x}_{15}$

Despite the good results obtained with the disaggregated versions of (L1) function, it was not possible to produce dynamic equivalents because there were too few observations in each of the large and small loan groups to carry out the necessary year-by-year regressions.

A similar analysis was carried out to determine whether a dynamic version of decision function (L1a) existed. A multiple regression analysis of the variables in (L1a) carried out on the three yearly groups of sample observations produced the following equations:

1965/66:

$$\underline{p} = 52.5809 + 29.4896\,\underline{x}_6 + 45.4191\underline{x}_7 - 0.4228\underline{x}_{22}; \quad \underline{r}^2 = 0.657$$

$$(17.3500) \quad (10.2497) \quad (0.4656) \quad SE = 17.035$$

1966/67:

$$\underline{p} = 62.2644 + 24.3996\,\underline{x}_6 + 26.6721\,\underline{x}_7 - 0.6682\,\underline{x}_{22}; \quad \underline{r}^2 = 0.898$$

$$(9.1461) \quad (7.0652) \quad (0.1084) \quad SE = 11.209$$

1967/68:

$$\underline{p} = 59.0739 + 38.9261\,\underline{x}_6 + 35.4732\,\underline{x}_7 - 0.1268\,\underline{x}_{22}; \quad r^2 = 0.482$$

$$(20.9531) \quad (8.5648) \quad (0.1104) \quad SE = 20.197$$

The second stage, a regression analysis for each variable, making the coefficients from the above equations the dependent variable $\underline{k}$, and time the independent variable $\underline{t}$, resulted in the following equations:

$\underline{x}_6$ (potential closure):

$$\underline{k} = 21.5020 + 4.7182\,\underline{t}; \quad \underline{r}^2 = 0.410$$

$$(5.6628) \quad SE = 8.008$$

$\underline{x}_7$ ("100 per cent area" location):

$$\underline{k} = 45.8007 - 4.9729\underline{t}; \quad \underline{r}^2 = 0.281$$

$$(7.9525) \quad SE = 11.247$$

$\underline{x}_{22}$ (machinery as percentage of request value):

$$\underline{k} = -0.7020 + 0.1480\,\underline{t}; \quad \underline{r}^2 = 0.298$$

$$(0.2271) \quad SE = 0.321$$

Values of Student's t for the respective coefficients of $\underline{t}$ were 0.833, 0.625 and 0.652, none of which is significant at the 5 per cent level of probability using either a one tail or a two tail test. Thus the hypothesis that one or more of the three coefficients were significantly different to zero (i.e., that there was a significant change through time in the importance of $\underline{x}_6$, $\underline{x}_7$ or $\underline{x}_{22}$) was rejected.

Covariance analysis was used to confirm that the time coefficients for $\underline{x}_6$, $\underline{x}_7$ and $\underline{x}_{22}$ did not significantly differ from each other. The F values obtained by pairing the coefficients for $\underline{x}_6$ and $\underline{x}_7$ $\underline{x}_6$ and $\underline{x}_{22}$, and $\underline{x}_7$ and $\underline{x}_{22}$ were 0.985, 0.650 and 0.414 respectively.

None were significant at the 5 per cent level. Thus the hypothesis that the time coefficient for any one variable was significantly different from those of the other variables was rejected.

The possibility that time had an indirect influence on the coefficients of the decision function, via year-to-year variation in the decentralisation programme's available funds, was also tested. Total funds available fluctuated from \$3.003 million in 1965/66 to \$3.603 million in 1966/67 and \$2.782 million in 1967/68 (Department of Decentralisation and Development, 1972, 12). Only one of the three variables in the original decision function, namely the "100 per cent area" variable ($\underline{x}_7$), showed a year-to-year variation in coefficient values approximating to this variation in funds. A linear regression of the coefficient of $\underline{x}_7$ in each of the three years (dependent variable) on the funds available in each year (independent variable) was carried out to test the significance of the relationship. An F value of 0.768 was produced, which was not significant at the 5 per cent level. Hence the hypothesis that the weighting given to the "100 per cent area" criterion varied according to the availability of decentralisation funds was rejected.

The possibility that the year-to-year variations in available funds influenced the dependent variable, the proportion approved of each request, was considered but rejected. It was hypothesized that the proportion approved would fall in years when funds were tighter, but the actual relationship was the reverse. The percentage of sample cases receiving a lower proportion than would have been expected by applying the Department's usual rules (see Chapter 7) was 20 in both 1965/66 and 1967/68, but rose to 33 per cent in 1966/67, the year when most funds were available.

ESTIMATES OF THE DECISION FUNCTION: GRANTS

In this section the estimation of three versions of the decision function for grants is described. Each of the versions uses the basic linear additive form of the function. The first version employs the standard linear utility/expenditure relationship, while the other versions use square root and logarithmic models of utility. The more complex multiplicative and dynamic formulations of the decision function are not tested, unlike loans, because of the lack of success achieved using the basic function.

Standard decision function

The standard formulation of the decision function, with additive goal criteria and a measure of utility which is linear with respect to expenditure, was tested first. The goal criteria used were the 19 relating to grants indicated in Table 4.1. As in the case of loans, the linear measure of utility used was $\underline{p}$, defined here as the government grant value as a percentage of the request value.

Of the 18 potential variables (criteria), three were excluded from all analysis of grants. Two - $\underline{x}_6$ (potential closure) and $\underline{x}_{15}$ (profit/loss) - were omitted because there was only one sample observation with a non-zero value in each case. As in the case of loans, variable $\underline{x}_{14}$ (net current assets) was excluded because $\underline{x}_{13}$ (current assets : liabilities) was a suitable surrogate. In order to produce approximately normal distributions, as determined by Lambe's test, four of the non-binary variables required transformation. Variables $\underline{x}_{11}$ (value of request), $\underline{x}_{16}$ (long term liabilities as a percentage of shareholders' funds) and $\underline{x}_{20}$ (urban population) were logarithmically transformed, while $\underline{x}_{10}$ (relating to female unemployment), required a double logarithmic transformation.

A multiple regression analysis of $\underline{p}$ and the 15 remaining goal variables (transformed as necessary) did not produce any significant explanatory variables, so that no estimating equation was produced. Although this was disappointing, a lesser degree of explanation in comparison with loans could have been expected for three reasons. Firstly, decentralisation grants were more heterogeneous in nature than were loans. Some kinds of grants were virtually unique, and there was no dominant type, unlike loans. The inclusion of dummy variables for input/output freight subsidies ($\underline{x}_{25}$) and labour training subsidies ($\underline{x}_{26}$) is an attempt to allow for this heterogeneity, but the binary nature of the dummies means that any differences in preference structure between different types of grants may not be fully captured by the model. The second reason for expecting less explanation with grants is that the Department handled fewer applications for grants than for loans, so that there was less precedent in each case and thus less likelihood of a uniform pattern of decision-making. This is an essentially non-normative influence. The third reason (partly arising from the second) is that, compared with loans, there were fewer rules to indicate the degree to which requests for grants should be met.

An analysis using multiplicative variables was not considered warranted, as there was no a priori reason to expect any combination of the 15 variables to be significant predictors of $\underline{p}$ when none of the separate variables had been so. An added reason was that there was no logical basis for eliminating sufficient of all the possible combinations of variables to reduce the number of variables tested to substantially below the number of observations.

Decision functions with non-linear utility

As in the case of loans, an attempt was made to estimate the form of the decision function using the hypothesis that marginal utility decreases as expenditure increases. The two non-linear definitions of utility used in the loans analysis, namely, $\underline{p}_{\underline{s}}$ (square root version) and $\underline{p}_{\underline{l}}$ (logarithmic version), were again employed here. The initial analysis for grants, based on the standard additive decision function, was repeated twice (with the same transformations of variables $\underline{x}_{10}$, $\underline{x}_{11}$, $\underline{x}_{16}$ and $\underline{x}_{20}$), using $\underline{p}_{\underline{s}}$ and $\underline{p}_{\underline{l}}$ in turn as the dependent variable. As with loans, the value of the request was deleted from the set of independent variables. The regressions of both $\underline{p}_{\underline{s}}$ and $\underline{p}_{\underline{l}}$ on variables $\underline{x}_7$, $\underline{x}_8$, $\underline{x}_{13}$, log $\underline{x}_{16}$, $\underline{x}_{18}$, log $\underline{x}_{20}$, $\underline{x}_{23}$, $\underline{x}_{24}$, $\underline{x}_{25}$ and $\underline{x}_{26}$ produced heteroscedastic residual values.[20] These variables were therefore retained in the analyses subject to the requirement that they would need higher than usual F values to be retained in the regression estimate of the decision function.

Using utility as a square root function. With $\underline{p}_{\underline{s}}$ being used as the dependent variable, the following regression equation was generated:

$$\text{(G1)}\quad \underline{p}_{\underline{s}} = 8.133 - \underset{(1.585)}{7.553^{**}}\underline{x}_{18}\ ; \qquad \underline{r}^2 = 0.508, \quad SE = 2.57$$

** Significant at the 1 per cent level

where $\underline{x}_{18}$ denotes whether management was rated satisfactory or not. There was very high multicollinearity between $\underline{x}_9$ and log log $\underline{x}_{10}$ ($\underline{r}$ = - 0.93), and between $\underline{x}_8$ on the one hand and log $\underline{x}_{20}$ ($\underline{r}$ = 0.87) and $\underline{x}_{24}$ ($\underline{r}$ = 0.88) on the other. Since, however, the highest F value of any of these variables was only 1.54, which was well below the 5 per cent significance value (4.32), the multicollinearity was not believed to have affected the structure of the equation.

The variable in the equation, $\underline{x}_{18}$ - the Department's rating of the applicant's management, was one of those having heteroscedastic residuals. Because only three of the sample observations had non-zero values of $\underline{x}_{18}$, the significance of the heteroscedasticity could not be calculated, but it was not considered sufficient to have excluded $\underline{x}_{18}$ from the equation at the 5 per cent level of significance because of the very high F value generated for $\underline{x}_{18}$.[21] The negative sign of $\underline{x}_{18}$'s coefficient, however, is opposite to the hypothesized direction: it indicates that a favourable rating of management would have decreased the utility of the project for the government. An examination of the three cases of unsatisfactory management, however, indicated that one was also the only case where closure was likely, while in another there was some threat, if not the likelihood, of closure. To the extent that unsatisfactory management was a proxy for likely closure, therefore, the negative coefficient sign is in the correct direction. Unsatisfactory management, however, would not necessarily be an adequate proxy for likely closure in other sample cases, and as it stands the equation is therefore liable to give misleading predictions. The necessary exclusion of the closure variable, $\underline{x}_6$, from the analysis has thus led to a mis-specified equation. The decision function estimate given by (G1) was consequently rejected. Despite this result, the importance of the management variable for loans is considered to have justified, *ex ante*, the testing of its influence on grants, even though the low number of grants cases involving poor management means there may be (as here) statistical problems in identifying the extent of this influence.

Using utility as a logarithmic function. When $\underline{p}_1$ was used as the dependent variable, the following regression equation was produced:

$$\text{(G2)} \quad \underline{p}_1 = 1.876 - \underset{(0.403)}{1.839^{**}}\underline{x}_{18} \quad ; \quad \begin{array}{l} \underline{r}^2 = 0.486 \\ \overline{SE} = 0.653 \end{array}$$

** Significant at the 1 per cent level

where $\underline{x}_{18}$ denotes whether management was rated satisfactory or not. Thus the structure of the equation is essentially the same as the square root version, similar caveats regarding multicollinearity and heteroscedasticity apply, and the decision function estimated by the equation was rejected for the same reason as (G1).

An analysis of the effect of time on the decision function for grants, in the same manner as loans, was ruled out because only one of the sample of grants observations was for the year 1966/67.

DECISION FUNCTION ESTIMATES FOR LOANS AND GRANTS: CONCLUSION

The decision functions for loans and grants estimated above provide a number of significant insights into the decision process of the Department of Decentralisation and Development between 1965/66 and 1967/68. Firstly, distinct differences emerged between loan and grant decisions, and within loan decisions between large and small requests. This points to the dangers in attempting to apply a monolithic decision function to government expenditure decisions even within a single programme. In the case of grants, the lack of success of the decision function method of analysis may have been partly because there were too few requests to have allowed fully "programmed" decision-making to develop.

In detail, the results of the loan analyses suggested an uncomplicated decision structure, with only few criteria being considered in an additive, non-linear manner. These criteria reflected two goals publicly stated by the Department as basic factors affecting willingness to lend: viability, regional/state significance, although the existence of a third stated goal, employment generation, was not properly verified. But the most important of the loan criteria, which was embodied in the prime decision rule used to determine the proportion of each loan request approved by the Department, was whether the project was to be located in a "100 per cent area". Thus the principal influence on the pattern of the Department's lending was a spatial one, with equity considerations causing a bias in funding towards requests from areas with a poor economic structure. The other important influence on loan decisions, the likelihood of closure in the absence of assistance, did not feature, however, in the Department's public list of factors or rules. The political environment of the decision-making was presumably an influence here.

From the viewpoint of the theory of government location decisions, it is significant that loan decisions, far from being geographically random, embodied distinct spatial influences. In the first place, the influence of "100 per cent area" locations was paramount. More indirectly, the likelihood of factory closure was significantly associated (positively) with distance from the metropolitan area in the case of loans, indicating the existence of an underlying "centre-periphery" decision component. The spatial influences on loan approvals of depressed area location and centre-periphery variation might have been expected on the respective bases of similar regional welfare policies overseas (such as in the United Kingdom - see McCrone, 1969) and of models of regional development incorporating government intervention in the periphery (see particularly Hirschman, 1958). Somewhat more indirectly, the inclusion of the profit/loss variable as an often significant determinant of loan approvals suggests that the location pattern of decisions has, to an important extent, an additional underlying component reflecting perhaps the most important of the forces influencing the laissez-faire location of industrial growth. To this extent the location pattern of the Department's loan approvals reinforces the free market pattern.

One other point concerning the loan decision functions estimated in this chapter is the predominance of criteria measured in binary (one/zero) terms. Such a dichotomous grouping of data is equivalent to a satisficing classification, even though it was argued that the 1-0 categorizations used above were generally the best (non-satisficing) or near-best ones that could have been made by the Department. With such variables, however, it may be very difficult to tell whether satisficing behaviour may have been the reason for the binary (satisfactory/ unsatisfactory) classification. On the other hand the existence of an overall satisficing decision approach is refuted by the spectrum of responses by the Department to requests, with the assistance given in each case varying anywhere between zero and 100 per cent of request value.[22]

It remains to be said, however, that all such conclusions regarding the nature of the decision functions developed above cannot be held with confidence if the underlying stability of the functions is in doubt. An appropriate method of testing this stability, as well as assessing the usefulness of the functions as a diagnostic tool for other similar decisions made by the Department, is to employ the functions to predict decisions made in 1968/69, the year after the sample period, using the programming model described in Chapter 3. This is done in the following chapter.

Footnotes

1. Distributions were considered to be approximately normal if $|\frac{\eta}{\sigma} - 0.7979|$ was about twice or less the value of $\frac{0.4}{\sqrt{n}}$

2. Values of 1 and 2 were added to the original values of x_5 and x_{16}, respectively, to avoid having to take the logarithm of zero (and also to produce a more normal distribution in the case of x_{16}).

3. The urban population variable produced a number of sets of equal-sized residuals. The minimum size of the runs test statistic obtained from the various possible permutations of residual sign sequences in this case was significant at the 5 per cent level. Since all the other permutations were not significant at this level, however, it was concluded that it was unlikely that the regression produced a non-random sequence of residual signs which suggested non-linearity.

4. The equation produced was

$$\underset{}{p} = 41.9396 - \underset{(6.5682)}{14.8750^{*}x_4} - \underset{(4.6616)}{11.4511^{*}\log x_5} + \underset{(11.5179)}{50.9398^{**}x_6}$$

$$+ \underset{(5.2393)}{33.8842^{**}x_7} + \underset{(11.2718)}{32.4280^{**}x_{18}}; \quad r^2 = 0.628 \quad SE = 17.105$$

** Significant at the 1 per cent level
* Significant at the 5 per cent level

5. The importance of a particular variable in a regression equation is measured by the value of its standard partial regression coefficients, which are the ordinary (partial) regression coefficients multiplied by the ratio of the variable's standard deviation to the standard deviation of the independent variable (Yamane, 1964, 649). However, the standard error of each variable is related to the corresponding standard deviation by a factor which is constant within each equation (Yamane, 1964, 161), so that the ratio of the ordinary regression coefficient to the corresponding standard error is sufficient to denote the relative importance of each variable.

6. Yates' correction for continuity was used. Excluded were non-closure requests associated with enterprises also making requests involving potential closure since they were usually subsequent to the latter requests, and by which time the previous government assistance

had obviated the possibility of closure. In Group 6 two cases whose distance values were on the relevant quartile division were each assumed to comprise half a case in both distance groupings. In Group 7 the functionally distinct local market firms, upon which metropolitan distance would have had different effects, were excluded.

7. The existence of a variation in utility according to project value was also suggested subsequently by the generation of decision functions for the non-linear utility/expenditure formulations, which are described later in the chapter.

8. The variable's F value was 4.29, whereas a value of 4.30 was required for inclusion at the 5 per cent level of significance.

9. The possibility that large and small loans were associated with significantly different locations, thus implying a different spatial application of the two disaggregated decision functions, was tested using 2 x 2 chi square analysis (incorporating Yates' correction). The null hypothesis was that there was no difference between the number of large and small loans at distances either greater than, or less than, the distance to the appropriate metropolitan area. The χ^2 value produced was 0.312, which was not significant. The null hypothesis was therefore accepted.

10. This strategy was implicitly assumed in the analyses above (equations (L1), (L2) and (L3)), which used regression estimates to derive $\underline{x}_{1,3}$ values.

11. In its ideal form the certainty-equivalent strategy was seen to involve, in addition, population skewness. The latter is not essential to the use of the strategy, however - variance alone can provide a sufficient measure of uncertainty, depending on the attitudes of the decision-maker to risk. In view of this and the complexity which a full variance/skewness formulation would have involved, just the simpler variance-only formulation was considered.

12. In fact, for a given population $\hat{\sigma}^2$ and $\hat{\sigma}$ are linearly related to population variance and standard deviation, respectively (the relationships are given in Yamane, 1964, 161 and 384-385).

13. $\hat{\sigma}^2$ values for multiplier increases were not calculated, as such increases were not large and applied only to the "other" industry group, and thus would not have significantly changed the regression results for this variable.

14. The linearity of the distribution could not be analysed using a runs test because of the occurrence of seven sets of equally-valued observations, but a plot of residuals from the regression of $\underline{p}$ on loglog $\underline{x}_{27}$ (using values for the 52 sample observations) indicated no apparent non-linearity. The same plot revealed a slight degree of heteroscedasticity in the residuals, but $\underline{x}_{27}$ was retained in the analysis with the proviso that a higher than normal F value would consequently be required for inclusion in the regression equation.

15. The same comments regarding linearity and heteroscedasticity made in footnote 14 for $\underline{x}_{27}$ apply to $\underline{x}_{28}$.

16. A visual assessment of the degree of heteroscedasticity was necessary, since there were too few non-zero observations to allow Bartlett's test to be carried out. Spatial autocorrelation, corresponding to the spatial distribution of values of the "100 per cent area" variable, $\underline{x}_7$ (already included in the analysis), was evident when the residual values of variables other than $\underline{x}_7$ were mapped.

17. All values used were in terms of June, 1969 prices. Multiples of 100 were included in the numerators of $\underline{p}_s$ and $\underline{p}_1$ so that they corresponded more closely to the percentage formulation of $\underline{p}$ used earlier for defining utility in linear terms.

18. The transformed variable $(\underline{x}_{22})^2$ was again used.

19. A time discount version of the function of the type outlined in Chapter 3 was not used because none of the three criteria in the function tested here, (L1), involved payoff streams extending over a number of years into the future.

20. Because of the computation involved, Bartlett's test was not carried out to test the significance of the heteroscedasticity prior to using the variables in the regression analyses of the decision function. It was intended, however, that Bartlett's test would be used on any of these variables which were included in the regression equations.

21. The F value generated was 22.70, compared to the value of 14.38 required for significance at the 0.1 per cent level.

22. This is not to say, however, that elements of the bounded rationality model, within which satisficing behaviour is usually hypothesized, are not useful as analytical tools; Chapter 7 in fact utilizes bounded rationality concepts to establish a non-normative framework of analysis.

CHAPTER 6

AN APPLICATION OF THE MODEL TO THE DECENTRALISATION PROGRAMME UNDER SEMI-NORMATIVE CONDITIONS

The definition in the last chapter of the parameters of a decision function for loans made during 1965/66 - 1967/68 enables the objective function of the programming model of government regional development decisions, described in Chapter 3, to be specified. Then, by using 1968/69 data for the exogenous variables in the model, the value of individual 1968/69 loan decisions by the Department can be predicted, as this chapter describes. The predictions proved to be very satisfactory using both the aggregated and disaggregated decision functions, with close correspondence with the actual pattern of loan assistance in 1968/69 being achieved.

THE LINEAR PROGRAMME

The actual linear programming model used here is a simplified version of the full model presented in Chapter 3. Its structure is as follows:

$$\text{Max} \quad \sum_{\underline{i}=1}^{\underline{n}} \underline{w}_{\underline{i}}\, \underline{e}_{\underline{i}}$$

subject to

$$\underline{e}_{\underline{i}} \leq \underline{r}_{\underline{i}}$$

$$\underline{e}_{\underline{i}} \geq 0$$

$$\sum_{\underline{i}=1}^{\underline{n}} \underline{e}_{\underline{i}} \leq \underline{E}$$

where $\underline{i}$ denotes an individual request; $\underline{n}$ is the total number of requests; $\underline{w}_i$ is the utility weighting of each dollar of assistance in response to $\underline{i}$ from an enterprise in a given location; $\underline{e}_i$, the variable whose level is to be generated by the model, is the total dollar value of assistance to an enterprise in response to $\underline{i}$; $\underline{r}_i$ is the dollar value of the request concerned; and $\underline{E}$ is the total dollar value of funds available to the Department for assistance. As indicated by the objective function at the top, the model maximizes utility by maximizing the sum of individual outlays on assistance, each weighted according to the appropriate per dollar utility weighting. Constraints operate so that the value of assistance in each case is limited by the size of the request concerned and by the fact that sub-zero assistance is not feasible. A third constraint limits the total amount that can be outlaid on assistance to the total funds available to the Department for assistance.

The first point to note about this reduced version of the model is that it assumes that the Department has no influence in directing claimant establishments to socially preferable locations (although varying levels of $\underline{w}_i$ imply that a given establishment location can be weighted by the Department according to social utility). This assumption was valid for the sample of 19 loan requests made in 1968/69 which were used to test the programming model,[1] as in all cases the location had already been determined by the applicant before approaching the Department. Hence constraints specifying that only one location should be chosen from a set of possible locations were not necessary.

Next, it might be noted that the model does not contain any constraints indicating threshold conditions. The first type of threshold constraint, relating to minimum economic plant sizes, was not considered necessary in relation to the seven 1968/69 sample cases involving new operations (excluding spatially transferred operations).[2] None of the industries concerned (engineering, stockfeed production, wine making, printing and packaging, and frozen corn production) appeared technically to require medium or larger scale operation, as might be the case with textile production or metal refining, for example. A relatively superficial assessment such as this was required because the necessary data upon which to base estimates of minimum plant size were lacking in sufficiently disaggregated form (both from the spatial and the industry classification points of view). Census data for individual urban areas, for example, were only available for the eight broad industry groups used previously in deriving employment goal criteria. In this situation the Department had the choice of ignoring consideration of minimum plant sizes, or relying on its own judgements or those of the companies concerned - a situation in which semi-normative and non-normative behaviour were similar.

Similarly, there seemed to be no necessity to add constraints indicating threshold populations. As in the case of minimum plant size, suitably disaggregated data for estimating the threshold populations for each type of establishment in the sample were not available. Consequently, a factory-by-factory assessment is necessary. Of the 19 sample requests, two (involving a rubber printing firm and a clothing firm) involved locational transfers. The new sites were in the Sydney or Wollongong Statistical Division/District, and threshold population requirements were therefore assumed to have been met. As noted, there were seven cases involving new, non-transferred operations. Four of these (the printing and packaging works, the general engineering works and the two stockfeed mills) were primarily established to supply, directly or indirectly, local primary industries with their output. As such they had no threshold population requirements on the output side, while these types of manufacturers also appear to have virtually no threshold population requirements regarding inputs. Two of the other three new operations were primary processing operations (the winery and the frozen corn plant) for which virtually the sole location factor was the need to process the raw material concerned close to its point of supply. Again, no threshold population requirements seemed to exist. The remaining new establishment was at Taree, intended to produce auto electrical equipment primarily for the Sydney market. There was no information on file as to the necessity for local supply of components or industrial services for the product concerned. However, another request in the 1968/69 sample, for a loan to assist expansion, came from an electrical engineer in Gunnedah, which is significantly smaller than Taree. This suggests that Taree may have been of sufficient size to meet any threshold population requirements involved.

The other basic type of constraint which has been omitted from the full model set out in Chapter 3 is one which limits the incremental population growth which can occur at each location as a result of industrial assistance there by the Department. A heuristic approach was adopted here. After the different programme versions had each been run, the pattern of predicted assistance was mapped in order to determine whether the resulting implicit increase in employment at each location, when added to employment and population growth arising from other sources, was greater than an arbitrary maximum (perhaps 10 per cent a year). Growth above this level would have then required a constraint to be added to the model which limited the value of assistance accruing at the location in question to an appropriate level, and a consequent re-iteration of the model. The application of this approach is described in the next section.

Other potential constraints not specified in the model are also possible, since the model included only those considered to be of most general significance. For example, the Department was aware of a shortage of industrial land in one or two towns. This was not relevant to the 19 sample firms, however, as they had already chosen their sites before approaching the Department for assistance. Another constraint factor frequently considered by the Department in assessing applications was whether sufficient labour would be available to run projects at the intended production levels. To a large extent, though, labour constraints would have been reflected in two other potential constraints, threshold population and maximum population.

Of the variables in the model, $\underline{e}_{\underline{i}}$ is estimated by the model itself, while $\underline{w}_{\underline{i}}$, $\underline{r}_{\underline{i}}$, $\underline{E}$ and $\underline{n}$ require prior specification of values. $\underline{w}_{\underline{i}}$, the utility weighting of assistance, is equivalent to the utility indicator $\underline{p}$ used in estimating the loan decision function in the previous chapter. The value of $\underline{w}_{\underline{i}}$ can therefore be given by the predicted value of $\underline{p}$ for request $\underline{i}$, using (L1), (L2)/(L3), or (L6) as appropriate,[3] with the values of the independent variables in the relevant function being the values relating to request $\underline{i}$ itself. Thus if request $\underline{i}$ is for a loan in a "100 per cent area", the value of $\underline{x}_7$ for request $\underline{i}$ would equal 1, and this value would be substituted in the appropriate function, say (L1). Similarly, the values of $\underline{x}_6$ and $\underline{x}_{15}$ for request $\underline{i}$ would be substituted in (L1). The three values of $\underline{x}_6$, $\underline{x}_7$ and $\underline{x}_{15}$ would thus determine the value of $\underline{p}$ (and therefore $\underline{w}_{\underline{i}}$) for request $\underline{i}$. The next variable in the model, $\underline{r}_{\underline{i}}$, is empirically determined in each case using departmental file data. E is set equal to the total actual value of assistance which arose from the requests included in the particular iteration of the model. n is simply the number of such requests.

RESULTS OF THE MODEL FOR SAMPLE 1968/69 LOAN APPLICATIONS

The model was used to predict the pattern of loan approvals by the Department in response to applications from a sample of 19 cases in 1968/69. The 19 cases represented 27 per cent of the 70 non-housing loan approvals given to companies in 1968/69 by the Department. Three iterations of the model were carried out, using w_i values calculated from the aggregated standard function (L1), the disaggregated standard functions (L2) and (L3), and the dynamic function (L6).

Applying the aggregated standard function

The first iteration of the model used w_i values calculated from the aggregated standard function (L1). The loan values predicted turned out to be distorted to the extent that the second lowest w_i level was shared among 14 requests. The result was that those of the 14 requests appearing highest in the list were allocated loans by the model equal to the full value of each request, and so on down the list until total allocations (including those made to the other four requests with higher w_i levels) reached E, the total available for allocations. The remainder of the 14 requests down the list thus received no allocation. To overcome this problem and enable equal relative treatment to be given to the 14 requests, the total value of allocation made by the model to requests with the second lowest $\underline{w}_i$ levels was found and divided by the total value of the requests themselves. The resulting proportion was then multiplied by the value of each request concerned to yield an adjusted allocation.

This *ex post* adjustment, necessitated by the prediction of equal values for a number of allocations, is not necessarily an indication that the wrong framework has been used. It may be that the normative element of the model is the reason, and that a non-normative version of the model (as tested in the next chapter) would produce fewer equal values. A constraint in the model to reflect the local council loan contribution, as discussed later in the chapter, would also have resulted in more realistic results. More generally, the outcome is not inconsistent with the random utility model (Dalvi, 1978, 91), in which a preference function embodying major factors is used as the first decision-making stage, and specific factors varying from one decision situation to another are used to make the final decision. Later chapters examine the influence of such specific factors, among them the influence of the characteristics of the various departmental officers involved in each decision (Chapter 9). Finally, it may be observed that *ex post* shortcomings of a model do not necessarily vitiate the testing of the model if a cogent *a priori* case for using the model has been made (as is considered to have been done here in Chapter 3).

The spatial pattern of the loan allocations (incorporating the adjusted allocations as just described) generated by the model is shown in Figure 6.1, together with the corresponding pattern of allocations that were actually made by the Department. It can be seen that the overall correspondence between predicted and actual allocations is encouragingly close. The value of the coefficient of rank correlation between predicted and actual values is 0.90, which is significant at the 1 per cent level.[4] (Skewed values meant that a product moment correlation coefficient could not be calculated, but in any case this test would have only been ten per cent more efficient than the rank correlation test - see Hotelling and Pabst, 1936).

The biggest deviations between predicted and actual values, those greater than 50 per cent of actual values, comprise the four cases of over-prediction. All involved enterprises faced with closure, perhaps suggesting that closure was a less important criterion in 1968/69 than during 1965/66-1967/68. In each case, however, other factors explained the over-prediction.

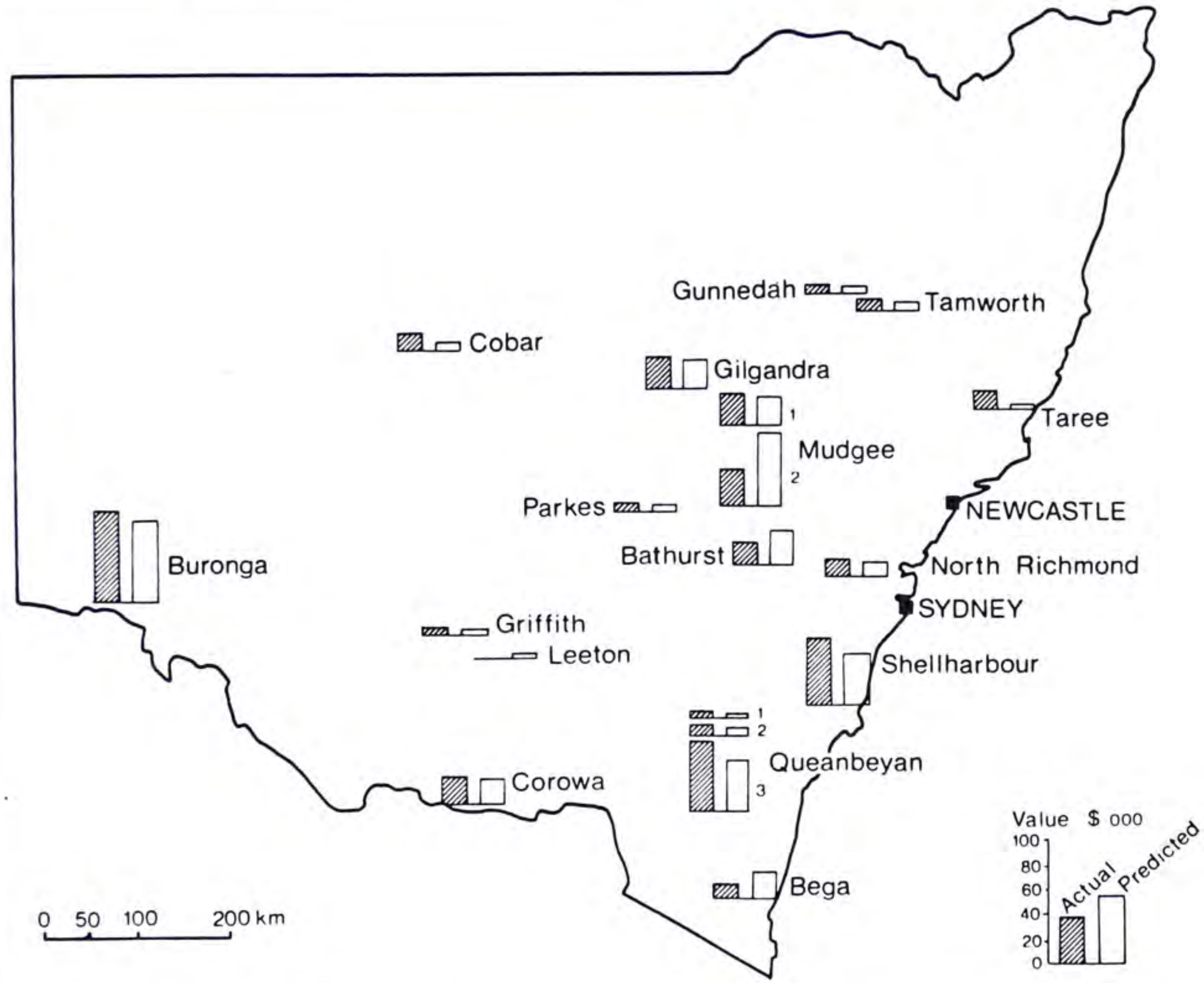

Figure 6.1 Predicted and Actual Values of Sample Loan Allocations in 1968/69: Aggregated Version

The Mudgee enterprise which was over-predicted carried out non-manufacturing as well as manufacturing activities, and the allocation was reduced to take account of this. The factory at Bega was only marginally qualified for assistance, since it was considered by the Department to have a natural advantage at its existing location because of processing of bulky local raw materials. The Bathurst enterprise was not allocated more than the standard 60 per cent of its request because it had sufficient remaining funds of its own, arising from fire insurance proceeds. The last of the four potential closure cases, that at Taree, was substantially over-predicted because of a number of reasons not embodied in its $\underline{w_i}$ weighting.[5] The proprietor had defaulted on payments to the Department when he had originally financed the factory with the help of government funds;[6] there were doubts about his ability to finance orders; and there were apparently cost disadvantages against which freight and telephone subsidies were being sought. The cost disadvantages could be interpreted as reflecting threshold population factors, though in this case they are more likely to have been a function of the distance of Taree from Sydney.

Of the remaining 15 requests in the sample, the zero assistance for the Leeton enterprise was exactly predicted while the other 14 were all under-predicted by the model, though none to the extent of 50 per cent or more of the actual value. The three cases which involved the greatest relative under-prediction, indicated in Figure 6.1 at Cobar, Parkes and Tamworth, were all loans for machinery. The direction of mis-prediction in the three cases is opposite to that hypothesized when the machinery variable, $\underline{x}_{22}$ was included as a goal criterion. It was suggested then that the greater risk of machinery loans might have resulted in lower utility and hence smaller loans but, in practice, the greater risk was reflected in the absence of a requirement for the usual local council contribution in areas outside the 100 per cent zone, and a correspondingly greater contribution by the Department.

The results of the model were analysed in order to see whether the spatial distribution of predicted loan allocations implied very high growth rates in one or more centres, which would require the addition of constraints to limit allocations at such centres. Three centres among those receiving loan allocations predicted by the model had implied totals of more than $100,000 worth of loan approvals in 1968/69 - Queanbeyan, Tamworth and Bathurst. The totals were derived by adding the total predicted by the model for requests in the sample to the actual value of other factory and machinery loans[7] given to non-sample enterprises in the respective centres that year. Since Queanbeyan was the most rapidly growing of the three centres around that time, it was the first choice for testing whether a maximum growth constraint was needed. The method of calculating the population increase resulting from implied 1968/69 loan assistance to Queanbeyan totalling $114,189 is given in Appendix 5. The resulting assumed population growth of 257 was 1.93 per cent of the estimated population of Queanbeyan at the end of 1967/68. Even if it is assumed that all this increase took place in 1968/69, in addition to normal growth of, say, 3.5 per cent a year (which was the actual rate of growth during 1967/68), the resulting rate of increase of 5.4 per cent is well within the 10 per cent rate above which serious problems in the provision of public services might have been felt.

Applying the same methodology in the case of Bathurst, the same conclusion was reached. But in the case of Tamworth the methodology[8] yielded a 1968/69 increase of about 11 per cent of the population at the beginning of the year. The estimate was, however, cruder than Queanbeyan's because the one sample request for Tamworth involved less than two per cent of the implied 1968/69 loan allocations for that centre. The extent to which the employment change values, per unit loan, required to derive Tamworth's increase were able to be estimated and not assumed was correspondingly small. Furthermore, the fact that 11 urban centres in New South Wales recorded population increases of more than 50 per cent between 1966 and 1971 (Department of Decentralisation and Development, 1972, 5) without any apparent direct growth restrictions having been placed on them by the government perhaps indicates that growth rates of well over 10 per cent per annum were tolerable. The concept of possible constraints on urban growth in the model had originally been conceived to prevent the generation of an allocation pattern in which most loans went to only one or two centres, producing unrealistic growth at those points. The pattern actually predicted for 1968/69 sample loan requests is obviously not of this kind. Other centres besides Queanbeyan, Tamworth and Bathurst to which the sample requests applied did not appear to have a sufficient combination of high loan allocation values and/or high current growth rates to lift potential population increases above 10 per cent of the total population at the end of 1967/68. As a result of the above conclusions, no constraints on loan allocations to individual urban centres, for the purpose of restricting their growth, were considered necessary.

Finally, it is significant that the values predicted by the model are equal to zero or to the values of the requests concerned (ignoring the post-model adjustment of predicted values for the 14 requests with the equal second lowest $\underline{w_i}$ values), whereas the Department's actual allocations were mostly in between these two extremes. In an environment of varying $\underline{w_i}$ values and a fixed overall budget, the former allocation procedure theoretically maximizes utility. A similar pattern of results was found with the ensuing two iterations of the model. Some hypotheses relating to the nature of this contrast between the actual and predicted patterns are discussed in the final section.

The model was also interated using the alternative aggregrated function (Lla). The allocations generated by this iteration are shown in Table 6.1, as are actual 1968/69 allocations and the deviations of predicted values from actual values.

Table 6.1

Predicted and Actual Values of Sample Loan Allocations in 1968/69, using Revised Decision Functions

Location (see Figure 6.1)	Actual allocation (dollars)	Aggregated model		Disaggregated model	
		Predicted allocation (dollars)	Deviation from actual allocation (dollars)	Predicted allocation (dollars)	Deviation from actual allocation (dollars)
Gunnedah	7,000	5,405	- 1,595	0	- 7,000
Tamworth	10,000	0	-10,000	0	-10,000
Taree	917	13,750	12,833	13,750	12,833
Cobar	13,950	0	-13,950	0	-13,950
Gilgandra	25,000	23,782	- 1,218	29,465	4,465
Mudgee 1	25,000	23,925	- 1,075	29,642	4,642
Mudgee 2	30,000	60,000	30,000	35,358	5,358
Parkes	7,500	0	- 7,500	0	- 7,500
Bathurst	16,800	28,000	11,200	16,500	- 300
North Richmond	13,400	12,747	- 653	15,793	2,393
Shellharbour	57,000	45,186	-11,814	55,983	- 1,017
Queanbeyan 1	5,100	4,043	- 1,057	0	- 5,100
Queanbeyan 2	9,600	7,610	- 1,990	0	- 9,600
Queanbeyan 3	57,000	45,186	-11,814	55,983	- 1,017
Bega	10,000	20,000	10,000	20,000	10,000
Corowa	22,500	21,404	- 1,096	26,518	4,018
Leeton	0	3,805	3,805	0	0
Griffith	1,800	1,427	- 373	0	- 1,800
Buronga	76,000	72,297	- 3,703	89,573	13,573

As in the initial iteration, there is a reasonable correspondence between predicted and actual values. The rank correlation coefficient between the two sets of values is 0.80, which is significant at the 1 per cent level of probability. Deviations between actual and predicted amounts are generally similar to those produced by the initial iteration; cases involving prospective closure and three of the four machinery requests are again respectively over - and under-predicted. This time, however, the complete refusal of the Leeton request is not correctly predicted. Because of the similarity of the results of the two iterations, it was again considered unnecessary to constrain the predicted loan allocations to Queanbeyan, Bathurst and Tamworth for the purpose of avoiding excessive urban growth there.

Applying the disaggregated standard function

The next iteration of the model employed $\underline{w_i}$ values calculated from the disaggregated standard function for either large loans (L2) or small loans (L3), according to which category the loan request belonged.[9] Six of the sample of 19 loan applications had to be omitted from the analysis because they were small requests which lacked the financial information required for estimating employment change per unit loan (one of the variables in the small loans function). As in the first iteration there was distortion of predicted loan values. The nine large requests all had the same $\underline{w_i}$ value because none involved machinery or location in a 100 per cent area, the two criteria included in the large loans function. Those large requests highest on the list were allocated loans by the model equal to the full value of the request, and the procedure was repeated for successive large requests down the list until the total allocation of funds was exhausted. Once again the solution adopted was to divide the total value of the model's large request allocations between the nine requests on a *pro rata* basis.

The spatial distribution of the loan allocations predicted by the model (and incorporating the adjusted predictions), together with the corresponding distribution of actual allocations, is shown in Figure 6.2 (the latter should be modified to show the Mudgee 1 prediction as $25,452, with the predicted allocations for all other towns except Gunnedah, Tamworth and Bega being reduced in total by the same amount, the reductions being pro rata ones of one eleventh in each case). Again, the actual and predicted patterns are very similar. The coefficient of rank correlation between the two distributions is 0.98, which is significant at better than the 1 per cent level.

Two predictions - those for Bega and Gunnedah - vary by 50 per cent or more from the actual values. The explanation of the Bega discrepancy is similar to that in the first iteration of the model. The Gunnedah case involved a small loan request in which the estimated employment increase per $1,000 requested was sufficient to raise its $\underline{w_i}$ level above that of the large loan requests.

An analysis to determine whether to include constraints to restrict growth at certain locations was not carried out because of the general similarity of the predicted values with those from the first iteration of the model, where such constraints were not shown to be necessary.

An alternative set of predictions was obtained using small loan function (L3a) rather than (L3), together with the original large loan function (L2) (since the revised and original versions of the latter were the same). These predicted values, together with differences between predicted and actual allocations, are shown in Table 6.1. A coefficient of rank correlation between predicted and actual values could not be calculated because of the number of predicted zero values. These are all cases involving small loan requests. All had the same $\underline{w}_{\underline{i}}$ value because all had zero values for the variables included in function (L3a). Hence the model's loan allocations in respect to these and the nine large requests hinged on the value of the constants in (L2) and (L3a). Since the constant in (L2) is greater, the larger request cases exhausted the funds left after the Taree and Bega cases (involving prospective closures) had received full allocations. Thus the predictions of this iteration of the model are less satisfactory than those of the previous iterations. Since the values predicted for Queanbeyan, Tamworth and Bathurst are similar to, or less than, those predicted by the aggregated versions of the model, no constraints to limit growth in these centres were considered to be required.

<u>Applying the dynamic function</u>

The last iteration of the model used $\underline{w}_i$ values calculated from the dynamic version of the standard aggregated function, (L6). The values predicted were

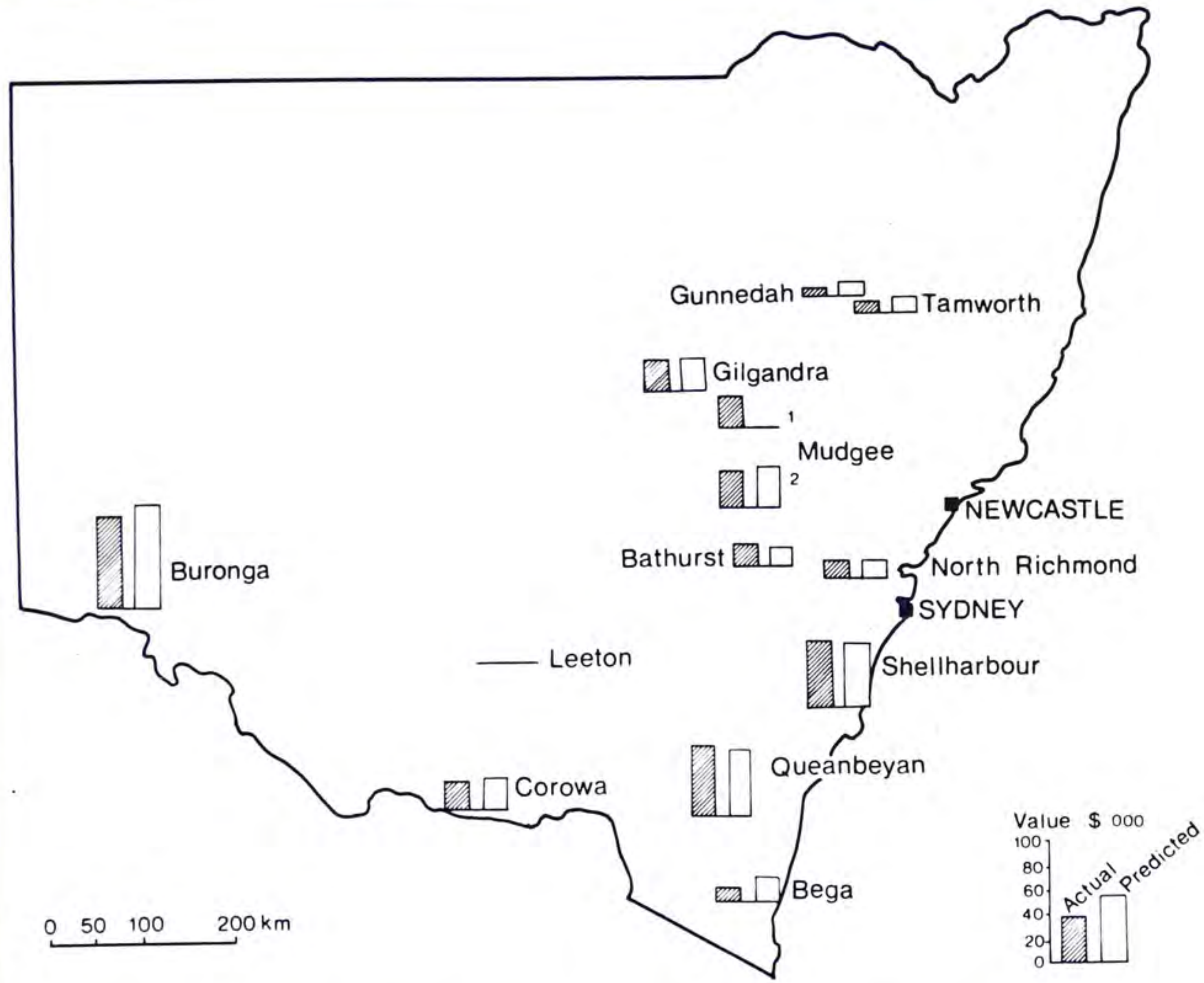

Figure 6.2 Predicted and Actual Values of Sample Loan Allocations in 1968/69: Disaggregated Version

identical with those predicted by the first iteration. This is because the effect of substituting the dynamic version is merely to increase the weighting given to the four cases involving potential closure. These cases already had a sufficiently high weight to be allocated the full request when the model was iterated using the (non-dynamic) standard function. However, the increased emphasis on the closure criterion in the dynamic version is unrealistic in terms of predicting the actual pattern of loan allocations in 1968/69. Loans in the four sample cases involving the likelihood of closure were all significantly over-predicted by the standard function model, and the use of the dynamic function increases this tendency (although the constraint limiting loans to the amount requested prevents any actual increase in the predicted levels for the four cases when the dynamic function is used).

HYPOTHESES ARISING FROM THE RESULTS

It is apparent that the semi-normative model has explained a good deal of the variation in the pattern of decentralisation loan assistance. This encourages some confidence as to the usefulness of decision functions, in association with basic financial constraints, as a tool for explaining government location decisions relating to industrial assistance. In one basic respect, however, the model is deficient. The optimum strategy indicated by the model is that requests should be ranked in decreasing order of utility per dollar and that, starting at the top, successive requests should each be met in full until funds are exhausted, after which no request would receive any funds. In reality, such an "all or nothing" strategy was not followed by the Department: the majority of loans were less than the requested amount. Several hypotheses can be advanced for this discrepancy.

The first possibility is that the government's utility per dollar of assistance is not uniform over the whole range of percentages of each request which are granted. This would imply that the objective function of the model is not linear. In particular, the model ignores the standard 30 per cent loan contribution of the local council outside the "100 per cent" areas. Moreover, the standard 10 per cent contribution of the applicant outside such areas is usually fairly nominal, and unlikely to adversely affect the prospects of viability. These two factors mean that, outside the maximum assistance areas, the government might have been able to gain virtually the same benefits (utility) from a 60 per cent loan as a 100 per cent loan. The funds saved in the former case could then have been directed to other enterprises, and thus increased the total utility obtained from a given expenditure of funds.

One suggested interpretation of the actual strategy arising out of this is that the percentage of each request which was granted was in proportion to the expected utility per dollar, so that two 50 per cent loans could in total yield the same utility as one 100 per cent loan, assuming requests of the same value. Such a strategy is made possible by the contributions of councils and companies in the former cases, a possibility not taken into account in the model. The predictive power of the model could thus, in retrospect, have been improved by the inclusion of a constraint limiting government expenditure to 60 per cent of each request, except for locations in maximum assistance areas or in those cases involving prospective closure.

The second consideration is that the model assumes that requests to be made during 1968/69 were known to the Department at the start of the year. From this aspect the model is normative, rather than semi-normative. With a foreknowledge of requests to be made during 1968/69, a ranking in order of utility per dollar, as implied by the model, would have been possible before any expenditure had been made. In reality, however, the Department was uncertain about the nature of future requests, and required an alternative strategy.

Another possible reason why the actual pattern of loan expenditure was more evenly spread (spatially and otherwise) than the model predicts is that such a pattern has a higher political utility which the calculated decision function does not reflect. This would concur with Manne's (1967) findings that Indian regional politics led to demands for "fair shares" and the construction of smaller and more numerous industrial plants than optimal. The external political decision environment of the Department is thus potentially important, a theme which is taken up in later chapters.

Finally, the differences between actual and predicted loan values may also be the result of two other sets of factors examined in subsequent chapters: the decision-making traits of the different groups of officers involved in the various decisions, and the operation of non-normative strategies for maximizing social utility. The former possibility is examined in Chapter 9, while the latter is the subject of the next chapter.

Footnotes

1. The 1968/69 sample of firms comprised all firms who responded to the June, 1969 questionnaire survey previously mentioned, and for which relevant background information was available.

2. Threshold conditions were assumed irrelevant in the case of expanded, as against new, activity at a particular location.

3. Decision functions (L4) and (L5), which incorporated non-linear versions of utility, were regarded as less satisfactory than the other four functions, and were therefore not used.

4. A product moment correlation coefficient was not computed because of skewness in the data.

5. This case involved a one-year lease rather than a loan. The value was calculated by assuming that the value of the usual 15-year factory lease outside "100 per cent areas" was equal to the value of the factory, and that the value of a one-year lease was therefore one-fifteenth of factory value.

6. No profit/loss data were available for this company, but in order to predict the value of $\underline{p}$ it was assumed that because of the payments default the value of $\underline{x}_{15}$ (the profit/loss variable) in this case was 1, indicating a loss.

7. Housing loans and grants were not added because no statistical correlation had been found, in Chapter 4, between the value of these forms of assistance and the corresponding employment change. The value of this assistance was, in any case, almost always much less than the value of factory and machinery loans in the centres where the sample enterprises were located.

8. In contrast to Queanbeyan, nearly all of the total value of loan allocations was apparently for activities serving non-local markets. It was therefore assumed that each job resulting directly from the loans generated one further local job (this assumption is discussed in Appendix 5).

9. Loan requests with a value (in June, 1969 terms) equal to, or greater than, $26,250 were classified as large, while requests with values below this level were classified as small, the same criterion as in the analysis in which the disaggregated standard function was estimated.

CHAPTER 7

NON-NORMATIVE ANALYSIS OF THE DECENTRALISATION PROGRAMME: PROGRAMMED DECISIONS

The previous chapters have investigated the extent to which an essentially normative framework fits the actual pattern of location decisions made within the decentralisation programme between 1965 and 1969. While the degree of explanation thus obtained was encouraging, sufficient of the pattern remained unexplained to warrant an alternative, non-normative framework.

The non-normative approach which has proven most successful in locational analysis is Simon's bounded rationality concept (Simon, 1957b). This approach therefore forms the basis here for a non-normative analysis of the same (or virtually the same) decisions investigated previously. At this point it is useful to reiterate the distinction between "programmed" and "non-programmed" decisions. Decisions may be termed "programmed" to the extent that they are repetitive, with a definite procedure evolved for handling them. Unprogrammed decisions, on the other hand, are novel and unstructured, with no routine procedure for handling them (Simon, 1965, 14). Virtually by definition, the kinds of decisions that can be incorporated within the programming model developed in Chapter 3 are programmed decisions. The last chapter used a semi-normative modification of the model to analyse such decisions. This chapter will use non-normative versions of the model (using elements derived from the bounded rationality model of organizational behaviour), as well as less structured behavioural approaches, to analyse programmed decentralisation decisions.

The focus in the chapter moves successively from decision functions representing non-normative equivalents of those in the last two chapters, to non-normative decision functions modified to take account of the existence of allocation rules within the Department, then to the subjective criteria required for the application of those rules, and finally behavioural factors hypothesized to cause decision outcomes to deviate from the standard rules. Thus the analysis progresses steadily towards less structured decision frameworks, involving successive relaxations of the decision function approach to incorporate important features of the actual programmed decision environment of the Department of Decentralisation.

Of the two decision function approaches, that involving rule deviations gave slightly better results in the case of loans, explaining about the same degree of variance in loan allocations as the corresponding semi-normative function. The main structural difference between the latter and the rule deviation function was the inclusion in the deviation function of a machinery request variable disaggregated by year of application, reflecting the fact that the policy towards machinery loans was evolving. A disaggregation of the function according to large and small requests did not, unlike the semi-normative case, result in significantly improved explanation. Neither did any of the more complex versions of the function - multiplicative, dynamic, or non-linear in utility/payoff - yield any improvement. Once more no explanation was achieved in the case of grants using any of the functional versions.

The main finding in regard to the criteria used in allocating loans according to the standard rules is that, except for a handful of key indicators, there was considerable variation from case to case; moreover, the number of criteria used in each case was small. Where criteria conflicted, the application of the appropriate allocation rule required a trade off between such criteria. Deviations from rules were found to reflect the external decision environment, in terms of the knowledge and importance of the applicant, and the greater discrimination possible where there was more than one concurrent request. Finally, loan patterns with more "noise" (larger deviations from rules) were identified with greater decision uncertainty, in particular.

A DECISION FUNCTION APPROACH

This section deals with the first of the non-normative lines of attack used in this chapter: the development of decentralisation decision functions based on loans made during 1965/66 - 1967/68 and their incorporation into the programming model as a means of predicting 1968/69 decisions. The method of analysis follows closely that used in the previous chapter, where semi-normative assumptions were used instead. The welfare function approach was used here before alternative non-normative constructs because of the traditionally important place it occupies in theories of government decision-making, and because the semi-normative version developed in the preceding chapters proved relatively encouraging as an explanatory and predictive tool.

Selection of non-normative loan criteria

Because Simon's model of bounded rationality is the framework of the present non-normative analysis, consideration of the main features of the model is useful for outlining the principal factors guiding the selection of goal criteria to be used in the estimation of decision functions. Simon's basic proposition is that humans have a limited ability to formulate and solve problems and process information to the extent required for objectively rational behaviour. Thus a simplified model of the real situation is constructed in order to deal with it, and behaviour is rational with respect to this model (Simon, 1957b, 198). The model is likely to involve a search of the subjective environment for alternatives whose outcomes are assessed, according to the decision maker's aspiration level, simply as satisfactory or unsatisfactory (Pred, 1967, 28).

These features suggest, firstly, that the number of decision criteria in a boundedly rational situation will be small. Secondly, they point to the likelihood that those criteria which are used will be satisficing or, in model-building terms, binary-valued. Concomitantly, these criteria are likely to incorporate the most easily available information, while there will also be a tendency to substitute subjective criteria for objective criteria. These themes resulted in two overriding considerations in choosing goal criteria: that the total number of criteria be fairly small, and that they be defined in binary (satisfactory/unsatisfactory) terms.

The actual choice of criteria for both the loans and grants functions was a two stage process. The first stage in each case was to select variables which were surrogates for the decision rules used by the Department to vary the proportion granted between various types of request. The establishment of rules is very much a boundedly rational approach to the complexity of the real world, so this provided a logical basis for the initial selection of criteria. The second stage was to separate out those decisions in which the proportion of request which was granted deviated from the rule for that type of request. File data on these decisions were then studied in order to isolate the key criteria which seemed to account for the deviation. These variables were then added, excluding criteria mentioned in only one decision, to the decision rule criteria to form the explanatory variables used in the regression estimation of decision functions.

For loans, the decision rule criteria selected were as follows:

(1) whether the project was to be located in a 100 per cent loan area, with a value 100 given if yes and 0 otherwise, less the percentage of the request to be used for the purchase of machinery (the 100 per cent area rule did not apply to machinery loans) (designated $\underline{x}_1$);

(2) whether the loan was for wholesaling activity (value 1 if yes, 0 otherwise) (to reflect the rule granting only 50 per cent of the value of such requests, compared to the usual 60 or 100 per cent for other activities)[1] ($\underline{x}_2$); and

(3) whether the factory to be built was to be leased to the applicant (value 1 if yes, 0 if no) (the rule here was that the Department contributed 70

per cent of the total cost instead of the usual 60 per cent if it was outside a 100 per cent area) ($\underline{x}_3$). The standard decision rule to grant 60 per cent of the value of loan requests, unless other rules applied, was not included as a separate variable, since it would be expected to be reflected in the value of the constant in the final regression equation.

Inspection of deviant cases produced the following extra hypothesized decision criteria:

(4) whether the loan requested was perceived to be a small one ($\underline{x}_4$);

(5) whether the loan requested was perceived to have been requested for a short period ($\underline{x}_5$);

(6) whether management of the applicant company was perceived to be unsatisfactory ($\underline{x}_6$);

(7) whether it was considered that the factory concerned would have closed in the absence of a loan from the Department ($\underline{x}_7$);

(8) the percentage of the request to be used for machinery purchase, if applied for in 1965/66 ($\underline{x}_8$);

(9) the percentage of the request for the purchase of machinery, if applied for in 1966/67 or 1967/68 ($\underline{x}_9$); and

(10) estimated employment change per \$1,000 lent (first run) / requested (second run). Criteria $\underline{x}_4$ to $\underline{x}_7$ were given a value of 1 if the answer

in each case was yes, and 0 if not.

In accordance with the bounded rationality model, the criteria have all been framed in binary (satisficing) and/or subjective (where relevant) terms, with the exception of criteria involving machinery. It was necessary to define the latter in percentage terms, since the inclusion of machinery in a request meant in practice that a separate loan was considered: a simple yes/no criterion would have made no allowance for the relative value of machinery loans within the total assistance requested. The basic rationale for this separate treatment of machinery requests is that in many such cases no decision rules seemed to apply (unlike factory loans) or, when one was applied, it was different to the other rules mentioned (being 75 per cent of a full machinery request). This was the case in areas of maximum assistance as well as other locations; hence the subtraction in $\underline{x}_1$ of the machinery component of requests. Such a subtraction had not been made in the semi-normative analysis because there was no obvious reason, in terms of decentralisation goals, for doing this. The difference in the treatment of machinery seems, rather, to have been a boundedly rational response to two factors: firstly, the possibility that total funds might not be sufficient to meet all worthwhile loan applications, and, secondly, a desire (stemming in large part from the riskier nature of machinery loans) not to ask local councils to contribute their loan share. Separate criteria have been used to distinguish between 1965/66 machinery requests and those occurring later, since an inspection of file data indicated a greater refusal rate applied to earlier requests because of the initial doubts about the sufficiency of funds.

The criteria of unsatisfactory management and employment change were not actually included as a result of analysis of deviant cases, but because of the explanatory significance their more objective surrogates (profit/loss, and econometric estimate of employment change) had shown in the previous chapters. It was considered that they may also be shown to have had an implicit importance within the non-normative decision framework used here. The estimates of employment change used here were those of the respective applicants, since these were the cheapest and most convenient estimates available to the Department and therefore, from a bounded rationality point of view, the appropriate ones to include here.[2] As in the semi-normative analysis, estimates of employment change in clothing/shoe manufacturing and in precision engineering were divided by 4.0 or multiplied by 2.08, respectively, to reflect the Department's different expectations in those industries.

Estimation of the standard loan decisi(ı function

The sample of observations on which the regression estimation of the decision function for loans was based consisted of loan applications made in the 1965/66 - 1967/68 period by companies which responded to the Department's 1969 questionnaire survey referred to in Chapter 4. From this total were subtracted applications in which the Department's initial response to the request had been altered as a result of bargaining.[3] Such applications thus involved essentially unprogrammed decision-making, and are therefore analysed in the following chapter. This left a total of 55 sample cases. Of these, the applicants' estimates of employment change could not be deduced from file data in eight cases. Hence these were excluded, leaving a final sample of 47 observations.

The structure of the standard version (that is, linear and additive) of the decision function was estimated first. As before, multiple linear regression analysis was used, the dependent variable being the percentage of each request which was actually granted, or $\underline{p}$. The two machinery variables had markedly skewed sample distributions, but were retained in their original forms since these are closer than their statistically transformed equivalents to both the bounded rationality model and what is known of the actual decision processes of the Department. Nevertheless, this example highlights the potential problem, when modelling decision processes, that there may be a conflict between the statistical requirements of even the most appropriate model available on the one hand and the accurate representation of the real decision structure on the other.

The multiple regression of $\underline{p}$ on the ten independent variables, using a five per cent level of significance for the inclusion and retention of variables (as in the other regression analyses in this chapter) yielded an equation in which two of the included variables, those relating to potential closure ($\underline{x}_7$) and to machinery requests ($\underline{x}_8$), displayed heteroscedasticity, though this was much more marked in the latter.[4] The 1965/66 machinery variable was consequently omitted because the heteroscedasticity seems likely to have wrongly caused the F value to have become just significant at the five per cent level; skewness made the variable additionally unsatisfactory. The new equation produced, using the remaining variables, was:

$$\text{(N1)}\quad \underline{p} = \underset{}{58.0213} + \underset{(0.0783)}{0.3631^{**}}\underline{x}_1 - \underset{(14.5365)}{32.9080^{*}}\underline{x}_6 + \underset{(14.3910)}{52.4098^{**}}\underline{x}_7 \quad ; \quad \underline{r}^2 = 0.400,\ SE = 18.572$$

** Significant at the 1 per cent level
* Significant at the 5 per cent level

The first point about the equation is the lower level of total explained variance ($\underline{r}^2 = 0.40$) in comparison with that in the estimated standard decision function using semi-normative analysis. This provides one justification for the use of the alternative decision rule approach in the estimation of non-normative functions, described in the next section.

The three variables included in the equation - the 100 per cent area ($\underline{x}_1$), management ($\underline{x}_6$) and closure ($\underline{x}_7$) criteria - are virtually the same as those in the standard semi-normative function, with the management criterion replacing its more objective equivalent, the profit/loss variable. This is not altogether surprising, since it was noted that the three variables included in the semi-normative function could also be interpreted in satisficing terms. The signs of the coefficients of each variable included in (N1) are all in the directions hypothesized, with location in a 100 per cent area or the threat of closure acting to increase the proportion granted of each request, and an unsatisfactory management rating acting to reduce it. The 100 per cent area coefficient of 0.3631 is close to the expected value, considering that of the maximum theoretical value of 0.40 (that is, 40 per cent above the standard loan proportion of 60 per cent), about 12 per cent, or 0.05, should be subtracted to allow for the average machinery proportion in the sample of requests relating to maximum assistance areas. Concomitantly the value of the constant, 58.0213, as expected closely reflects the 60 per cent proportion of request value given in standard cases. From a spatial point of view the twin equity themes of stagnant <u>versus</u> non-stagnant regions (as expressed in the 100 per cent area variable) and central versus peripheral regions (implicit in the closure variable)[5] are again very evident. These are apparently much more significant than the efficiency/viability theme involving support for the pre-existing capitalist location pattern, as expressed in the management variable. On the other hand, the fact that 60 per cent was the normal proportion given, with deviations due to depressed area location, prospective closure and poor management, suggests that the free market pattern within country areas was the norm on which the loan decision structure was based.

An inspection of residuals of predicted values of p from actual values (Figure 7.1) does not suggest that any potentially significant goal criteria have been omitted from the set of independent variables. To a large extent the residuals appear to be the result of decision criteria already included as independent variables but which were not used often enough to be significant for inclusion in the estimating equation. This points to a potentially fundamental behavioural problem in using regression analysis to model decision behaviour. This is that the criteria used by a decision maker may vary between one situation and another; that is, the complete range of criteria may not necessarily be used in every decision (Brown, 1971, 100; Golledge, Brown and Williamson, 1972, 71). An occasionally used

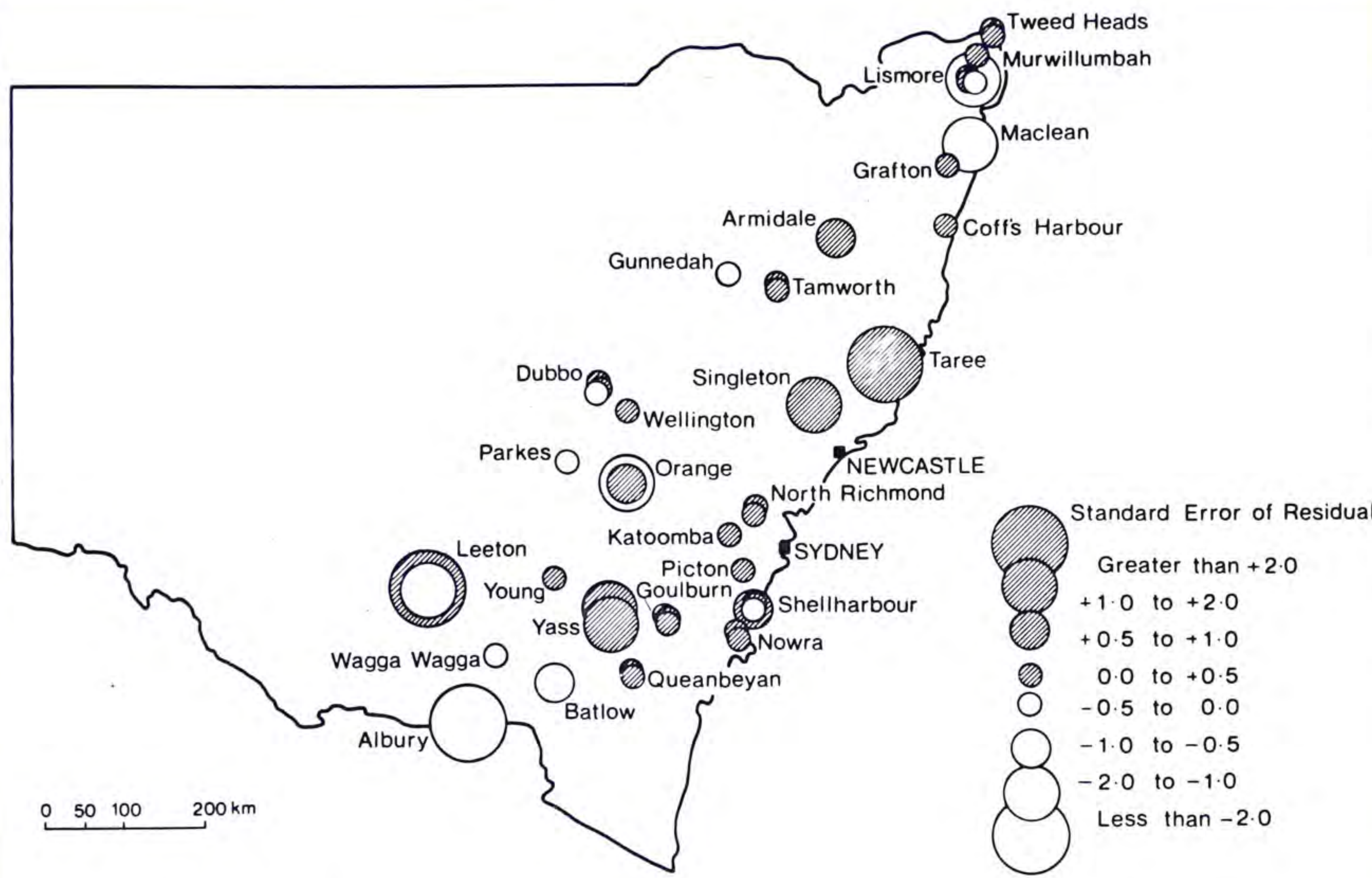

Figure 7.1 Residuals from Preferred Non-Normative Estimates of Percentage of Loan Request Rule Granted

criterion may not appear to be statistically significant using regression analysis, because of the necessity to record zero values in situations in which it is not even considered as well as when it is consciously considered to be not important. In the present case, the criteria of whether a loan was perceived to be small or for a short period appear in particular to be of this kind. (In the third section of this chapter, a possible behavioural rationale for this is given.) In fact, however, only one residual greater than one standard deviation, that for Singleton, appears to have been underestimated because of the omission of either of these two criteria.

The most consistant factor behind the high residuals shown in Figure 7.1 is the importance of machinery in the loan request, despite the regression result that the two machinery variables were not significant explanatory variables. The greater the importance of machinery in the request, the lower the percentage of the loan likely to have been granted (mainly because of the lesser security which machinery represented). This largely explains the high negative residuals for Lismore, Maclean, Orange and Leeton. The high negative residuals for Queanbeyan and Albury also occurred in the semi-normative version of the welfare function, and the same reasons probably again apply. Conversely, an abnormally critical closure situation appears to have been the reason for the two large positive residuals at Yass. The very large positive residuals for Taree and Leeton are puzzling at first sight, but there was a common factor in that departmental information regarding both applications was probably better than average (since one applicant was personally known to departmental officers and the other was a public company). The influence of this and other behavioural variables on the decision pattern is tested in the fourth section of this chapter. Finally, it should be noted that equation (N1) was generated using each definition of the employment change variable, $\underline{x}_{10}$.

Estimation of disaggregated loan decision functions

The semi-normative analysis achieved significantly improved results by disaggregating the standard decision function for loans into large request and small request components. Hence the same approach was used here. The same criterion of largeness was adopted: whether the value (in June, 1969 terms) of the request was equal to or greater than $26,250. This meant that 26 of the total sample of 47 loan applications were classified as large, and 21 as small.

The previous regression analysis for all 47 requests was repeated for large requests only and for small requests only.[6] The analysis of large requests produced the following equation:

$$\text{(N2)}\quad \underline{p} = 61.0135 + \underset{(0.0812)}{0.3709^{**}}\underline{x}_1 - \underset{(15.5843)}{51.7335^{**}}\underline{x}_6 + \underset{(21.2810)}{50.7200^{**}}\underline{x}_7 - \underset{(0.2213)}{0.5551^{*}}\underline{x}_9; \quad \underline{r}^2 = 0.619, \quad \text{SE} = 13.978$$

** Significant at the 1 per cent level

* Significant at the 5 per cent level

where $\underline{x}_1$ denotes location in a 100 per cent area, $\underline{x}_6$ is the rating of management, $\underline{x}_7$ denotes closure in the absence of a loan, and $\underline{x}_9$ indicates the percentage of the request comprised by machinery in the case of 1966/67 or 1967/68 applications. The analysis of small requests resulted in the following equation:

$$\text{(N3)} \quad \underline{p} = \underset{}{57.2667} + \underset{(0.4273)}{0.4273^{**}\underline{x}_1} + \underset{(12.2435)}{37.0667^{**}\underline{x}_7} \; ; \qquad \begin{aligned} \underline{r}^2 &= 0.505 \\ \text{SE} &= 19.359 \end{aligned}$$

** Significant at the 1 per cent level

The results of the disaggregated analyses of loans are similar to those achieved in the semi-normative case. The total explained variance ($\underline{r}^2$ = 0.62 for large loans and 0.51 for small loans) is again significantly greater than that achieved by the aggregated standard function, (N1) ($\underline{r}^2$ = 0.40), although still not as great as that of the equivalent semi-normative functions. In addition, the structures of the two functions are dissimilar, although not by as much as in the semi-normative analysis. There is also a closer relationship between the aggregated and disaggregated decision structures than found using a semi-normative framework. In each case (all loans, large loans and small loans), location in a 100 per cent loan area and prospective closure are estimated to have significantly increased the proportion of a request which was granted, virtually repeating the semi-normative findings. The higher closure coefficient in the case of large requests suggests that the closure of large factories was relatively more important, presumably because of the more visible political impact. Less satisfactory management was significant in decreasing the proportion granted in the case of all loans and large loans, whereas the equivalent semi-normative variable, profit/loss, was not significant in either of the large group analyses (and in only one of each of the two all loans and two small group analyses). The inclusion of the 1966/67-1967/68 machinery variable as significant in explaining variations in the proportion granted of each large request (requests with a bigger machinery component leading to smaller loans) is similar to the semi-normative finding.

The non-normative results exclude estimated employment change from the decision functions. To this extent they replicate those semi-normative analyses using estimated change per $1,000 requested as the appropriate criterion. Any attempt by applicants to boost their chances by painting as rosy a picture possible of potential employment increases (c.f. O'Riordan, 1971, 114) does not thus appear to have had a significant influence on final decisions. In any event, the exclusion of this variable from the above decision functions makes more difficult the interpretation of the results in terms of the Department's publicly stated decision criteria of viability, employment generation, and regional or state significance. Nevertheless, the viability goal is reflected in the inclusion of management rating as significant in two functions, while the higher values of the constant and the coefficient of the closure variable in the large loan function suggest that factories which are more significant in regional/state terms have a higher proportion of their requests met, especially where there is a likelihood of closure.

Estimation of multiplicative decision function

Although the multiplicative formulation of the decision function did not yield any increased explanation using the semi-normative framework, the question of whether decision variables are considered additively or multiplicatively is sufficiently important to warrant further investigation with regard to the non-normative situation. A multiplicative version of the aggregated function (N1) was therefore constructed along the lines of equation (3) in Chapter 3 (page 76). The notional variables $\underline{x}_6^2$ and $\underline{x}_7^2$ were omitted since they took the same values as the original binary-valued variables $\underline{x}_6$ and $\underline{x}_7$. The multiplicative variables $\underline{x}_1\ \underline{x}_6$ and $\underline{x}_1\ \underline{x}_7$ were also omitted because they had either only one or no non-zero sample values. This left only $\underline{x}_1^2$ and $\underline{x}_6\ \underline{x}_7$ in the analysis besides the three original variables from (N1). Both $\underline{x}_1^2$ and $\underline{x}_6\ \underline{x}_7$, however, showed very marked collinearity with the other three variables: the former with $\underline{x}_1$ ($\underline{r}$ = 0.95) and the latter with both $\underline{x}_6$ ($\underline{r}$ = 0.86) and $\underline{x}_7$ ($\underline{r}$ = 0.86). Thus a multiplicative version of (N1) could not be tested without significantly violating at least one assumption of ordinary multiple regression analysis.

<u>Prediction of 1968/69 loan pattern</u>

To test the applicability of the programming model (Chapter 3) within a non-normative framework, the 1968/69 pattern of loan allocations was predicted using the decision functions above the specify the coefficients in the objective function of the model. The same simplified version of the full Chapter 3 model used in the semi-normative analysis was again adopted. Moreover, the bounded rationality approach did not suggest the need (unlike the semi-normative case) to take account of threshold population, minimum plant size or urban growth constraints in the programming model. In order to reduce decision-making costs, the Department could be expected to have accepted applicants' judgements of whether the locations selected had a sufficient population or whether new factories were of minimum technical size. Similarly, the computation of population multiplier effects, along the lines of Chapter 4, for example, would not have been expected if the Department had adopted a simplified model of reality.

The model was iterated with 1968/69 data from the same 19 loan applications used in the semi-normative iteration, using coefficients derived from, firstly, the aggregated decision function (N1), and secondly, the disaggregated functions (N2) and (N3). In the latter case, coefficients from the large requests function were applied if the sample request was $26,250 or more; otherwise coefficients derived from the small requests function were used. Once again, because of the "all or nothing" method of allocation within constraints in linear programming, a number of cases with lower but equal weights were allocated the full value of their request in both iterations, while other cases with the same weight but further down the list received no allocation because the total expenditure limit had been reached. The same modification to the allocation as used before in this situation was therefore used again, with the total expenditure allocated by the programme to the lower weighted cases being manually divided amongst these cases in proportion to the value of the respective requests.

The allocations generated by the model in each iteration are shown in Table 7.1, together with the allocations actually made in 1968/69 and the deviations of predicted values from actual values.

Table 7.1

Predicted and Actual Values of Sample Loan Allocations in 1968/69:

Non-Normative Analysis - Decision Rule Method

Location (see Figure 6.1)	Actual allocation (dollars)	Aggregated model		Disaggregated model	
		Predicted allocation (dollars)	Deviation from actual allocation (dollars)	Predicted allocation (dollars)	Deviation from actual allocation (dollars)
Gunnedah	7,000	5,300	1,700	0	7,000
Tamworth	10,000	5,741	4,259	0	10,000
Taree	917	13,750	-12,833	13,750	-12,833
Cobar	13,950	8,215	5,735	0	13,950
Gilgandra	25,000	22,082	2,918	28,731	- 3,731
Mudgee 1	25,000	22,215	2,785	0	25,000
Mudgee 2	30,000	60,000	-30,000	60,000	-30,000
Parkes	7,500	4,527	2,973	0	7,500
Bathurst	16,800	28,046	-11,246	28,046	-11,246
North Richmond	13,400	11,836	1,564	15,400	- 2,000
Shellharbour	57,000	41,956	15,044	54,589	2,411
Queanbeyan 1	5,100	3,754	1,346	0	5,100
Queanbeyan 2	9,600	7,066	2,534	0	9,600
Queanbeyan 3	57,000	41,956	15,044	54,589	2,411
Bega	10,000	20,000	-10,000	20,000	-10,000
Corowa	22,500	19,874	2,626	25,858	- 3,358
Leeton	0	3,533	- 3,533	0	0
Griffith	1,800	1,325	475	0	1,800
Buronga	76,000	67,129	8,871	87,342	-11,342

The allocations generated by the aggregated model, modified where necessary as just outlined, were the same as produced in the aggregated semi-normative version, except that the allocation to Leeton has now been correctly predicted to be zero. This was largely to have been expected, since the decision function (from which the model's objective function weights were formed) contained the same variables, except for the replacement of profit/loss by the closely correlated management variable, and the same size order of coefficients in each case. In addition, of course, the constraints in each version of the model were the same. The coefficient of rank correlation between actual and values predicted by the non-normative analysis was again significant at the 0.1 per cent level.

The disaggregated version of the model did not perform as well, despite the fact that the disaggregated decision functions yielded greater explanation of the overall variance in sample loan allocations between 1965/66 and 1967/68. This was because most of the 1968/69 sample cases had zero values for all of the goal criteria in the objective function. Thus their weights were given by the value of the constant in the large or small request functions, (N2) or (N3), and this constant was greater in the case of large requests: hence all small requests with a weighting equal to the value of the constant were allocated zero amounts because the last of the total funds had already been allocated to equivalent large requests. The result is that the predicted pattern of loans does not generally reflect actual 1968/69 allocations as well as the aggregated version, although no rank correlation test is possible because of the number of predictions with zero value. In general, the same conclusions made in the semi-normative analysis apply again to the non-normative analysis. In particular, the introduction of a bounded rationality version of the regional welfare function failed to produce a model which fully replicates the fact that most decisions by the Department did not give applicants either all or none of their request, but rather some proportion in between. In Chapter 6 it was suggested that this was because the Department varied the proportion according to the per dollar utility of each request. The development of decision rules about the proportion to be given is a formalization of this objective. Thus the development of a decision rule approach in the next section was designed to overcome the "all or nothing" shortcoming of the programming model.

Estimation of grant decision functions

In order to estimate decision functions applying to grants, the same approach was followed. The decision rules identified resulted in the following criteria:

(1) the employment level at the factory concerned (or the expected level, for new factories) multiplied by $200, as a percentage of the value of the request (maximum 100 per cent), in the case of requests for rail freight subsidies on raw materials or on

inished products despatched to the local district (to reflect the rule that the maximum subsidy payable in such cases was $200 per employee) (designated $\underline{x}_1$); and

(2) the expected increase in employment multiplied by $50, as a percentage of the value of the request (maximum 100 per cent), in the case of requests for labour training subsidies in the first three years of a factory's establishment (corresponding to the rule that each employee trained and employed for a certain period in new factories received a training subsidy of $50 in standard cases) ($\underline{x}_2$).

Criteria derived from an analysis of deviant cases (with a value of 1 being given if applicable, and 0 otherwise) were:

(3) whether the grant was perceived to be a small one ($\underline{x}_3$); and

(4) whether the request was for the extension of a previous grant ($\underline{x}_5$).

To these were added two criteria which yielded significant explanation in the loans analysis, and which therefore may also have been implicit in grants decisions:

(5) whether management of the applicant company was perceived to be unsatisfactory ($\underline{x}_4$); and

(6) whether the application applied to a 100 per cent loan area ($\underline{x}_6$).[7]

These criteria formed the independent variables used in the estimation of grants decision functions by regression analysis, with p, as before, being the dependent variable. The sample of grant cases used in the ensuing analysis was selected in the same way as the loans sample. A total of 25 cases was thus chosen.

Using a linear additive format for the function, the multiple linear regression analysis failed to generate any explanatory variables which were significant at the 5 per cent level. One possible reason was the amount of "noise" produced by cases involving requests which were outside normal policy. The 12 such requests were therefore excluded and the analysis repeated using the other 13 cases. Once again, however, no significant variables were generated. The difficulty which had been experienced in the semi-normative analyses in deriving a significant explanation of the grants pattern was thus repeated here. Once more, the most likely explanation is the heterogeneity of the grants cases, making in turn for heterogeneity and inconsistency in the decision criteria.

Summary

The first point emerging from the results of this section is that the adoption of the bounded rationality version of the non-normative approach did not result in more powerful estimates of decentralisation decision functions. The suggested reason is that decision makers did not adopt a single simplified model of reality, but instead had a frame of reference which altered from one type of case to another. Evidence in support of this was found in the greater explanation of loan decisions which was obtained when the decision function was disaggregated into large and small requests, and in the lack of explanation obtained in the analysis of grants, which were more heterogeneous than loans. The possibility that different decision criteria are used from case to case is explored in the third section of this chapter.

The other main conclusion from the results is that the adoption of a non-normative framework did not overcome the chief deficiency of the semi-normative model: the failure to take account of the fact that in most cases the Department gave loans between zero and the full value of each request. Underlying this latter pattern was a series of decision rules which specified the proportion of each request which would be given in different types of cases. Accordingly, the next section explores the possibility of achieving improved explanation by using these decision rules as the fixed starting points for prediction.

A DECISION RULE APPROACH

Despite their widespread acceptance as tools of analysis, welfare functions and decision functions may not be an appropriate representation of the structure of many individual or organizational decision situations. In particular, the literature on the behavioural approach to organizational decision-making has stressed that sequential attention to goals is one likely response to an uncertain and complex decision environment (Cyert and March, 1963).

This consideration appears to have possible relevance to the Department's own decision process in relation to requests for decentralisation assistance. Thus the decision rules listed in the previous section could be viewed as providing an initial classification of cases according to the degree to which they promoted certain basic goals. Further criteria would then have been used to determine whether, and how much, deviation from the rules was warranted by the particular circumstances of each case.

Given the decision rules, the modelling problem becomes one of specifying the criteria causing deviations from the rules, together with the criteria weightings denoting the extent of deviation. This is done in the following paragraphs. The specified deviation criteria can then be incorporated into a full decision model. Two ways of doing this to predict the 1968/69 decision pattern are described in the last half of this section.

Estimation of standard rule deviation function for loans

In order to estimate the parameters of

criteria causing deviations from loan decision rules during 1965/66 - 1967/68, multiple regression analysis was used again. The dependent variable was the deviation (as a percentage of the request) from the appropriate decision rule, and the independent variables were the criteria hypothesized to cause deviations. Thus "rule deviation functions" were generated.

The same decision rules, deviation criteria and sample observations used in the previous section were used initially, with the addition of a loans decision rule that 75 per cent of the value of machinery loan requests should be granted. This was the percentage most often granted in 1967/68, by which time a policy of giving loans for machinery had become accepted. Where machinery comprised less than the full value of the request, the decision rule percentage was determined on a pro rata value basis. The 100 per cent area rule was dominant over the lease rule, but was in turn dominated by the wholesaling and machinery rules.

The multiple stepwise linear regression analysis, using a five per cent significance level as the criterion for inclusion and retention of variables, produced the following equation:

$$\text{(D1)}\quad \underline{d} = \underset{}{-0.0652}\underset{(13.0052)}{-31.0605^{*}\underline{x}_6}\underset{(13.0589)}{+55.0723^{**}\underline{x}_7}\underset{(0.2285)}{-0.7462^{**}\underline{x}_8}\underset{(0.1096)}{-0.2667^{*}\underline{x}_9};\quad \underline{r}^2=0.449,\ SE=16.984$$

** Significant at the 1 per cent level
* Significant at the 5 per cent level

where $\underline{x}_6$ is the management rating, $\underline{x}_7$ denotes prospective closure, and $\underline{x}_8$ and $\underline{x}_9$ are the percentages of the request desired for machinery for applications in 1965/66 and 1966/68, respectively. The highly significant coefficients of $\underline{x}_7$ and $\underline{x}_8$ did not suggest that the heteroscedasticity of the respective sample distributions, when regressed on $\underline{d}$, had caused the variables to be wrongly included.

In order to test the extent to which the actual 1966/68 pattern of sample loan decisions was predicted by the combined operation of the decision rules and the deviation equation (D1), the percentage of sample requests granted if the decision rules applied were calculated. Deviations from these percentages predicted by the above equation were then added to produce the final predicted percentages. These were then regressed against the actual percentages. The value of $\underline{r}^2$ thus produced was 0.513, which was about the level produced by the semi-normative analysis, but above that of the non-normative analysis.

The coefficients of the two machinery variables indicate that machinery policy was in a state of evolution over the period concerned. The coefficients show there was a decline in average negative machinery rule deviations from 75 per cent in 1965/66 to 27 per cent in 1966/68 (although the skewed sample distribution of $\underline{x}_9$ means the latter figure may not be accurate).[8] An inspection of sample cases involving machinery revealed that, in the early period after the establishment of the Country Industries Assistance Fund, there had been a concern that there might not be enough funds to finance all worthwhile requests, so requests for machinery loans tended to be rejected because of their lesser security compared with factory loans. However, the number of machinery requests coming forward in this period was not enough for concern, so a less restrictive approach came to be adopted.

The other two criteria included in the equation are the potential closure and management rating variables. This was to have been expected since they were the only two deviation criteria to have appeared also in the aggregated semi-normative and non-normative decision functions for loans. The coefficient signs of each are both again in the hypothesized directions, with potential closure causing positive deviations and poor management producing negative deviations.

The pattern of residuals of d values predicted by the regression equation from actual values (Figure 7.2) is broadly similar to that previously indicated for the corresponding non-normative welfare function (Figure 7.1). Residuals outside the +1 standard error range for Albury, Leeton, Singleton and Taree are again evident, doubtless for the same reasons. The inclusion of the two machinery variables in the

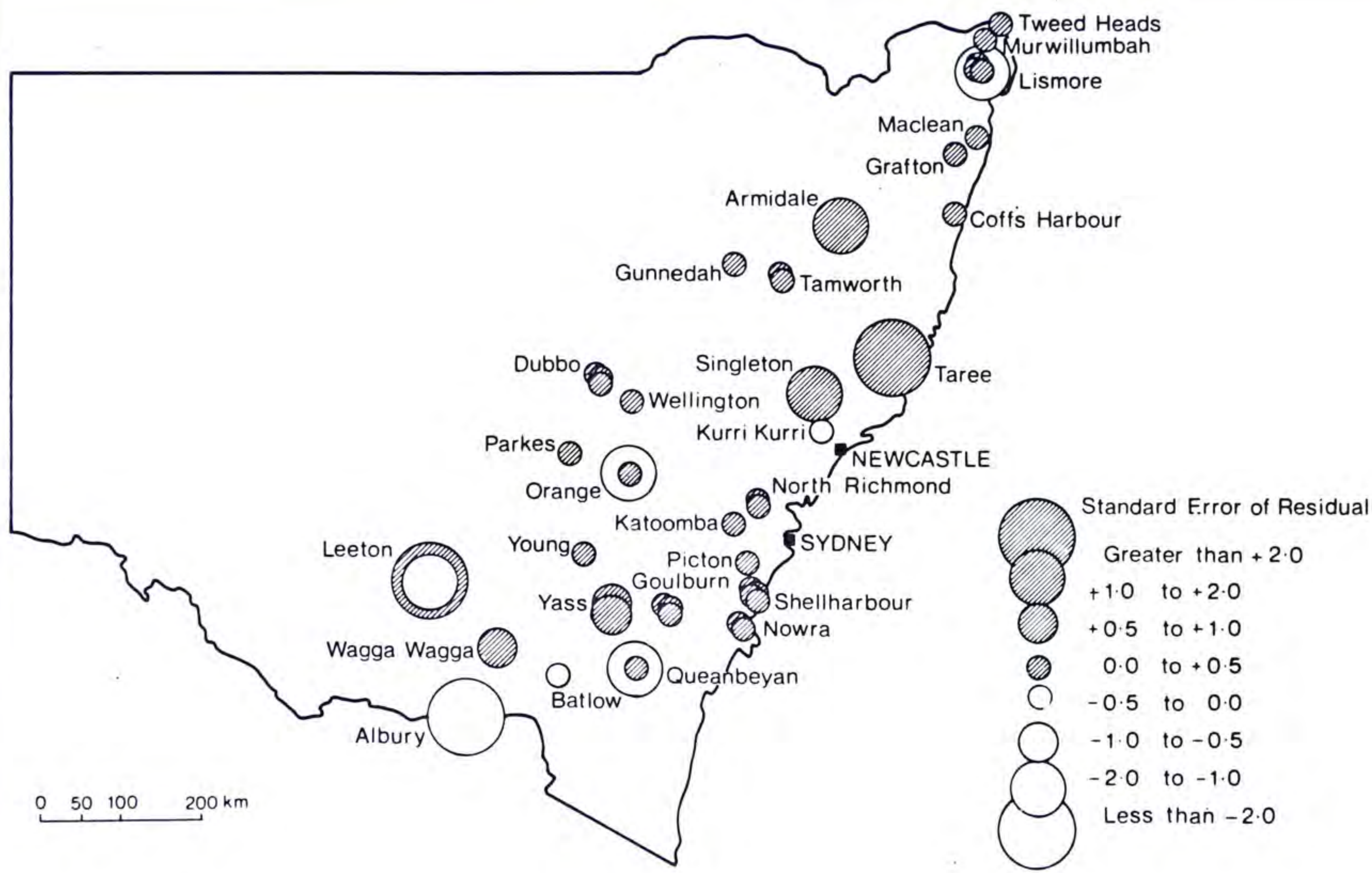

Figure 7.2 Residuals from Preferred Non-Normative Estimates of Deviations from Percentage of Loan Request Granted under Usual Rules

equation has not caused the inaccurate estimates in machinery loan cases (particularly those in Orange, Leeton and Armidale) to disappear, since the machinery criteria seem to have been administered in a fluctuating manner due to variations in the security offered by the machinery in question and in the ability of applicants to finance the purchase of machinery. In both the remaining cases with residuals greater than 1.0 standard errors, those for Lismore and Queanbeyan, it is possible that a multiplicative relationship between two of the decision criteria could have produced the over-prediction. In the Lismore case, the presence of two criteria involved (poor management rating and a 1966/68 machinery request) both independently acted to cause reductions in $\underline{d}$, but their joint action may have meant that the decrease in $\underline{d}$ was less than the sum of the independent effects. The reverse may have applied in the Queanbeyan case, which involved potential closure and a request perceived as small.

Two other cases of relatively high residuals - those at Yass of just under +1 standard error - could also have been produced by a single multiplicative relationship between two deviation criteria (in this instance management rating and potential closure) which each had a value of 1 in these cases. To test this possibility a new multiplicative variable, $\underline{x}_{10}$, taking a value of 1 if there was both a threat of closure and a poor management rating and a value of 0 otherwise, was added and another multiple regression analysis carried out. The new variable was included in the final equation at the expense of the closure variable, but almost certainly wrongly so in view of the high correlation ($\underline{r}$ = 0.86) between the two variables.[9]

Estimation of disaggregated rule deviation functions for loans

Previous analyses showed that loan decision functions could offer increased explanatory power if they were disaggregated into two separate functions, one applying to large requests (equal to or greater than $26,250) and one to small requests. Accordingly, this approach was also tested for rule deviations.

A repetition of the initial (aggregated) multiple regression analysis (equation (D1)) for large requests only generated the following equation:

$$\text{(D2)}\quad \underline{d} = \underset{}{2.4102} - \underset{(0.2006)}{0.6319^{**}}\underline{x}_8 - \underset{(0.2292)}{0.9750^{**}}\underline{x}_9 \;; \qquad \begin{aligned}\underline{r}^2 &= 0.527\\ SE &= 15.001\end{aligned}$$

** Significant at the 1 per cent level

where $\underline{x}_8$ and $\underline{x}_9$ denote the percentage of each request in 1965/66 and 1966/68, respectively, which was for machinery. The same analysis for small requests only resulted in the following equation:

$$\text{(D3)}\quad \underline{d} = -3.7778 + \underset{(11.8233)}{38.1111^{**}}\underline{x}_7 \;; \qquad \begin{aligned}\underline{r}^2 &= 0.354\\ SE &= 18.960\end{aligned}$$

** Significant at the 1 per cent level

where $\underline{x}_7$ denotes prospective closure.

Unlike the decision function analysis, disaggregation did not produce any increase in overall explanatory power: while the total variance explained by equation (D2) for large requests ($\underline{r}^2 = 0.53$) is above that of the aggregated function ($\underline{r}^2 = 0.45$), that explained by equation (D3) for small requests is significantly less ($\underline{r}^2 = 0.35$). Moreover, the relative values of the coefficients of the machinery variables in (D2) are different to those in the aggregated function, (D1): instead of the hypothesized decrease in the negative deviation over time, the equation estimates an increase. The fact that only two large sample requests in 1965/66 involved machinery has undoubtedly caused the structure of (D2) to be unstable. Because of this, and the lack of improvement in overall explanation, equations (D2) and D3) were not used for predicting the 1968/69 distribution of loans.

<u>More complex rule deviation functions for loans</u>

The analysis in Chapter 3 pointed to two potentially important influences on the structure of decisions: the operation of diminishing marginal utility, and the effect of time. Neither has yet been tested within the non-normative framework. Their application within this framework is now analysed for loans, using the rule deviation approach rather than the decision function approach because of the better explanation yielded by the former, using the aggregated standard function. The same sample of 47 cases has been used.

The applicability of the diminishing marginal utility hypothesis was investigated first. The nature of the rule deviation variable, d, required that the hypothesis be tested by determining whether the value of requests (in June, 1969 terms) was an additional determinant of d, with d being hypothesized to be inversely related to the value of requests. The sample distribution of the value of requests was significantly skewed, but normally distributed after logarithmic (base 10) transformation. The transformation also meant that the particular hypothesis that the marginal utility of deviations declined logarithmically with increasing values of requests could be tested. The original multiple stepwise regression analysis of rule deviations was repeated, adding the logarithm of request value to the set of independent variables. The new variable was not significant at the 5 per cent level, however, and the original equation remained unchanged. A similar result was achieved using the square root of values of requests instead: the variable did not prove significant and the structure of the original rule deviation function remained the same. The hypothesis of diminishing marginal utility within the bounded rationality framework was therefore rejected for decentralisation loans.

The influence of time on the structure of the rule deviation function was tested using the same method described in Chapter 5. Firstly, the sample of cases was divided according to whether the request had been made in 1965/66, 1966/67 or 1967/68. A separate multiple regression analysis was performed on each group, using $\underline{d}$ as the dependent variable again but only using the variables included in (D1) - potential closure, management rating, and the percentage of the request desired for machinery - as the independent variables. The two machinery variables $\underline{x}_8$ and $\underline{x}_9$ were combined into a single variable so that the influence of time on the machinery component could be properly tested. The coefficients from the resulting equations then became the dependent variables in three new regression analyses, one for each of management, closure, and machinery, with the corresponding year (1965/66 being set equal to 1, etc.) becoming the independent variable. The hypothesis that the resulting coefficients of the time variable were significantly different to zero was then tested. As expected, the time coefficient in the machinery equation had the highest value of Student's t (being 1.312), but it was not significant at the 5 per cent level. This apparently contradicts the results of (D1), but the actual pattern of machinery coefficient values in fact confirmed the earlier findings, the values being -0.63 in 1965/66, -0.25 in 1966/67, and -0.30 in 1967/68. Thus the average deviation from the machinery rule fell sharply and then remained roughly constant, which is consistent with the rejection of the hypothesis that the size of machinery deviations was linearly related to time over those three years. Nevertheless, this latter result meant that no dynamic rule deviation function could be developed for the purpose of predicting 1968/69 loans.

Prediction of 1968/69 loan allocations from rule deviation functions

Two main alternative approaches were available for predicting the pattern of 1968/69 loan allocations from the rule deviation functions developed above:

(a) to assume that the functions were a form of utility function, to be maximized using the basic programming model; and

(b) using the rule deviation functions themselves for prediction by incorporating the values of deviation criteria for the 1968/69 cases into the functions.

The first approach appears to be feasible only in a situation in which the total expenditure available is greater than the sum of the expenditures required by applying the decision rules in each case. Otherwise, no excess expenditure would be available to enable maximization of the rule deviation function to be carried out. In the 19 sample 1968/69 loan cases, this problem was evident, with no case being granted a loan greater than specified by the appropriate rule. Hence there was no "surplus" available for modelling the allocation in deviant cases.

The second approach was therefore used to predict the 1968/69 loan pattern. The first step was to calculate the percentage of the value of each sample request granted, using the appropriate decision rule. Next, for the eight cases having deviation criteria values not equal to zero, the values concerned were substituted into the aggregated version of the rule deviation function, (D1), to predict deviations.[10] A rule was adopted that the percentage resulting by adding the predicted deviations to the decision rule percentage could not exceed 100 or fall below zero. The predicted loan values were obtained by multiplying the value of each request by the predicted percentage (as a fraction of 1).

The results of thus applying the method to predicting the sample 1968/69 loan decisions are shown in Table 7.2. It can be seen that the actual pattern of loans has been predicted fairly closely. The value of the coefficient of rank correlation between actual and predicted values was 0.895, virtually the same as that in the non-normative decision rule case, and significant at the 0.1 per cent level.

Table 7.2

Predicted and Actual Values of Sample Loan Allocations in 1968/69:

Non-Normative Analysis - Rule Deviation Method

Location (see Fig.6.1)	Actual value (dollars)	Predicted value (dollars)	Deviation (dollars)
Gunnedah	7,000	7,200	- 200
Tamworth	10,000	6,283	3,717
Taree	917	11,552	-10,635
Cobar	13,950	8,989	4,961
Gilgandra	25,000	30,000	- 5,000
Mudgee 1	25,000	24,310	690
Mudgee 2	30,000	60,000	-30,000
Parkes	7,500	4,954	2,546
Bathurst	16,800	28,046	-11,246
North Richmond	13,400	16,080	- 2,680
Shellharbour	57,000	57,000	0
Queanbeyan 1	5,100	5,100	0
Queanbeyan 2	9,600	9,600	0
Queanbeyan 3	57,000	57,000	0
Bega	10,000	20,000	-10,000
Corowa	22,500	27,000	- 4,500
Leeton	0	4,800	- 4,800
Griffith	1,800	1,800	0
Buronga	76,000	91,200	-15,200

The main deviations are, ironically enough, those for four cases having non-zero values for one of the deviation criteria. In all four cases there was a threat of potential closure, but the Department did not increase the percentage granted to take account of this. The problem here seems to be partly the same as that mentioned earlier in potential closure cases, that is, the fact that the simple binary measure of the likelihood of closure does not take into account varying closure probabilities. Another factor was undoubtedly the marginal eligibility of two of the four applicants, one being a saw miller and the other a primarily servicing company with only a small proportion of its business being manufacturing. In the Taree case, the extra consideration of particularly poor management was undoubtedly dominant (although the rule deviation function suggested that potential closure would more than offset any rating of management as unsatisfactory).

The other main feature of the results is the slight over-prediction, equivalent to 10 per cent of request value, in four cases. This appears to reflect the introduction of a new decision rule to grant 50 per cent, rather than the standard 60 per cent, of values of requests outside the maximum assistance areas in cases involving marginal eligibility (and thus a lesser contribution to the Department's objectives). Two of the closure cases (one at Bega and one at Mudgee) were also over-predicted partly for this reason. The relevant cases here were principally those which involved either first stage processing of local primary produce, namely wine-making (Buronga), sawmilling (Bega) and stockfeed manufacture (Corowa), or else a small amount of manufacture in the total business of the applicant companies (Gilgandra and Mudgee). In the other instance, involving the North Richmond case, the marginal eligibility was because of the close proximity to the Sydney metropolitan area.

The new policy appears to have been the result of greater learning/awareness over time about the value of particular types of applications to decentralisation goals. Another factor may have been that the potential political pressure arising from the Department's not contributing the standard proportion would have been less because the operation of the decentralisation programme after 1965 had demonstrated that many applications contributing highly to goals could be made in a climate of greater funds (compare Figures 2.3 and 2.4). The introduction of new policies in this way will inevitably produce prediction errors in models adopting a revealed preference approach in the manner outlined here. But it is difficult on the basis of current ideas about organizational policy changes to see how such events could be quantitatively forecasted.

Estimation of rule deviation functions for grants

For grants, the same approach to constructing a rule deviation function as used for loans was followed. The 25 sample observations used were the same as used initially in the previous section. For those observations which fell within the ambit of the labour training subsidy and freight subsidy rules, the percentage of the value of request which would have been granted by following either rule was calculated. For remaining requests, the percentage was set at zero. Deviations (d) were then calculated as the difference between actual percentages and the percentages just calculated. The four criteria hypothesized to explain these deviations were the same as the four non-decision rule grants criteria used in the previous section.

A stepwise multiple regression analysis was then carried out using these four criteria as the independent variables and $\underline{d}$ as the dependent variable.[11] However, using a significance level of 5 per cent as the yardstick for the inclusion and retention of variables, no equation was generated. One possible reason for this lack of explanation is that all but one of the 13 requests not involving freight subsidies of the kind usually paid or labour training subsidies were for abnormal types of subsidies. Hence the analysis was re-run using only the 12 relevant freight and labour training request cases. Again, however, no equation was generated.

It was considered that, despite the failure to explain deviations from decision rules for grants, the rules themselves may have still explained a significant proportion of the real world grants pattern. The actual percentages granted in the 12 freight/labour cases over the 1966/68 period were therefore regressed on the corresponding percentages predicted by the two decision rules. The degree of explanation thus yielded was very low, the $\underline{r}^2$ value being only 0.128; moreover, the coefficient of the independent variable was not significant at even the 10 per cent level. These results confirm earlier observations concerning the difficulty experienced in modelling decisions about grants assistance made by the Department of Decentralisation.[12]

Summary

The use of rule deviation functions has been shown to increase the explanatory power of the non-normative approach in the context of decentralisation loan decisions. The degree of explanation was not, however, very different to that achieved using semi-normative decision functions. This is partly because the two approaches were not in practice markedly different, in terms of the determinant decision criteria: the criteria included in the semi-normative functions could also generally be given a non-normative interpretation, and in particular a satisficing one, since they were basically of the binary type. The comparability of the two approaches is also perhaps due to the fact that the use of a single function to predict decisions is not fully appropriate anyway. The explanatory power of the disaggregated functions and the concomitant lack of explanation achieved with grants, which are very heterogeneous when pooled together, suggests that different criteria may be relevant in different loan or grant cases. This possibility is explored in the next section.

REASONS FOR SATISFICING IN NON-DEVIANT CASES

The rule deviation approach to modelling decentralisation location decisions which has just been described has perhaps given the impression that applications for assistance were automatically allocated a certain percentage of the full request (using the decision rules), from which deviations might then have been made. In fact the decision process seems to have been more complex than this, involving a prior stage in which requests were first assessed as to whether they were generally satisfactory in terms of one or more factors. On being judged satisfactory, the decision rules could then be applied and deviations from these rules made if necessary. The reason that this initial stage was able to be ignored in the modelling process above is that the samples of loan or grant cases used were drawn from those applicants who had been successful in receiving assistance. There was insufficient information to include applicants without any successful requests in the models. Despite this, the initial filtering process into satisfactory and unsatisfactory cases is important to an understanding of the final location pattern.

Thus the filtering process appears to have been a two stage one. The first stage involved the exclusion of applications not meeting the basic conditions for decentralisation assistance (such as loan collateral and alternative sources of funds) set out in the application form (Appendix 1). The second stage was the classification of basically acceptable applications into those to which the decision rules could be applied, and those in which some deviation from decision rules was considered warranted. It is the reasons for this second stage classification to which the present section is directed.

In order to analyse the reasons for the classification of reasons according to whether the decision rules should be applied, a factor analysis (using varimax rotation) was carried out on the decision reasons at the time of effective approval in each of the 36 non-deviant sample loan cases in the total sample of 47 used earlier in the section. Altogether, 29 different reasons were suggested. A value of 1 was recorded if the reason was mentioned, and 0 if it was not. The factor analysis reduced the 29 reasons to eight distinct factors with eigenvalues above 1. The eight factors accounted for 52.9 per cent of the total variance. The factors, with their suggested interpretation and a listing of those reasons with loadings above 0.6 on each factor, are shown in Table 7.3.

Before discussing the results, it should be pointed out that the effect of factor analysis is to generate factors which identify major dimensional differences within the data set. Hence it does not

Table 7.3

Factor Analysis of Decision Variables for Non-Deviant Loan Cases:

Eigenvalues, Proportion of Total Variance, and Factor Loadings

Factor 1

Eigenvalue	2.823
Proportion of total variance	0.097
High loadings	
Lack of security for machinery loan	-0.976
Markets doubtful	-0.976

Interpretation: Lack of doubtful security and markets.

Factor 2

Eigenvalue	2.720
Proportion of total variance	0.094
High loadings	
Minimal flow-on of assistance to other projects	0.627
Low cost project through special factor	0.606

Interpretation: Low cost project.

Factor 3

Eigenvalue	2.088
Proportion of total variance	0.072
High loadings	
Low cost project through special factor	-0.864
Employment increase too low	-0.840

Interpretation: Lack of low cost compensated by lack of low employment increase.

Factor 4

Eigenvalue	1.866
Proportion of total variance	0.064
High loadings	
Compensation for Department aid to another company	0.809
Possibility of competition with existing producers	0.791

Interpretation: High competition.

Factor 5

Eigenvalue	1.824
Proportion of total variance	0.063
High loadings	
Precedent	-0.907
Quasi service industry	-0.813

Interpretation: Lack of precedent compensated by application not for quasi service project.

Factor 6

Eigenvalue	1.520
Proportion of total variance	0.052
High loadings	
Important company	0.865
Rapid past growth	0.819

Interpretation: Important, rapidly growing company.

Factor 7

Eigenvalue	1.401
Proportion of total variance	0.048
High loadings	
High local unemployment	-0.992

Interpretation: Lack of high local unemployment.

Factor 8

Eigenvalue	1.097
Proportion of total variance	0.038
High loadings	
Location not particularly satisfactory	0.911
Department influenced application	0.727

Interpretation: Unsatisfactory location compensated by influence of Department on application isolate those variables which are relatively common through the set of observations. In the present case, the four constantly recurring decision reasons: favourable estimated employment increase (30 cases), sound financial position (21 cases), satisfactory potential market/demand (16 cases), and sound management/technical expertise (11 cases), do not thus load highly on any of the eight factors. Nevertheless, they obviously represent the fundamental criteria by which requests were judged as satisfactory for the application of the decision rules.

It is of some interest to note the important place of expected employment increase as a criterion here. Only rarely in the 30 cases in which it was mentioned favourably was it related to the prospective size of departmental assistance, despite wide variations in the expected employment: assistance ratio. This supports the findings in Chapter 5 that large employment increases *per se* were favoured, giving rise on this account to a preference for large projects.

The last of the four most common decision reasons, sound management/technical expertise, is an interesting one because an unsatisfactory rating of the same variable was found in the previous sections to be significant in explaining deviations from decision rules. Since most of such deviant requests still received some assistance, it indicates that the management criterion did not necessarily have to be passed for the applicant to be granted a loan. This in turn illustrates the fact that the satisficing criteria used by the Department could be traded off against each other, a point which is shown clearly in the results of the factor analysis.

The main feature of the factor analysis results (Table 7.3) is the number of factors which can be interpreted in terms of criteria that denoted an unsatisfactory situation, or in terms of such criteria being compensated by ones indicating greater satisfaction. This seems to be true of factors 1, 3, 4, 5 and 8. In the unrotated version a negative factor ("location not particularly satisfactory") also shows up strongly in factor 7. The factors dominated by two variables, one compensating the other, are obviously explicable in terms of a trade off between the two. In the factors involving high loadings of criteria denoting an unsatisfactory situation, a trade off can be envisaged with the four common satisficing criteria mentioned previously.

Where one of the basic criteria was considered unsatisfactory, however, it appeared to require satisfactory ratings on other basic criteria for the application of the appropriate decision rule. Thus in one case, low expected employment was offset by favourable market, financial and managerial factors; in a second, a poor financial position was offset by market, employment increase and managerial considerations, while in a third case good management offset doubts about the size of the prospective market.

The concept of a trade off between satisficing criteria is compatible with Isard and Smith's (Isard, 1969) concept of satisficing as applying to a complete decision action which may be satisfactory in terms of alternative groupings of variables. The latter situation does not completely describe the decentralisation decision situation, however, since loan requests which were not suitable for the application of decision rules were allocated varying proportions of the value of the request.

The interaction of satisficing criteria in the manner described can be illustrated by a locational example. Factors 7 and 8 both owe much of their distinctiveness to locational criteria. When scores on factor 7 are plotted against scores on factor 8, two distinct locational clusters emerge (Figure 7.3). Firstly there is a two point cluster having high positive scores on both factors. These points relate to two North Richmond cases. In each instance the Department considered that the near-Sydney location involved was not as satisfactory in terms of decentralisation objectives as less proximate areas. In both cases, however, the standard request percentage was eventually given in view of the encouragement which the Department had shown to the companies concerned.

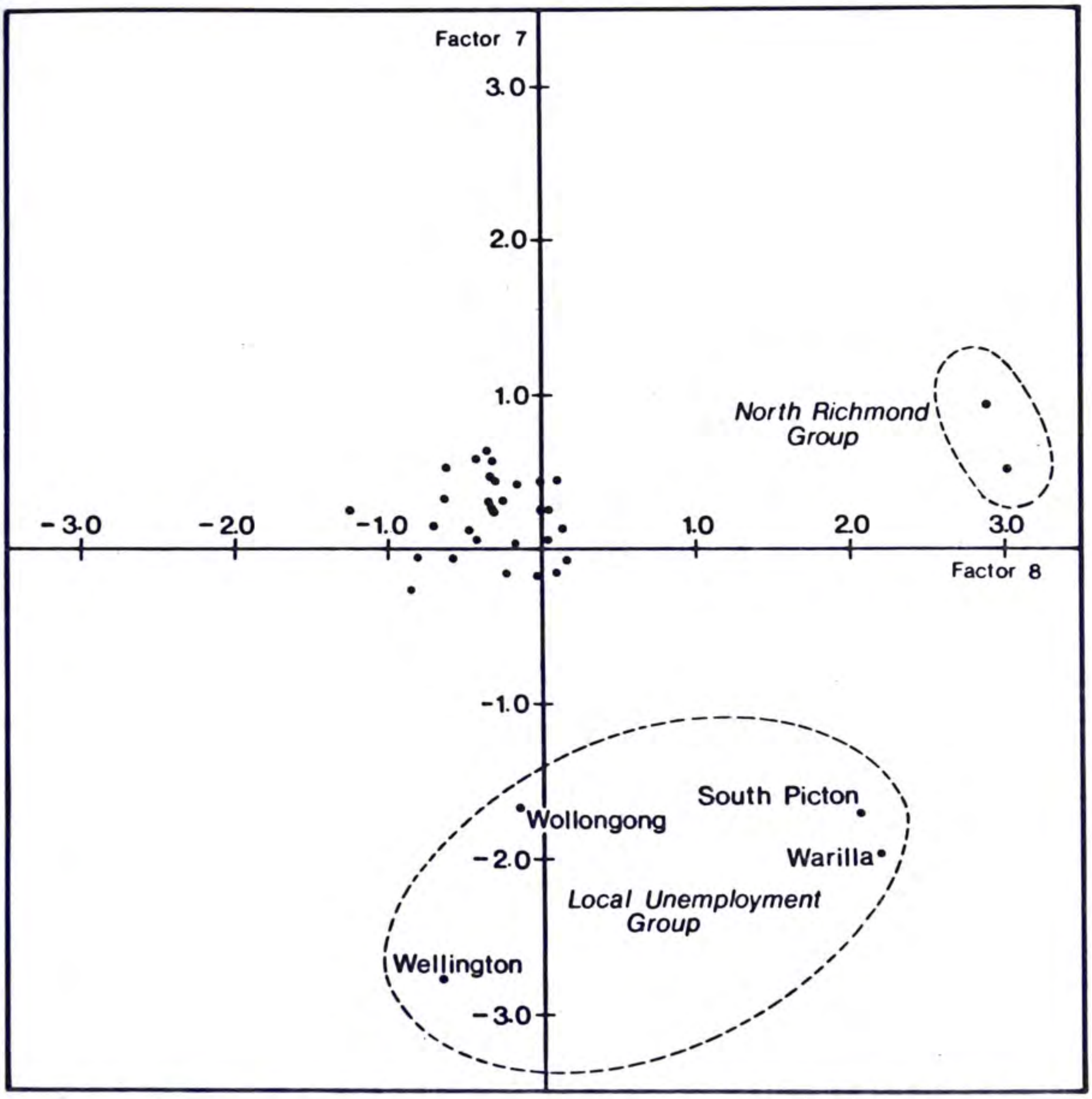

Figure 7.3 Decision Reasons in "Non Deviant" Loan Cases: Scores on Factors 7 and 8

The other cluster contains four points having high negative scores on factor 7, indicating high local unemployment. The favourable rating of the four cases against this criterion was in each case, however, traded off against less favourable factors. Thus in the South Picton and Warilla cases, the locations were again considered too close to Sydney (as suggested by the high positive score of each on factor 8). Wollongong, to which another of the cases applied, was normally ineligible for departmental assistance because of its already large industrial economy (only industries employing 75 per cent female labour qualified for assistance). In the Wellington case, the applicant company was in an unsatisfactory financial position. It can thus be seen that in the main cases involving satisficing locational criteria there were trade offs between favourable and unfavourable criteria ratings which resulted in an eventually satisfactory assessment.

Finally, an important general feature of the results is the extent to which the less basic trade off criteria vary from one case to another (as evidenced by the relatively large number of factors in Table 7.3, for example). One suggestion is that such focussing is a strategy for reducing non-critical elements of the decision environment to manageable proportions (Shepard, 1964), which very much accords with the bounded rationality model. On the other hand, it has been suggested that complexity of the decision environment may lead to preconceived choices (Sims and Baumann, 1976, 2) for which information is then found to rationalize the situation and reduce "cognitive dissonance" (Vedder, 1973, 95). This latter interpretation would be compatible with the large variation in criteria in decentralisation decisions. Nevertheless, the relatively structured nature of the trade off process described here suggests that such rationalization was not a dominant factor. More generally, the analysis in this section has implied that decisions were structured purely on the extent to which applications satisfied decentralisation goals, which is only part of the whole story. In particular, government location decisions are likely to be especially sensitive to external decision factors, while organizational theory also suggests that the internal decision environment may be important. The role of such environmental factors on decentralisation decisions in New South Wales is therefore explored in the next section.

THE INFLUENCE OF THE DECISION ENVIRONMENT

This section explores the role of certain factors related to the decision environment on the pattern of programmed decisions. The section has two parts. The first is an analysis of the potential influence of selected decision environment variables on deviations from decision rules. The second part is an analysis of potential influences in cases involving greater than normal stress, as indicated by the absolute (percentage) value of deviations from rules.

Influence of the decision environment on decision rule deviations

The method adopted to test the influence of factors in the decision environment on deviations from decision rules was to add variables replicating these factors to the sets of explanatory variables used in the previous section. The new variables were of two types. In the first were included variables denoting the quality of information available on each case. Information quality is a basic component of one of the most significant location theories involving a behavioural emphasis, that of Pred (1967), while it is also central to spatial diffusion analysis, among others. The second class of variable used here related to one denoting the size of the decision problem.

Two variables were used to denote information availability. The first was a catch-all indicator for which a value of 1 was recorded if information availability was greater than average, as evidenced by the presence of any of the following: having company headquarters in Sydney, being a public and/or overseas company, or being someone known personally within the Department (as evident from minutes on file). The first and third of these would be expected to have improved information flows because of the resulting improvement in accessibility to the Department. Public companies have more immediately accessible information than private companies, in the form of accounts and annual reports while their generally greater size means that more information is circulated concerning them. Applicant companies from overseas usually sent officials to Sydney for extensive discussions with the Department, and this would have served to closely familiarize the Department with necessary information. If there was less than average information availability for a request according to these criteria, a value of zero was given.

The second of the information availability variables was whether the applicant had previously received assistance from the Department, excluding instances in which the aid had not been considered successful. A value of one was awarded in the case of previous successful assistance, and zero otherwise. Pred notes that repeating previously successful behaviour is the most spatially significant form of uncertainty reduction. The latter implies a strategy of increasing relevant information, and it was hypothesized that values of one for either of the information availability variables would decrease the tendency for satisficing behaviour and increase deviations from decision rules (and, in the case of previously successful assistance, produce positive deviations).

Two variables were used to denote the second decision environment factor, the size of the decision problem. The first was the employment increase expected by applicants (excluding increases beyond two years because of their lesser reliability). This was included to test the hypothesis that the Department examined requests for larger projects more closely (c.f. Townroe, 1972, 263-265) and hence involved less satisficing and greater deviations from the standard decision rules.[13] The second variable was the number of separate requests for different kinds of assistance made at the time of the sample application. It was hypothesized that more requests would make the boundaries of a particular decision less well confined and thus increase decision rule behaviour (c.f. Mack, 1971, 198).

To avoid the problem of skewed sample values, a value of one was given to cases in which there were one or more additional requests, and zero otherwise. Values of the only non-binary variable, expected employment increase, were logarithmically transformed for the same reason.[14] The stepwise multiple regression analysis of decision rule deviations (aggregated version) was then repeated, but this time adding the four decision environment variables (including the transformed version of expected employment increase). The following equation was generated:

$$\text{(E1)}\quad \underline{d} = -3.3750 + \underset{(9.3305)}{39.5000^{**}}\underline{x}_7 + \underset{(5.5038)}{13.3750^{*}}\underline{x}_{11} - \underset{(5.8403)}{23.7500^{**}}\underline{x}_{12}\ ; \quad \underline{r}^2 = 0.423,\ SE = 17.174$$

** Significant at the 1 per cent level
* Significant at the 5 per cent level

As before, the included variable, $\underline{x}_7$, denotes the potential closure variable. Two of the decision environment variables have been included in the equation - the "general" information availability variable, $\underline{x}_{11}$, and the additional requests variable, $\underline{x}_{12}$.

The general information variable appears to have been included in the equation at the expense of the management rating variable. Since the general information variable postulates a significant spatial bias in information receipt by the Department, with information originating in Sydney being favoured, its inclusion in the equation has important locational implications. In particular, its positive coefficient suggests that applicants who were part of the local Sydney business and government information field (or at least for a certain period, in the case of officials of overseas companies) had a better chance of having their request met than other applicants not in close contact with this field. This supports equivalent hypotheses concerning the spatial bias of large companies to sources which are spatially proximate to strategic decision makers (Westaway, 1974; Ley, 1977).

The negative coefficient for the number of requests variable indicates that applications involving more than one request were likely to have been allocated a lower proportion of the level applied for. The result suggests, firstly, that the Department felt more easily able to reduce its outlay per request in such cases, while still being able to grant at least some of the total application bundle. It may also be a reflection of the tendency for applicants involving more than one request to include, to a greater extent, a request for machinery. The analyses in the earlier part of the chapter suggested in turn that machinery requests were less likely to be successful.

A similar analysis was performed in the case of grants, with three decision environment variables (that is, excluding the estimated employment increase variable) being added to the original set of four deviation criteria. A stepwise multiple regression analysis, using these seven independent variables and taking the percentage deviation, *d*, as the dependent variable, was performed using the normal 5 per cent significance criterion. Once again, however, no variable proved to be significant.

The analysis was repeated for just the 12 freight/labour training cases used previously, because of the greater heterogeneity and more abnormal nature of the other 13 requests. But again the multiple regression analysis failed to produce any significant statistical explanation of *d*. The results thus emphasized the heterogeneity of the sample of grants cases.

Influence of the decision environment on absolute deviations

Thus far the emphasis has been on explaining the direction of deviations from decentralisation decision rules in the 1965-1968 period. It may have been, however, that much of the variation in deviations was a result of factors affecting just the absolute size of deviations, viewing large absolute deviations as an indicator of the degree of stress surrounding each decision. This part therefore analyses the importance of this notion, using the original loan sample of 55 observations.

A set of variables to denote different kinds of decision stress situations was developed. The first variable chosen was the value of the request, since the larger the request, the more the Department would stand to lose in the event of an unsuccessful decision. Next, the variable denoting an additional request used earlier was again included. The presence of one or more extra requests is hypothesized to have added to stress by requiring a greater number of decisions to be made. This stress would have obviously increased if the decision was perceived to have been required urgently. Hence a variable to this effect was added (taking a value of 1 if urgency was perceived and 0 otherwise), using file data to see whether any mention of time pressure or urgency had been recorded.

Next, it has been suggested that decisions may be difficult to make when there is either too little or too much information (Mack, 1971). As a surrogate for the former, the number of times that abnormal information (that is, not relating to data required for all loan requests, such as sources of working capital, balance sheet information, and the like) was sought in each case was used. (To avoid problems of skewness in the data, the seeking of information more than twice in a particular case was counted as twice only.) Finding a variable to describe an over-abundant information situation was a more difficult problem. The best surrogate was considered to be the number of card pages, containing relevant decision information, copied out by the author for each case. This was not completely satisfactory, since there was no guarantee that there would be the same degree of relevancy in the information from one case to the next (cases were analysed here before the full relevance of certain information was realized).[15] (To avoid skewness, the upper value for the card page variable was set at 4, but this loss of information was not serious as the number of card pages exceeded 5 only twice.) Finally, a general stress variable was included, denoting whether uncertainty was perceived about whether or to what extent assistance should be given.

The request value variable had previously been tested for regression assumptions with virtually the same sample. A logarithmic transformation had been found necessary to overcome skewness. The other non-binary variables were tested for the various regression assumptions in the usual manner, and found to be satisfactory. A stepwise multiple regression analysis, using the absolute deviation value ($\underline{a}$) as the dependent variable, produced the following equation:

$$\text{(A1)} \quad \underline{a} = 3.5638 + \underset{(6.1483)}{14.5473^*}\underline{x}_{12} + \underset{(5.9933)}{16.5334^*}\underline{x}_{15} \; ; \; \underline{r}^2 = 0.268, \; \underline{SE} = 18.068$$

* Significant at the 5 per cent level

where $\underline{x}_{12}$ denotes the additional request variable and $\underline{x}_{15}$ denotes the uncertainty variable. The signs of both coefficients are in the direction hypothesized, viz., larger values of the variables tended to increase absolute deviations. The latter is the variable which probably came closest to being a surrogate for decision stress, so it is not altogether surprising to see it included. Thus the greater uncertainty surrounding decisions, the more "noisy" was the resulting location pattern. The inclusion of the additional requests variable is probably at least partly a reflection of its inclusion in the previous deviation equation (E1).

CONCLUSION

The present chapter has identified some potentially important components of programmed location decisions of governments. The main finding is that the decision process for loans cannot be interpreted solely in terms of either semi-normative analysis or the satisficing version of the bounded rationality approach.

A distinguishing feature of the programmed decision situation is that there is considerable information about previous cases of a given kind. This enabled the prospective utility of decentralisation applications to be assessed in more precise terms than a binary-valued, satisficing classification. However, because of the existence of uncertainty concerning future applications, there was a need for decision rules about basic types of request in order to provide *a priori* benchmarks of the expected utility per unit of expenditure. In order to decide whether a particular application should be allocated a loan according to the appropriate decision rule, two sorts of information are used: criteria of major importance in determining the contribution to decentralisation, such as expected employment change (relating to the objective regarding regional/state significance) and management rating/ profitability (relating to the viability objective). The semi-normative and decision rule functions broadly reflect the operation of the process to this stage.

Another stage is not reflected, however. This is the inclusion of additional criteria, relatively specific to each decision, to support the final decision about how much of each request should be given. This is because the basic decision rules and criteria do not reflect the particular circumstances of particular decisions. The final decision may also involve a trade off between conflicting criteria (basic or otherwise), with the decision as to whether to use the decision rule being dependent upon the net balance between the conflicting variables. This goes beyond Isard and Smith's (Isard, 1969) concept that satisficing variables may be traded off to produce an overall decision classification of satisfactory/unsatisfactory, since the Department of Decentralisation did not follow an "all or nothing" response to applications for assistance. The situation is further complicated by the fact that criteria themselves may not be seen purely in terms of whether they are satisfactory or not: the intensity with which a particular criterion applied (e.g. the degree of eligibility of different industries) was relevant. In short, the programming decision process fell somewhere between the semi-normative and bounded rationality approaches.

Finally, reflecting the governmental aspect, the decision process also reflected the influence of the external decision environment, in particular. For example, the fact that a factory was likely to close in the absence of a decentralisation loan appeared to override other criteria, presumably because of the political environment within which decentralisation decisions were made. In addition, biases in information availability, determined by the degree of contact between applicants and the Department, were shown to be an important influence on decisions.

Footnotes

1. A loan given to a company intending to set up a factory in Wollongong to employ female labour was also given a value of 1 under this rule, since the rule in this situation was apparently also a 50 per cent one.

2. Employment change not expected to take place within two years of expenditure of the loan was excluded, since the estimates of changes beyond two years were considered to be too unreliable.

3. During the early part of 1965/66 applications were still being referred to the Secondary Industries Inter-departmental Co-ordinating Committee for recommendation or otherwise to the Minister. The Committee was disbanded during the 1965/66 year. Such approvals have also been excluded from the sample since the decision process involved was different to that of the subsequent period.

4. The equation produced was:

$$\underline{p} = 58.7272 + \underset{(0.0743)}{0.3702^{**}}\underline{x}_1 - \underset{(13.6757)}{30.3450^{*}}\underline{x}_6 + \underset{(13.8325)}{55.5272^{**}}\underline{x}_7 - \underset{(0.2365)}{0.5746^{*}}\underline{x}_8;\quad \underline{r}^2 = 0.474,\ \underline{SE} = 17.597$$

** Significant at the 1 per cent level
* Significant at the 5 per cent level

where $\underline{x}_1$ denotes location in a 100 per cent area (subtracting the machinery percentage of the request), $\underline{x}_6$ denotes management rating, and $\underline{x}_7$ and $\underline{x}_8$ are the potential closure and 1965/66 machinery criteria, respectively.

5. Since the 47 observations were drawn from the same population and are in fact mostly the same as the 52 used in the semi-normative analysis, it is assumed that the closure-periphery relationship found in the latter also applied here.

6. The variable relating to the machinery component of 1965/66 requests was omitted because there were too few non-zero observations in each group.

7. The other highly significant loan criterion, the likelihood of closure in the absence of assistance, was not included here because the response of the Department in cases of imminent closure was to give loan assistance rather than grants.

8. This skewness could probably have been removed if a logarithmic transformation of the machinery percentage had been used, but this would have meant that the variable no longer reflected the apparent prediliction of the Department to use actual percentages of request values as decision criteria.

9. The multiple stepwise regression analysis, regressing $\underline{d}$ on the new set of independent variables and again using 5 per cent as the level of significance for the inclusion and retention of variables, produced the following equation:

$$\text{(D2)}\quad \underline{d} = 1.2903 \underset{(15.7789)}{-64.6156^{**}}\underline{x}_6 \underset{(0.2106)}{-0.8393^{**}}\underline{x}_8 \underset{(0.1002)}{-0.2579^{*}}\underline{x}_9 \underset{(18.2744)}{+99.1832^{**}}\underline{x}_{10} \quad ;$$

$\underline{r}^2 = 0.539$
$\underline{\text{SE}} = 15.535$

** Significant at the 1 per cent level
* Significant at the 5 per cent level

10. The very small constant value in (D1) was ignored.

11. Mapped residual values from the regression of $\underline{d}$ on each variable revealed a minor degree of spatial autocorrelation for the clusters of cases at Orange and Yass, each cluster representing several grants to one particular company. This was not felt to be significant, however, since an examination of each grant did not indicate that the Department considered any to be explicitly interdependent.

12. As for loans, the possibility that there was a diminishing marginal welfare decision criterion was tested by including the logarithm of the value of requests as an extra independent variable in the multiple regression analyses of deviations. For two of the original 25 sample observations, the value of the request was not known. The remaining 23 values were then adjusted for consumer price changes between the date of the final decision on each request and June, 1969, and the resulting figures transformed logarithmically. A stepwise multiple regression analysis of the 23 observations, using the same variables as the original 25 observation case above and adding the logarithm of request value as a further independent variable, failed to generate any variables which were significant at the 5 per cent level, however. A similar analysis of the 11 freight and labour training cases (omitting the twelfth because no request value was available) produced the same result. Hence the possibility of a diminishing marginal welfare decision basis was rejected.

13. This particu ar variable was not used in the case of grants.

14. Cases in which there was no expected increase in employment were given a nominal value of one to avoid having to take the logarithm of zero.

15. Three cases for which data on extra information were not available either were omitted from further analysis.

CHAPTER 8

NON-NORMATIVE ANALYSIS OF THE DECENTRALISATION PROGRAMME: NON-PROGRAMMED DECISIONS

The last chapter investigated so-called programmed decentralisation decisions using a non-normative framework of analysis. This chapter uses the same framework to investigate non-programmed decentralisation decisions made by the state government up to 1969. It will be recalled that decisions were considered to be non-programmed to the extent that they were novel and unstructured, with no routine procedure for handling them (Simon, 1965, 14). Since the information and computation requirements for non-programmed decisions are thus likely to be much greater than for programmed decisions, it is likely that a non-normative framework will be even more applicable.

Three principal types of non-programmed decisions with locational implications can be discerned in the New South Wales decentralisation programme up to 1969:

a) the selection of locations which the Department of Decentralisation wished firms to consider;

b) decisions required when firms decided to bargain with the Department; and

c) decisions involving policy changes.

Type a) decisions are probably more structured than types b) or c). They are included in this chapter, however, because of their infrequency and the significant inter-firm differences in feasible locations. Each of the above types of non-programmed decisions is discussed in turn.

SELECTION OF DECENTRALISED LOCATIONS

The number of cases in which the Department recommended to decentralising firms that they consider particular locations, either single towns or a preferred set of towns, was relatively small. It was, however, a significant proportion of those applications which involved factories in new locations rather than *in situ* expansions.[1] Of the 23 such sample applications studied in this or the last chapter,[2] for example, eight involved locational recommendations by the Department. Data for this section have been drawn from these cases.

Characteristics of applications receiving locational suggestions

The most striking feature of the eight applications is that they were all from persons or companies domiciled outside the non-metropolitan area of the state. Of the other 15 applications involving new locations, nine were from Sydney or places outside New South Wales while the other six were from the non-metropolitan area of the state. This contrast is perhaps due to three main factors. The first is that country applicants would probably have had greater familiarity, in comparison with other applicants, with locations in their own area, and hence have been more likely to have already reached a final decision (involving a local location). This seems to be borne out by the fact that five of the six non-metropolitan applicants established factories[3] in their local districts.

Allied to this is a second factor: the tendency of privately owned firms to be more open to subjective influences than public companies (Townroe, 1972, 270). Thus the attractions of locations close to friends, family and home, for example, may be important for private concerns, whereas public companies are probably more likely to consider a wider range of locations to ensure a selection that meets the aspirations of shareholders and management alike. The latter companies are therefore more likely to be open to suggestions from the Department. Again the relevant data support this hypothesis. None of the country applicants considering new locations were public companies, whereas eight of the corresponding non-country applications came from firms which were either publicly owned or else from overseas (the ownership status not being known but probably also public in most cases). Four of these were the subject of locational suggestions by the Department.

The third factor is the tendency for the location decision process to be more detailed, the larger the proposed plant (Townroe, 1972, 270). The largest new factories, in terms of intended employment, were those set up by non-country concerns, the biggest seven all being larger than the proposed 81 employee factory which headed the applications from the country. The average proposed size of the eight factories for which the Department made locational recommendations was 124 employees, compared with 42 for the remaining 15 factories. Indeed, the former group contained five of the total of six factories with proposed employment of 100 or more. Hence the largest factories were set up by Sydney, interstate or overseas concerns, and the presumably more detailed locational decision processes thus involved (arising from the importance of the projects and the lack of local knowledge) implied a greater willingness to consider the Department's suggestions.

The locations selected

It was a two way process, however. The Department itself would have obviously been particularly concerned to ensure that the larger projects, for which its financial commitment was greater, were locationally viable. In two of the eight cases the companies concerned were explicitly invited by the Department to consider locations which would be more accessible than those the companies had in mind. Thus Nowra was suggested to one engineering company as having advantages from the point of view of raw material supply (steel from Wollongong) in comparison with Taree, Port Macquarie and Coff's Harbour, which were the potential locations the firm was considering. In the other six cases the sets of locations suggested by the Department generally comprised both minimum cost and high social welfare (but still viable) locations, the latter tending to predominate when the company concerned had already selected its own set of locations for further examination before approaching the Department. Locational aspects of individual cases are discussed below. In addition, two case studies are briefly presented to illustrate ways in which the Department and applicant companies interacted to form locational sets and select the best location from those sets.

Figure 8.1 shows the locations suggested for consideration by the Department in six cases, together with those locations originating from the companies themselves and the final location chosen.[4] In one of the other two cases the locations suggested by the Department were not available on file, and in the remaining case a location with greater accessibility was suggested without nominating a specific example.

The most significant overall feature of the maps is the general concentration of locations in areas relatively close to Sydney. The absence of locations suggested by the Department in the north of the state, particularly the upper north coast, is especially noticeable. The reason is that in all six cases access to Sydney was important. In four of the cases the head office was in Sydney, and in the other two cases Sydney was the main market. (In case 6 the relatively scattered

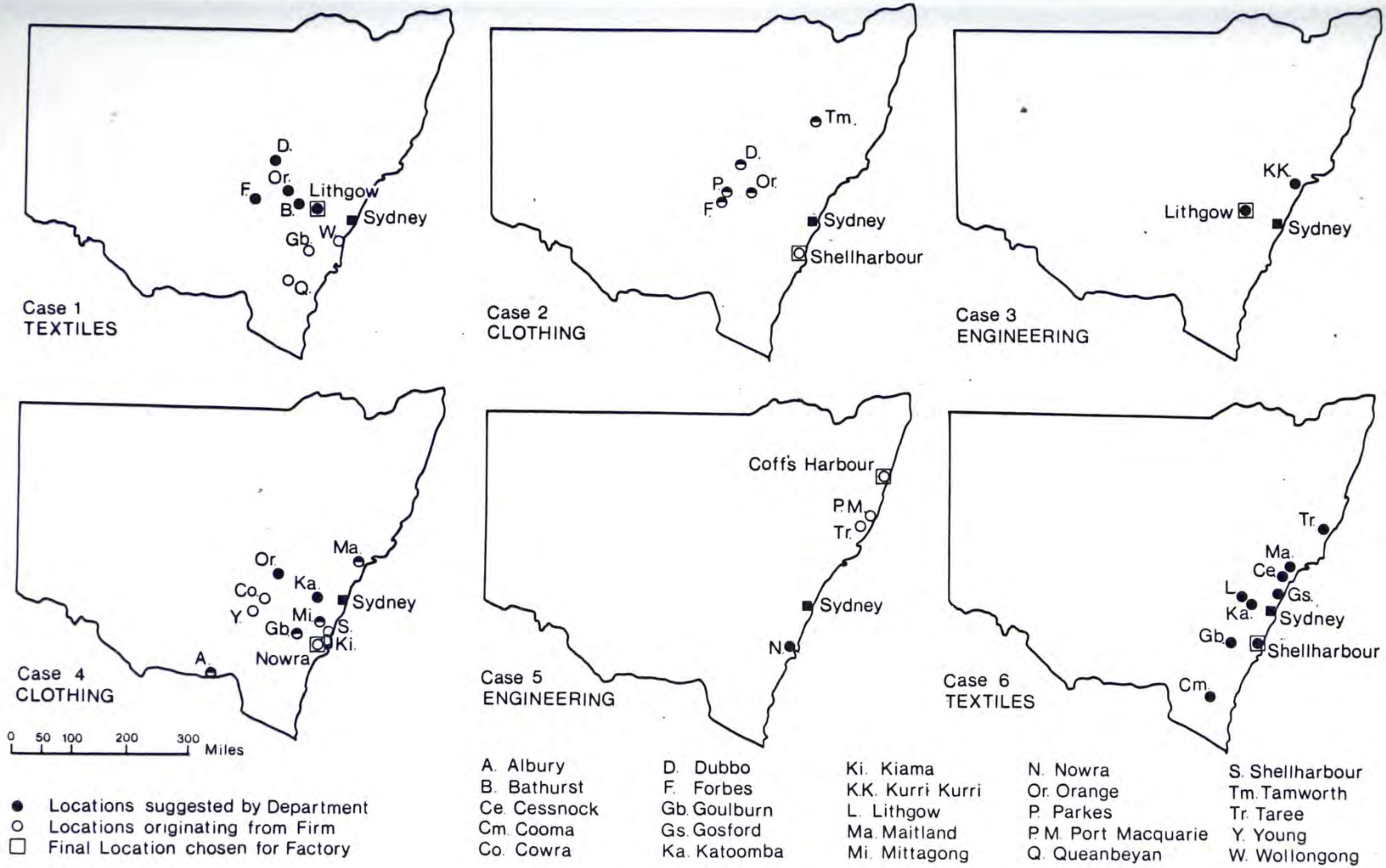

Figure 8.1 Locational Search Sets of Six Firms

set of locations suggested by the Department was reduced to Lithgow, the Blue Mountains (Katoomba), Gosford and Shellharbour when the Company's need to be close to Sydney became clear.) The Department obviously only recommended locations that it considered viable for the companies concerned, and hence was unable to suggest certain areas such as the north coast which had higher regional welfare priority but which were more remote.

The sites chosen by the eight non-country concerns not receiving locational suggestions from the Department were, by contrast, more spatially scattered. For four of the factories accessibility to Sydney was not important: two were located so as to fill gaps in the supply of goods with regional markets, and the other two were primary processing units requiring proximity to their main raw material sources. By contrast, the non-country firms locating closer to Sydney were usually in the clothing or textile industries (only two firms receiving location suggestions from the Department was not of this type). For them, two location factors were generally paramount: accessibility to Sydney, and the availability of female labour. The need to take account of two factors rather than one would have acted to make the best site less clearcut, and increased the need to investigate a set of alternative locations.

Two of the remaining four factories established near Sydney by non-country firms without the Department's locational guidance were set up in North Richmond, just outside the metropolitan area, by nearby Sydney entrepreneurs. Locations such as this are so close to Sydney as to fall probably within the personal "action space" (Wolpert, 1965) of a significant proportion of company decision makers living in Sydney and thus be very familiar to them. Hence factories requiring locations which are extremely accessible to Sydney are less likely to require a comprehensive search procedure then those with lower accessibility requirements. Another reason for the lack of Departmental recommendations in these cases is the fact that, while such locations were within the scope of the relevant Act, they were not encouraged by the Department because they were not considered to contribute to Departmental objectives as much as more distant locations.

Another influence may be that, as noted, the factories set up by non-country entrepreneurs without locational guidance from the Department were smaller than those having such guidance. This can be interpreted as a direct corollary of the more scattered locations of smaller factories. Webber (1972, 204), for example, has given theoretical reasons in terms of the effects of uncertainty on plant size why smaller plants will tend to be located further from the centre of the market than larger plants. In turn, as argued earlier, the smaller the plant size, the less the likelihood that the location decision process will be a detailed one. Hence the relationship between a more scattered location pattern and a lack of locational guidance from the Department could be also given an uncertainty-based rationale.

Another significant feature of the Department's location suggestions shown in Figure 8.1 is that all the towns concerned are medium-sized or larger. The smallest of the suggested towns is Forbes, which had a population of 7,367 in 1966. This emphasis is mainly due to the large employee size of the proposed factories and their consequent need for female labour pools of a magnitude which only the larger country centres possessed. In part, however, the emphasis may have been due to perceptual factors, with large centres being nominated simply because they were better known to departmental officers and came more readily to mind. The evidence from company 4 in Figure 8.1 points in this direction. The map shows that it considered towns with a smaller population than Forbes, such as Young, to be potentially viable for its intended clothing factory of 150 employees.

Another factor influencing the Department's perception of the availability of female labour seems to have been the industrial structure of each town. Orange and Lithgow, for example, were suggested more often than other towns of similar size and accessibility, such as Bathurst, seemingly because they contained large blue collar industries with predominantly male employment, through which significant female labour pools would be generated. In Orange's case there may also have been a favourable perceptual bias because the town's major industry dominates its industrial structure and is well-known as an example of a decentralised industry. Moreover, the industry received freight subsidies from the Department amounting to about a quarter of a million dollars annually, thus making the industry, and hence the town, even more potentially dominant in the mental maps of the departmental officers. In the case of Lithgow the Department was motivated by welfare considerations, arising from the town's declining economy which had made it one of the 100 per cent loan assistance areas. Maitland and Cessnock, which had industrial structures and loan assistance provisions similar to Lithgow's,were however suggested less frequently by the Department. This was probably due to the considerable success already achieved in attracting clothing and textile firms to that area (c.f. Figures 2.3 and 2.4).

A further influence affecting the Department's location suggestions was the perception of the policy of local councils toward industrial development. Thus Dubbo, Forbes and Bathurst were suggested in case 1 in Figure 8.1 because of the favourable attitude of the municipal councils to new industries. The reappearance of the first two towns in the search set of the same company at a later date in case 2 probably also owes something to this reason, assuming that the investigation in case 1 produced sufficiently encouraging information for both places.[5] Finally, reference has already been made to the main influence on the Department's recommendations involving engineering companies (cases 3 and 5), namely, accessibility to low cost steel supplies (either from Newcastle or Wollongong).

A natural consequence in cases in which the Department's location suggestions made up the entire search set of applicant companies is that the final location chosen necessarily evolved as a direct consequence of the perceptions of the Department about viable locations for the company concerned. Three of the eight cases in which departmental recommendations were made were of this kind. In three of the other five cases the firms involved had investigated various locations before approaching the Department, while in the other two cases no investigations were carried out until the complete final search set (including the Department's contribution) had been defined. In all three former cases (and also in one of the latter two), the firms eventually chose a centre which they, and not the Department, had originally put forward. This tends to indicate that where ideas about the best location were formed before approaching the Department, they were retained in the face of later information. This conforms to previous findings that greater weight is given to information coming early in the location search sequence (Townroe, 1973, 54).

Two case studies

Case 1 (see Figure 8.1). The company concerned came to the Department seeking financial assistance to set up a textile plant with 170 employees. The company had no preconceived ideas about location at that stage. The Department had mentioned the proposal to the Mayor of Lithgow. The Mayor had contacted the company, whose executive manager then decided to visit the town. The

Department also suggested that the company consider Orange because of its known labour pool, and Bathurst, Dubbo and Forbes because of the respective councils' policy of assistance to new industries.

The company itself subsequently added Wollongong, Goulburn and Queanbeyan to the Department's suggested list of potential locations. Forbes and its neighbour Parkes were then ruled out by the company because they were considered too far from Sydney. Although not mentioned on file, Dubbo was also probably omitted partly for the same reason, allied with the fact that the company had closed a branch plant there some five years earlier. The executive manager then made a "grand tour" of the remaining locations.

The Department stressed to the company its preference for Lithgow, of the centres being considered, ostensibly because of the large female labour pool available there for a factory of the type envisaged. In fact, similar pools of labour were available in areas near Wollongong, for example, so that the Department's preference should perhaps be seen rather as an opportunity to stimulate the declining economy of Lithgow, given that it appeared to meet the minimum requirements of the company. The company then decided to locate at Lithgow. It seems quite possible that its attitude was influenced by the fact that it was seeking a very large amount of factory finance from the Department, as well as eight other forms of assistance. Adoption of the Department's locational preference would thus have strengthened the company's hand in its subsequent negotiations with the Department.

Case 4 (see Figure 8.1). In this case the company wanted to set up a clothing factory having about 150 employees. In its initial approach to the Department, it mentioned that it would prefer to locate in a larger country centre, and suggested Warilla (near Wollongong), somewhere along the Sydney - Melbourne railway line or the Newcastle area as possible locations. The Department suggested to the company that it should also examine Orange and other major western towns. The company concurred, provided these towns had adequate labour.

The Department then arranged for advertisements to be placed in local media calling for women experienced in sewing machine work, in an attempt to ascertain how much suitable labour would be available for work in the industry in each area. In the light of initial discussions between the company and the Department, the survey was initially proposed to cover Orange, Maitland (near Newcastle), Goulburn and Albury (the latter two being on the Sydney - Melbourne railway). Newcastle and Wollongong were not included because of their recognized availability of labour. The company asked that Nowra, Kiama, Cowra and Young be added to the locations being surveyed. The first two were considered to be sufficiently close to Sydney and the Sydney - Melbourne rail service, while the last two were on the Olympic Highway, a recognized alternative road route between Sydney and Melbourne. At the Department's suggestion, Katoomba was also included in the survey. Albury, however, was finally excluded, doubtless because of the company's obvious preference for locations within reasonable distance of Sydney.

As a result of further discussions with the Department, and before the surveys were commenced, the company decided to limit its feasibility studies to Maitland, Goulburn, Katoomba, Cowra, Shellharbour (near Wollongong), Nowra and Mittagong. The latter had apparently been added as a result of discussions with the Department. Orange, on the other hand, was dropped because the company considered there would be competition for labour from the town's major domestic appliance industry. Following the results of the surveys, the company chose Nowra as the site for its plant.

These two cases, particularly the second, indicate the manner in which the Department and applicant companies could interact in arriving at a final location decision. The Department's role can be seen primarily as one of providing information about sites it saw as being suitable in terms of company requirements, but which the companies themselves may not have properly considered because of their less comprehensive knowledge of the various possible locations. The Department's expressed preference for Lithgow in case 1, however, indicates that welfare considerations could play a subordinate role. Such preference for disadvantaged areas, beyond the normal 100 per cent loan provisions, is a theme which was also apparent in other areas of the administration of decentralisation policy. It applied to Lithgow and the North Coast rather than to the other principal 100 per cent loan area of Maitland-Cessnock, where the full loan assistance and proximity to Newcastle generated a significant number of industrial jobs. In attempting to achieve the same success in Lithgow and the North Coast, tactics such as stressing the Department's desire for growth in those areas were obviously simpler to initiate than a further form of special financial assistance.

DECISIONS IN BARGAINING SITUATIONS

While the decision process in decentralisation aid cases handled by the Department between 1965 and 1969 did not generally involve any participation by applicants beyond making the initial request, this was not so in a number of instances. Such cases, in which the original request was the subject of further representations from the applicants' side, are here defined as bargaining situations. This section investigates potential influences on the Department's decision process in these situations. The results of the analysis suggest, firstly, that bargaining was less likely to have been successful for companies if more than one request was involved and, secondly, that bargaining was more likely to have achieved gains if the project or company was small and able, following the intervention of a member of parliament, to produce supporting information previously overlooked by the Department.

A total of 21 cases involving bargaining situations can be identified among the full sample of requests for the 1965/66 - 1967/68 period. Of these, 10 did not involve full bargaining in that either the initial offer by the Department was the same as the request, with the applicant raising this request following the offer, or else the representations were only of a supportive kind from outside the applicant company and made before the Department's initial decision. As with cases in which the Department made recommendations concerning location, cases involving bargaining tended disproportionately to involve large projects. Of the 11 examples of full bargaining, five were for projects generating estimated employment of 100 or more. By contrast, none of the 40 sample cases used in Chapter 7 which did not involve bargaining related to projects of this size.[6] This can be related to the tendency noted in the previous section for larger projects to involve more detailed and "rational" decision processes, in the sense that bargaining is intended to produce a result closer to the preconceived objective. It can also be related to a tendency for more important companies to perhaps be willing to use their strength in bargaining with the Department, since the five largest projects comprised the only three public companies in the bargaining sample and the two largest (in terms of assets) private companies.[7]

The number of bargaining cases provides an opportunity for at least crude modelling of the bargaining process. Two surrogate measures of the gain to applicants from bargaining have been used here. The first is the deviation of the percentage of the request granted from the percentage which would have been allocated using the relevant standard rule (see previous chapter). The second, which recognizes that the improvement on the Department's initial offer may be a better indicator of bargaining success, is the difference between the initial offer and the final loan or grant, as a percentage of the request. Each measure is analysed in turn.

Influences on bargaining resulting in deviation from standard rules

In an attempt to discern factors influencing the extent to which bargaining resulted in deviations from the standard rules, multiple regression analyses were performed in which the deviation was regressed on various potential explanatory variables. Although the total decision process cannot be quantified it is nevertheless felt that dummy variables (particularly of the binary-valued 1-0 type) are capable of capturing a good deal of the process.

Perhaps the most obvious factor potentially influencing bargaining success, as developed in the works of Galbraith in particular, is the relative size of the bargaining participants, with larger size giving greater bargaining power. In a locational context this factor has been alluded to by Wolpert (1970, 228), for example. In the present case it has been denoted by a surrogate measuring the existing size and status of the applicant company. A value of 1 was given if the company was an important one, as denoted either by being public or having more than 300 employees. A value of 0 was given otherwise. A closely related variable was included as another measure of size. This is whether the project was to be a large one, the Department thus having more to lose in terms of its stated evaluation criterion of regional or state significance. A value of 1 was accordingly given if the project was expected to generate employment of 50 or more,[8] and 0 otherwise. Binary measures of these two size variables were preferred to avoid potential problems arising from skewness in the original data, but the resulting big/small classification is also more in accord with a bounded rationality framework than the original data.

The next two explanatory variables chosen for testing are related to Wolpert's (1970) concept of bargaining between public and private sector groups as a product of stress responses. The degree of stress experienced by the Department in a particular bargaining situation might be expected to have been at least partly related to the number of representations made to the Department concerning a particular request, with more representations causing increased stress. Further, representations from local members of parliament and local councils might be expected to have been more stress-inducing than those from the applicant himself, because of the greater political power of the former. Hence two variables were developed to measure the effect of representations to the Department: the total number of representations or approaches recorded on file in relation to a particular request, and the number of representations made only by the local member of parliament or by the local council.[9] The total number of representations was preferred as a variable to the number of representations by the applicant company itself as it was considered that company and non-company representations may have acted as substitutes and thus required a combined variable.

The remaining two variables tested were also used in the previous chapter, but are included here for slightly different reasons. The number of requests variable (taking a value of 1 if more than 1 request and 0 otherwise) was put in, like the two variables just discussed, as a measure of the pressure exerted on the Department by the applicant. The variable denoting previously successful assistance to the applicant (value 1 if this was the case and 0 if not) was included as a successful learning experience surrogate.

These six variables formed the set of independent variables used in the multiple regression analysis of percentage deviations from the standard rules (_d_) for the 21 bargaining cases. Residuals of the regression of _d_ on values of each of the variables showed some spatial autocorrelation in the far north coast observations, with three of the five such points consistently producing high negative residuals. All three related to applicants in industries with a natural non-metropolitan location advantage and therefore not usually eligible for assistance. The fact that some assistance, albeit less than provided by the standard rules, was given in the three cases concerned illustrates how assistance to such industries was able to be used as a supportive equity measure in the north coast region.

The multiple regression analysis, employing the usual stepwise regression technique with a significance level of five per cent for inclusion and retention of variables, produced the following equation:

$$d = 2.5000 - \underset{(8.0471)}{22.7727^{**}\underline{x}_1} \quad ; \quad \underline{r}^2 = 0.297, \quad SE = 18.417$$

** Significant at the 1 per cent level

where $\underline{x}_1$ is the number of requests variable. The residual values of the regression of $\underline{d}$ on values of the requests variable displayed heteroscedasticity. Since the variable entered the equation at the 1 per cent significance level it would perhaps still have been significant at the five per cent level in the absence of heteroscedasticity, although this is not certain.[10]

The coefficient of the requests variable in the equation indicates that applications involving more than one request received about 22 per cent less, on average, of the total amount requested following bargaining than applications involving only one request. This is contrary to the hypothesized result but is in line with a similar result in the previous chapter regarding programmed decisions. There it was suggested that extra requests enabled the Department to reduce its outlay but still avoid politically damaging total refusals by granting less than the total of requests. The same seems to have applied in bargaining situations. Thus it might be concluded that extra requests served to increase the bargaining power of the Department rather than the applicant, by giving the Department a greater choice of solutions more or less acceptable to the applicant.

The sample of 21 cases used in this analysis includes, as noted, 10 cases which did not involve full bargaining. In order to see whether the inclusion of such cases distorted the results, the analysis was re-iterated using just the 11 full bargaining cases as observations. This time, however, no variable generated an F value which was significant at the five per cent level or better, and so no regression equation was produced.

While this appears to negate the initial 21 case result, closer consideration of the data indicates otherwise. In particular, nine of the 11 full bargaining cases involved applications with more than one request, whereas in only two of the other 10 cases was this so. When added to the fact that the full bargaining cases included six of the seven negative deviations and excluded the only positive deviation, it can be seen that the Department tended to apply the appropriate standard rule where there was only one request involved, and offer less in other cases. This accords with the result of the regression analysis for all 21 cases.

Influences on bargaining resulting in improvement on the initial offer

The distinction between full bargaining and other cases highlights the fact that in the latter instances full bargaining was not necessary because the Department's initial offer met the request, in terms of the appropriate standard rule. In the full bargaining cases, however, the initial offer fell short of the request and bargaining was initiated in order to improve the offer. A measure of the gain from such bargaining is the resulting improvement on the initial offer as a percentage of the final allocation. This measure (denoted *i*) is used here as a surrogate for second round bargaining success: potential influences affecting its value are now analysed.

As before, multiple regression analysis was used in order to isolate factors causing significant variation in the degree of bargaining success. The same set of six independent variables tested above for the first measure of bargaining success was used. A stepwise multiple linear regression of *i* on the six independent variables for the 11 full bargaining cases, employing the usual significance level criterion of five per cent, produced the following result:

$$\underline{i} = 75.0000 - 58.8571^{**}\underline{x}_1 \quad ; \quad \underline{r}^2 = 0.508$$
$$(19.3016) \qquad\qquad SE = 30.795$$

** Significant at the 1 per cent level

where $\underline{x}_1$ is the project size variable. Residual values from the above regression equation estimates of $\underline{i}$ displayed some heteroscedasticity. The fact that the project size variable was included at the one per cent significance level indicates that it would perhaps still have been significant at the five per cent level in the absence of this heteroscedasticity, although as in the previous equation this is not certain.

The equation indicates that applicants seeking funds for projects intended to employ 50 or more persons received an average of 59 per cent less gain on the initial offer than did other applicants. This is in the opposite direction to that hypothesized. An examination of the four cases in which intended employment size was under 50 helps to explain the result. In three of the four cases the requests were initially refused completely, but then eventually granted in all or most part. The key factor in each case was the intervention of the local member of parliament with representations in support of the request following the initial refusal. This caused the Department to reconsider each request, and in all three cases this caused new information which was favourable to the applicants to come to the Department's notice. Two of the requests were initially ruled out because they were thought to be for (ineligible) service-type industry. The subsequent investigations, however, disclosed that in one instance significant manufacturing would be carried out while in the other, work presently sent to the metropolitan area would be carried out. In the third case the trading position of the applicant was found to be much better than originally believed.

The result of the regression analysis therefore suggests that in the case of large projects there was no significant gap between the relevant actual facts and those perceived by the Department, whereas there was such a gap for small projects. Besides the lesser attention the Department might have been expected to give to less important requests, the positive relationship between the importance of the applicant company and the importance of the project ($\underline{r}$ = 0.69) would have pointed to this situation. Three of the five largest project proposals to the Department involving full bargaining were made by public companies while another was from a firm with headquarters in Sydney.[11] In the previous chapter it was suggested that information concerning such companies would be better than that for non-public or non-Sydney firms, and that a bias operated in non-bargaining cases in favour of such companies. The result above suggests that other applicants[12] could overcome this bias to a certain extent by invoking the support of their local member of parliament as a means of inducing the Department to investigate their requests more fully. The attention given to such representations by the Department reflected its external decision environment, and related to the political pressure members were seen as being able to exert.

The intensity of representations by parliament members and local councils (but predominantly the former) tended to be locationally differentiated. All of the four instances in which there were two or more such representations were concerned with projects to be set up in the maximum assistance areas, whereas only two of the other seven full bargaining cases involving less than two such representations involved such projects. A 2 x 2 chi square test using Yates' correction did not indicate the tendency was significant at the five per cent level (owing to the small sample involved), but what tendency there was could be hypothesized to have been the result of the greater need of such areas for development and hence greater pressure on local elected representatives to achieve this objective.

The influence of threats

Finally, some attention should be given to the influence of threat on bargaining gain. This is the mechanism by which improvements are achieved within the locational bargaining framework of Wolpert, perhaps the most comprehensive such framework so far developed (Wolpert, 1970). Of the 21 full and quasi-bargaining cases examined, only four appeared to involve overt threats (as recorded on file) on the part of the applicants, three being full bargaining cases. All were threats to either locate the proposed factory in Sydney (or not shift it from Sydney), or to close an existing country establishment. However, only in one of the four cases, a full bargaining case, did the existence of such a threat coincide with an improvement on the Department's original offer. Thus two of the three full bargaining cases involving a threat did not yield any bargaining gain, whereas in seven of the eight remaining full bargaining cases the Department's initial offer was improved.

This suggests that the threat concept has limited worth as an explanatory tool in the context of the bargaining cases studied here. This is perhaps because of the particular decision environment of the Department: if a factory carries out its threat to locate in Sydney, there is no perceptible worsening of congestion and pollution in Sydney as a whole; on the other hand, the country community proposed as the alternative location would not necessarily know of this and hence not cause any political repercussions.

THE EMERGENCE OF CHANGES IN POLICY

Decisions to change existing policy are perhaps the most fundamental of all government decisions pertaining to location, since they set the framework within which other location decisions are made. The existence of such policy changes is essentially an aspect of bounded rationality (Radner, 1975, 254), since normative decision theory postulates a given set of goals and a single optimal strategy for achieving those goals. The general lack of file data on the reasons behind such decisions in the New South Wales decentralisation programme in the 1960s makes retrospective analysis difficult, but enough data relating to policy changes exist in files on individual applications for assistance, however, to enable important influences to be picked out.

A study of the circumstances of policy changes in the Department up to 1969 suggests that there were three basic types of change:

a) Changes arising from a review of existing policy in which new policies were applied to certain classes of cases completely outside existing policy;

b) Changes resulting from a recognition that the emphasis on certain types of cases within the ambit of existing policy should be altered; and

c) Changes in which exceptions to existing policy evolved into a new policy of their own.

Type a) changes are the result of a discontinuous process by which basic policies appear or disappear discretely. Types b) and c) represent a more evolutionary process in which existing policies are gradually modified to produce new ones. The former may be seen as involving changes in the goal criteria applied to cases qualifying for consideration, while the latter involves changes in the satisficing rules by which particular cases qualify to be considered for assistance. Each type of change is analysed in turn.

New policies widening the programme's scope

The introduction of new basic policies which widened the decentralisation programme's scope, by providing assistance for previously ineligible firms or areas, was the most important type of decentralisation policy change. The rarer instances of revocation of existing policies, which rendered certain cases ineligible, were similarly significant.

The most important example of this type of new policy is the set of measures introduced following the election of the Liberal-Country Party coalition government in 1965 (Chapter 2). On the face of it, the origins of the 1965 policies are due to political factors external to the Department. Thus one obvious fact is that the coalition stood to gain in electoral terms from the promised measures. For the Country Party in particular, the decentralisation pledges were important in confirming its projected role of protecting country interests, especially as the proposed measures widened the focus of the programme away from the coalfield towns held by Labor (opposition) MPs. More fundamentally, the emergence of decentralisation as a significant issue in the 1965 election could be viewed, in the terms of Hirschman (1958) and Friedmann (1972), as an attempt by the country population to force the government to adopt measures to redress the lack of balance in development between the core (Sydney) and the periphery (country areas) of the state.

A more cognitive factor may also have operated, however. In the early 1960s the Department commissioned Dr G M Neutze of the Australian National University to carry out a study of the costs of traffic congestion in large and small urban areas. The study indicated that the costs of increased traffic congestion arising from further growth in Sydney would be many times the costs in smaller centres (Neutze, 1965, 58). The results appeared to be an important factor in widening the arguments in favour of decentralisation to include the question of optimum city size (as evidenced by its incorporation, including reference to Neutze's study, in the second reading speech on the State Development and Country Industries Assistance Bill).[13] In terms of Hall et al's (1975) identification of factors involved in the emergence of new social policies, the study had several important dimensions: it gave legitimacy and support to the expansion of the programme; it enabled the programme to be associated with a wider goal, the better planning of Sydney, and thus at the same time helped to reduce the scope for city-country conflict; while the fact that it produced new, authoritative results was perhaps itself helpful in producing a suitable climate for the new policies (c.f. Hall et al, 1975, 504). Finally, since one end result of the 1965 measures was a significant expansion in the Department's size, the funding of the study by the Department could perhaps partly be interpreted in terms of an objective of expanding the bureaucracy's size (Tullock, 1976). Although Hall et al's legitimacy and support concepts seem more directly appropriate in this respect these have the effect of strengthening the bureaucracy and thus complementing the goal hypothesized by Tullock.

A cognitive factor also appears to have operated in another regard: the source and timing of particular types of policies introduced in 1965/66 and in other years. In proposing the new measures to parliament in his second reading speech in 1966, the Minister for Decentralisation and Development referred to his recent trip to the United Kingdom, where he had investigated the steps taken by the government to overcome regional disparities. Three of the measures subsequently enacted were already being used in the UK: the advance construction of factories for sale or rent, assistance for the purchase of machinery, and the extension of assistance to non-manufacturing firms. The suggestion that diffusion of policy innovations from the UK to New South Wales was occurring is supported by a comparison of the dates when equivalent regional policies were introduced in the UK and New South Wales (Table 8.1).

Table 8.1

Date of Introduction of Regional Policies:

United Kingdom and New South Wales

Policy	Year of introduction[1]	
	United Kingdom	New South Wales
Loans to firms	1936	1960
Subsidies on operating costs[2]	1937	1958
Assistance for key worker housing	1950	1958
Exceptional grants for losses during establishment period	1950	1962
Assistance to non-manufacturing firms	1958	1966
Assistance for machinery purchase	1963	1966
Labour training subsidies	1963	1958
Advance construction of factories	1963	1966

1. Date of enactment of relevant legislaticn, where appropriate.

2. Eligible operating costs comprised rent, rates and income taxes in the UK, and water, gas and telephone charges in NSW.

Sources of United Kingdom data: McCrone (1969), Millard (1974)

With the exception of labour training subsidies, New South Wales policies were introduced three or more years after the corresponding

UK policies. There is also rough correspondence in the order of introduction: the 1966 measures in New South Wales corresponded to policies introduced in the UK after 1950. The notion that the UK was the source of various New South Wales policies is supported by the UK's acknowledged role as the leading proponent of regional assistance policies in this period, and the special channels for the dissemination of information from the UK provided by the New South Wales Government Office in London and the visits to the UK of ministers and officials seeking investment. The timing of new policies is, in turn, a potentially significant determinant of the overall spatial pattern of assistance, since the locational impact of different policies may vary: labour training subsidies in New South Wales, for example, were mostly paid to clothing and textile firms, and these in turn had a preference for locations close to Sydney. It is not suggested, however, that the UK policies were the only determinant of New South Wales decentralisation measures. For example, the earliest form of assistance in New South Wales, freight subsidies, has never bten part of the UK regional policy package. Nevertheless, Sheriff's (1976, 40) observation that bureaucracies engage in a considerable search for practices abroad when a significant change is contemplated appears to be valid for the New South Wales decentralisation programme.

Only rarely did the force for the introduction or revocation of policies originate internally. Thus the discontinuance in the early 1960s of the policy of subsidising 75 per cent of the cost of trunk telephone calls made by decentralised industries reflected a learning response to the policy's effectiveness. The number of claims for small amounts being processed by the Department was considered excessive, and the subsidies were not generating sufficient additional employment.

Changing the emphasis on eligible cases

Major, rapid expansions of government programmes in which the basic parameters of policy are set by legislation, such as occurred in the case of decentralisation in 1965, do not mean that the ensuing policies are completely static. Peters (1976), for example, suggests incremental policy changes will be introduced by the bureaucracy in response to alterations in the availability of resources. Other changes in the external and internal decision environments of government departments, brought about external stress or learning, for example, could also be hypothesized to induce policy modifications within the legislative framework. One such set of modifications is analysed next: changes of emphasis on certain cases already within the ambit of the decentralisation programme. The other main kind of modification of decentralisation policy, arising out of exceptions to existing policy, is analysed in the final part of the section.

An instructive example of policy modifications of the change of emphasis type is loan assistance to the fringe zone around the Sydney metropolitan area. Before 1968, a policy rule that suitable applicants in this area received 60 per cent of the amount requested was applied, the same as elsewhere in the state outside the maximum assistance areas. In several cases, however, it had been recognized that assistance to this area did not contribute as fully to the Department's objectives as assistance to areas further from Sydney (as indicated by the trade off between close proximity to Sydney and more favourable factors described in the last chapter (c.f. Figure 7.3)). When a further application for fringe zone assistance was made in 1968, a decision was therefore taken by the Department to reduce the usual proportion lent in this area to one-third of the total request. It appears that the fringe zone applications themselves had been required to focus the Department's attention on the lower decentralisation benefits involved.

The decision in 1965 to increase lending for suitable North Coast projects from 60 per cent of the request to 100 per cent can perhaps also be included as an example of a change in policy emphasis, as it did not require supporting legislation. In decisions relating to North Coast applications before 1965, the region's stagnant economy and poor employment prospects had been consistently stressed, particularly by members of the Secondary Industries Inter-Departmental Co-ordinating Committee (the body then responsible for making recommendations on decentralisation assistance to the Minister). Such feedback would have heightened the Department's awareness of the problems of the region. By implication, the then existing 60 per cent loan policy had been insufficient to generate enough growth to overcome the economic inertia. At the same time, the lack of growth would have generated local political pressure of its own, thus exerting at least low stress on the Department as long as the existing policy remained. Hence the decision to make North Coast locations eligible for maximum assistance could be interpreted in Simon's (1957b) or Cyert and March's (1963) terms as a response to the failure to meet the Department's aspirations. At the same time, however, direct external stress was probably also important, emphasizing the distinctive nature of the decision environment of governments.

Evolution from policy exceptions

This third type of policy change can be understood in the light of the importance of precedent in government administration. Precedent is an administratively economical response to uncertain situations (Rose, 1976, 26; Mack, 1971, 127), such as that analysed here involving applications for assistance that were marginal in terms of existing policy. In the particular case of government decisions, precedent is particularly useful as a means of being even-handed to private individuals and organizations, thus avoiding the political repercussions of perceived bias toward particular sections of the community.

Once a sufficient number of policy exceptions of a particular kind have been approved, the tendency to rely on precedent will act to cause the exceptions to become the rule. This factor is only part of the mechanism behind the emergence of policies in this fashion, however. Other questions which need to be answered here are the causes behind the initial appearance of policy exceptions, and the reasons why some types of exceptions ultimately emerge as new policy while others do not.

In general, the factors behind the initial appearance of exceptions to existing decentralisation policies were primarily related to some kind of stress perceived in relation to the cases concerned. An example concerns the Department's policy towards assistance to sawmills. Originally, assistance was limited to providing housing for key personnel, because of the industry's natural locational advantage in country areas. Following the burning down of one large sawmill, the local Regional Development Committee (one of a number set up by the Department to foster decentralised development) pressed for reconsideration of the Department's factory loan policy towards sawmilling. At the Committee's meeting the company's bank manager expressed concern at the sawmill's loss of production because of the company's large overdraft. For the Department, a rationale for assistance was provided by the support[14] which such a loan would have given to State Forestry Commission policy: the company had previously bought out three smaller mills and consolidated them into a more economic scale of production, a trend which the Forestry Commission considered to be very desirable and necessary in that particular area. A factory loan was therefore provided to re-establish the sawmill. Applications for loans by other sawmills were thereafter treated on the basis that the industry was now eligible for the usual range of decentralisation assistance.

A related class of exceptions to policy occurred when country factories of a type not normally eligible for assistance because of natural locational advantages over metropolitan firms, were granted loans when faced with abnormal competition from Sydney or interstate. In Lismore, for example, loans were granted to a soft drink firm and a brickworks to help them meet competition from Brisbane manufacturers. In another case, a factory loan was given to a wooden box manufacturer facing interstate competition who was then burnt out. Loans were also given to at least two other firms in "natural" country industries (soft drinks and fruit processing) to enable production to be shifted from Sydney. In the first three cases the competition or fire posed a real threat to production and thus produced a politically stressful decision environment which the Department changed by giving assistance. The latter two cases, however, could perhaps be better interpreted as a learning response to feedback from situations in which existing policy had been shown to be too inflexible.

A third example related to the provision of working capital loans to companies on the verge of closing. The Department constantly stressed that working capital assistance was outside normal policy. It was nevertheless a usual response to the infrequent cases of potential closure. The critical nature of these cases, politically and otherwise, thus required a response which would be immediately effective, regardless of whether the response was official policy or not.

These examples relate to the first aspect of the evolution of new policies from exceptions to existing policies, that is, the ways in which these exceptions originate. The second aspect, the reasons why certain types of exceptions evolve into new policies, is more difficult to analyse partly because the evolution tended to be an implicit process.

A factor common to such evolutionary policies is that they tended to involve cases which occurred fairly frequently. This was certainly true of requests for machinery, despite legislative authorization in 1966, because of doubts whether sufficient funds would be available to satisfy all worthwhile applications. The significance of frequently occurring cases of the necessary type as a condition for the evolution of a new policy is understandable when viewed in terms of administrative costs. A large number of cases would increase the incentive to reduce administrative costs by adopting a uniform approach (thereby implying the adoption of a policy) toward such cases. Given that exceptions had already been made in favour of particular applicants, political pressure, implicit or explicit, to increase the proportion of such decisions would then have acted to ensure that the uniform approach was in the direction of the exceptions that had already been made.

On the other hand, there was also a relatively large number of cases involving country industries with supposed location advantages over city firms, which were assisted because of interstate or metropolitan competition. Such cases were never accepted by the Department as constituting a separate policy group, however. One factor appears to have been the difficulty of assessing whether the competition in particular cases was due to the applicant's inefficiency or to disadvantages suffered purely by being non-metropolitan. The distinction was significant, with the second type of disadvantage being the preferred basis of approval. Lack of information concerning the true reason for competition would have again meant that consistent criteria on which to base a policy were not always available.

This reference to information availability highlights the significance of uncertainty in the policy evolution process within the Department, and the importance of opportunities for familiarisation and learning to reduce that uncertainty and enable a commitment to a new policy to be made. Frequently occurring cases of the same type would thus have provided such opportunities, in addition to providing the administrative cost incentive for a uniform approach.

CONCLUSION

This chapter has investigated the three most important types of non-programmed decentralisation aid decisions having locational implications. While the nature and scope of each type of decision varied considerably, there are certain common threads running through them which enable general influences on such decisions to be identified.

The most apparent of these common factors are related to the external decision environment of the Department: information availability and interdependence with the rest of the community. These appear in one form or another throughout the analysis as influences on unprogrammed decision patterns over the period studied. The selection of location search sets for applicants by the Department, for example, was seen primarily as a means of increasing the knowledge of applicants regarding efficient locations for production. Conversely, the Department's own initial lack, and subsequent acquisition, of correct information in the case of small projects was put forward as the basic reason why the applicants concerned were able to obtain significant improvements on the initial offers of assistance.

Information availability, in the form of results of research on traffic congestion and knowledge of relevant policy innovations in the UK, was also hypothesized to have been significant in providing support and content for the expanded decentralisation programme in 1965/66. More generally, the tendency over time for the decentralisation programme to include more types of eligible industries and to become spatially extended and differentiated could be broadly seen in learning/information terms. As the programme continued, a sequential awareness of the social costs and benefits of assisting specific industries and areas developed, and this evoked appropriate policy responses.

This interpretation, however, overlooks the other general influence on policy decisions - the interdependence between the Department and the community. This interdependence could be regarded as having had two main dimensions: one being company size, and the other being a political dimension (using political in the sense of indicating general community pressures on the government, whether explicitly political or not). The political aspect was generally the more important influence on non-programmed decisions. Its chief effects were related to policy formation. The political pressures for an expanded decentralisation programme can be seen as a reaction from country areas to spatially unbalanced state development, with a growing core region and a stagnant rural periphery. A concomitant was the implicit political support for favourable treatment of areas with particularly severe problems.

At a lower level, the political necessity of an even-handed response to applications for assistance supported the use of precedent as a decision process, and the latter in turn tended to cause policy exceptions to form the basis of new policies, given sufficient further cases of the same type. The desirability, political or otherwise, of making applicants satisfied with the Department's treatment, could explain the finding that extra requests weakened the bargaining position of firms in respect to any particular request since the Department thus had more opportunity for refusal.

The other main dimension of interdependence, company size, was also evident in non-programmed decision-making. An example of its influence was the bias towards large companies among those for which the Department made recommendations about possible locations. On the other hand, gains in bargaining were biased toward small companies (projects). This theme of the dual influence of political and company size aspects of interdependence between the Department and the community will be taken up again in the concluding chapter, when the findings of this chapter will be set in a wider context.

Footnotes

1. Factories constructed for non-manufacturing companies at their existing sites were classed as new location situations.

2. The 23 applications comprised 19 which formed part of the sample used in the last chapter, and four which were not included there but which formed part of the sample studied in the section on bargaining later in this chapter.

3. Or, in one case, a warehouse.

4. Divided symbols indicate (a) locations originating from the company concerned but for which the Department indicated it was prepared to offer special assistance (case 2), or (b) particular locations suggested by the Department in areas nominated by the company (case 4).

5. Similarly, feedback from case 1 could potentially have caused the retention of Orange and the dropping of Bathurst, both originally suggested by the Department in case 1, from the company's search set in case 2.

6. A 2 x 2 chi square test using Yates' correction yielded a chi square value of 10.5, indicating that this tendency was statistically significant at the 1 per cent level.

7. The correlation coefficient ($\underline{r}$) between whether the company was a public one or had more than 300 employees, and whether the project was expected to generate employment of 50 or more, was 0.81.

8. Below this level there appeared to be a distinct break in the size distribution of expected project employment in cases involving bargaining, the next largest project having an estimated employment of only 19.

9. This was taken to include representations from the local Regional Development Committee. The only instance of more than three local council representations was given a value of three to avoid potential skewness in the variable's distribution.

10. The variables relating to project size and importance of applicant company showed a fair degree of multicollinearity ($\underline{r}$ = 0.81). The highest F value of either was only 2.43, however, which was significantly below the level required for inclusion in the equation at the 5 per cent level of significance; thus the multicollinearity was unlikely to have affected the structure of the equation.

11. The other large project was one in which assistance was sought by a country firm to avoid closure (the number of jobs likely to be saved being treated as equivalent to an increase in employment of the same size), and the crisis nature of this case led to an immediate and thorough investigation of the full circumstances.

12. None of the four small project applicants referred to here were public companies or had headquarters in Sydney; nor had they an overseas parent or executives personally known to the Department, two other categories which the previous chapter suggested could produce favourable bias.

13. Three of these were full bargaining cases.

14. New South Wales Parliamentary Debates (Third Series). Session 1965-66, Vol 60, 1st March 1966.

15. As noted, the concept of policy support as a factor favouring the emergence of new policies has been hypothesized by Hall et al (1975, 483).

CHAPTER 9

THE INFLUENCE OF INTRA-ORGANIZATIONAL FACTORS

So far the analysis has treated the Department of Decentralisation and Development as a single entity in regard to the making of decisions. Within the field of organizational decision theory, however, it has been recognized for some time that the internal structure of organizations and the attributes of their personnel are basic influences on the decision process (for example, March and Simon, 1958). With the increasing recognition within geography of the importance of behavioural factors, these internal influences on the location decisions of organizations have become recognized by geographers (for example, Pred, 1967; Rees, 1972; Soderman, 1975).

The number of ways in which intra-organizational factors can affect the decisions eventually taken is obviously considerable. For example, a considerable literature has been given over to studies of the theory of teams (Marschak and Radner, 1972), which analyses, *inter alia*, the ways in which coalitions of decision makers form within organizations in order to more effectively influence the decision process. An examination of this particular aspect of organizational behaviour, however, is beyond the scope of the present study because of its intangible nature and the consequent lack of appropriate recordings on file (the source of data used here). Similarly, the intangibility of individual personality and value system traits prevents analysis of their potential influence on decision-making.[1]

Other intra-organizational aspects of behaviour are more amenable to analysis, though. The principal one chosen for study here is perhaps the most important: the structure (in terms of the reasons given) of assistance recommendations by each officer.

The structure of recommendations is analysed below at two levels. In the first, comparisons of overall structures are carried out using factor analysis to isolate the distinguishing dimensions of each structure. In the second, two significant aspects of this structure are chosen for closer analysis of formative influences. These aspects are the total number of reasons (variables) given in making each recommendation, and whether location factors were among the reasons given.

The two main groups of factors used to try and explain variations in recommendation structure are selected personal attributes of the officers (decision makers) themselves, and the position of these officers within the Department. The first group is at the heart of behavioural analyses of location decisions, and has been placed in an organizational context for such decisions by Pred (1967) in particular. The second group is in some ways an extension of the first, defining the officers' positions within the decision structure of the Department. Its importance is suggested by the fact that programmed and non-programmed decisions have been observed to be made by different levels of the organizational hierarchy (Brown, 1971, 95).

From the viewpoint of the effect on the pattern of final decisions concerning assistance, the subject of this study, one other important factor besides the initial decision structure of each officer is the extent to which different officers influence the final decisions. Accordingly, consideration is given to the degree to which each officer's recommendations were accepted, the size of the applications handled by each officer, and his participation in bargaining with applicants.

The results of the analyses point to the dominance of position within the Department as a determinant of decision structure and importance. The recommendations of higher officers, particularly the Director, involved more conflicting criteria, suggesting a more strategic perspective. This is supported by the fact that higher rank also appeared to be associated with decisions containing fewer reasons but greater locational input. Upper level officers were also found to be far more influential in final decisions, with most or all of their recommendations being accepted and a much greater involvement in bargaining with applicants.

In order to provide comparability with the analyses of previous chapters, only data obtained from the 1969 survey on cases in the years 1965/66 to 1967/68 were used. To increase comparability between cases, only loan applications were included. Where the officer making a recommendation could not be identified, the case concerned was excluded from the sample. In some instances the recommendation was made by specialist officers within the Department, such as investigating accountants or technical research officers. Since their involvement in assistance cases was usually concerned merely with analysis of aspects appropriate to their specialist function, the relevant cases were omitted from the sample because of the atypical intra-organizational factor involved. The final number of sample cases thus emerging was 57. Four of these had to be excluded from the analyses of the number and locational content of factors because attribute information on one officer was incomplete.

INTER-OFFICER DIFFERENCES IN THE STRUCTURE OF RECOMMENDATIONS

The first set of analyses was concerned to identify the extent of differences between officers in the Department with respect to the structure of their recommendations. The basic method used was factor analysis. Three separate sample data sets were analysed: all loan recommendations made by officers; all final loan decisions approved by the Minister; and the recommendations made by the Director.

Analysis of all recommendations by officers

The initial analysis investigated the structure of all recommendations put forward by single officers (regardless of whether they were accepted or not), and then looked at the extent to which the different elements of the overall structure were preferred by each officer.

Since the total number of different variables (reasons) mentioned in the 57 cases was 37, it was considered that the most efficient method of comparison would be to reduce the 37 variables to a number of common dimensions with factor analysis and use these dimensions as the bench-marks of comparison. A factor analysis of the 57 cases, giving each variable a value of 1 if mentioned and 0 if not, produced 18 factors with eigenvalues greater than 1.00. Together these factors explained 81.0 per cent of the total variance. To clarify their interpretation, the 18 factors were then rotated using the varimax method. Eleven factors had eigenvalues above 1.00 after rotation, together explaining 79.4 per cent of the variance of the rotated factors (or nearly two thirds of the original total variance). Variables with high loadings (greater than $|0.50|$) on these factors, together with the resulting factor interpretations, are shown in Table 9.1. The per centage of the variance explained is also shown for each factor.

Table 9.1

Factor Analysis of Variables included in Loan Recommendations by Single Officers

Factor 1

Adjusted percentage of total variance [1]	9.8
High loadings	
Labour supply problems	0.84
Closure if no aid given	0.82
Precedent exists	0.60

Interpretation: Factory likely to close and for which aid precedent exists, but with labour supply problems.

Factor 2

Adjusted percentage of total variance [1]	8.9
High loadings	
Would give improved service to local population	0.72
Small loan	0.57
Large/important company	0.55
Past growth of company good	0.53

Interpretation: Project involving improved local service and small loan requested by large, growing company.

Factor 3

Adjusted percentage of total variance [1]	6.6
High loadings	
Not enough decentralisation finance to meet request	0.90
Applicant given project insufficient study	0.87

Interpretation: Expensive, poorly conceived project.

Factor 4

Adjusted percentage of total variance [1]	6.2
High loadings	
Local council/M.P. wants project	0.92
Output would replace non-decentralised production	0.67

Interpretation: Favoured project because of local council/M.P. representations and decentralisation of production.

Factor 5

Adjusted percentage of total variance [1]	6.0
High loadings	
Location satisfactory	0.79
Low cost project for special reasons	0.77

Interpretation: Low cost project in satisfactory location.

Factor 6

Adjusted percentage of total variance [1]	5.3
High loadings	
Satisfactory market prospects	0.62
Financial position of company satisfactory	0.61
Management/technical expertise rated good	0.58

Interpretation: Satisfactory project in relation to market and applicant company's finances and management.

Table 9.1 (cont'd)

Factor 7		Factor 8	
Adjusted percentage of total variance [1]	4.9	Adjusted percentage of total variance [1]	4.7
High loadings		High loadings	
Not policy to give loans for machinery	0.79	Doubtful market prospects	0.87
Management/technical expertise rated poor	0.75	Financial position of company not satisfactory	0.58
Interpretation: Unsatisfactory project because of poor management and inclusion of machinery in request.		Interpretation: Unsatisfactory project in regard to market and applicant's finances.	

Factor 9		Factor 10	
Adjusted percentage of total variance [1]	4.2	Adjusted percentage of total variance [1]	4.0
High loadings		High loadings	
Local unemployment/depressed economy	0.81	Would compensate decentralisation aid elsewhere	0.79
Low value of other aid requests generated	0.57	Competition with existing companies	0.78
Interpretation: Satisfactory project because of depressed local economy and small flow-on of assistance.		Interpretation: Possible competition with existing companies, but project would compensate aid given elsewhere.	

Factor 11	
Adjusted percentage of total variance [1]	3.7
High loadings	
Satisfactory prospects for alternative use of factory	0.86
Interpretation: Satisfactory prospects for factory re-use.	

[1] Proportion of initial total variance (0.810) explained by factors with eigenvalues greater than one before rotation, multiplied by percentage of variance of rotated factors explained by the factor in question.

At this point it is probably appropriate to observe that data sets such as the present one, in which each observation has zero values for most variables, may produce factors based almost entirely on zeros (c.f. Hay, 1975, 166). This has not occurred here, however: all factors in Table 9.1 contain a few variables with high positive loadings. The latent identifiable structure thus suggested is confirmed by the high factor scores (above $|1.00|$) nearly all observations have on one, or sometimes two or three, of these factors. Variables couched in negative terms (for example, "not enough decentralisation finance to meet request") do not indicate lack of structure, but are direct summaries of reasons appearing in departmental files; like other variables, a value of one has been given to each case in which that reason was present. The comments in this paragraph apply equally to Tables 9.3 and 9.4, which can be interpreted in similar terms.

Perhaps the most significant feature of the results from the point of view of the present chapter is the generally unequivocal nature of the 11 factor interpretations. Only two of the factors (numbers 1 and 10) contain high loading variables which would have produced a conflict in the officer's mind and required a trade off. This is in contrast to the findings of Chapter 7 for decisions following the standard rules, when trade offs between different reasons were found in a number of decision types (factors). This could suggest that decisions involving more than one officer were more likely to involve compromises between variables than cases involving a single officer whose recommendation was approved and thus effectively became the final decision (such cases were a significant proportion of the total). This could have been expected both because extra officers would have been likely to have discerned additionally relevant variables, and because single officer recommendations may have involved some prior rationalization of reasons to accord with the direction of the recommendation (c.f. Shepard, 1964).

Given the overall structure of recommendations revealed by the factor analysis, the next question concerns the extent to which it reflects the recommendations of individual officers. It is perhaps most appropriate to identify officers by their position in the decision hierarchy of the Department. The positions of the nine officers making the 57 sample recommendations were as follows, with the identification code given in brackets: Director (A), Deputy Director (B), Regional Planning Officer (C), Assistant Regional Planning Officer (D), Regional Officers (E, F, G, H, I). The nominal reporting line was from E, F, G, H or I to D, thence the C, and then to B and A in turn, although one or more of these links were usually by-passed in actual decision situations. In order to see whether particular decision dimensions were more preferred by some officers and not others, the identity of officers making recommendations which had a factor score above $|1.00|$ on any of the 11 factors was identified. The results are shown in Table 9.2, together with instances where there was a particularly strong association as indicated by a factor score greater than $|2.50|$.

The table reveals a basic two-fold division into factors which only (or virtually only) featured strongly in the recommendations of higher level officers (factors 1, 3, 7, 8, 9 and 10), and factors which were significant in the recommendations of both high and low level officers (factors 2, 4, 5, 6 and 11). Within the first set, a tendency can be discerned for the Director (A) to score significantly on a wider range of factors than the Deputy Director (B). An inspection of the structures of the two sets of factors indicated that the first, higher level set included both factors involving

Table 9.2

Identity of Officers making Recommendations with Factor Scores above |1.00|

Factor	Officer A	B	C	D	E	F	G	H	I
	Number of recommendations with factor scores above |1.00|								
1	1*	2*	1			1*			
2		2*	2	1		2**		1	
3	2*		2*						
4	1		2**	1*		1*			1
5	1*	1		1		1		2**	
6	4	5	4*			2	1	1	
7	1*			2					1
8				1*					
9	4*	1		2*					
10	1*		3						
11	2*	1	1			4*		2	
Total recommendations in sample[1]	13	9	8	10	1	9	2	4	1

1 Total may be less than total number of recommendations in column because recommendations can have a factor score above |1.00| on more than one factor.

Asterisks indicate number of recommendations with factor scores above |2.50| .

conflicts and trade-offs between high loading variables. This suggests that upper level officers tended to view applications, and recommendations from lower levels, in a broader perspective, not rationalizing to the same extent as lower officers.

<u>Analysis of final decisions</u>

Comparison of the structure of all loan recommendations by single officers with that of final decisions where standard rules were followed suggested there was a significant difference between the two. To provide a fully comparable test which included non-standard as well as standard final decisions, a factor analysis using varimax rotation was carried out on decision reasons for the full sample of 55 loan cases used in Chapter 7. The analysis reduced the 40 different reasons to 18 factors with eigenvalues above 1.00 before rotation, and these were reduced to 12 factors with eigenvalues greater than unity after rotation. (The two variables denoting, firstly, an unhelpful relationship between applicant and Department and, secondly, an unfavourable attitude by the local council, were entered in the factor analysis as a single reason because their pattern of values between cases was identical.) The 18 rotated factors explained 78.1 per cent of the total variance, and 83.7 per cent of this was in turn explained by the 12 main rotated factors. Thus in the number of basic factors and the overall explanation of variance obtained, the results were almost the same as those for the recommendations made by single officers.

The structures of the 12 factors, however, are somewhat different, as Table 9.3 shows. Only one factor appears to be common (factor 10 in the first analysis matching factor 6 in the secon). Factor 1 in Table 9.1 is fairly similar to factor 2 in Table 9.3, having two high loadings in common, while factor 8 in the first analysis appears to have been split into factors 7 and 12 in the second. Of more interest here is the fact that six of the factors in Table 9.3 (factors 1, 2, 6, 7, 9 and 10) have high loading variables in conflict and requiring trade offs, as indicated in the factor interpretations shown in the table. This compares with only two in the single officer analysis (Table 9.1).

Table 9.3

Factor Analysis of Variables included in Final Loan Decisions

Factor 1

Adjusted percentage of total variance [1]	10.8
High loadings	
Raw material supply uncertain	0.86
Management/technical expertise rated poor	0.79
Fluctuating demand in industry group	0.78
Precedent exists	0.64

Interpretation: Uncertain demand and raw material supply plus poor management, offset by existence of precedent.

Factor 2

Adjusted percentage of total variance [1]	7.8
High loadings	
Labour supply problems	0.95
Satisfactory prospects for alternative use of factory	0.73
Closure likely in absence of assistance	0.54

Interpretation: Labour supply problems offset by prospective alternative use of factory and closure unless assisted.

Factor 3

Adjusted percentage of total variance [1]	7.0
High loadings	
Low value of other aid requests generated	0.79

Interpretation: Small flow-on of assistance from project.

Factor 4

Adjusted percentage of total variance [1]	6.2
High loadings	
Employment increase satisfactory	0.71

Interpretation: Satisfactory employment increase.

Factor 5

Adjusted percentage of total variance [1]	5.3
High loadings	
Past growth of company good	0.98
Department encouraged application	0.51

Interpretation: Growing company making application encouraged by Department.

Factor 6

Adjusted percentage of total variance [1]	5.2
High loadings	
Would compensate decentralisation aid elsewhere	0.77
Competition with existing companies considered	0.63

Interpretation: Project would compensate aid given elsewhere but may involve competition with existing companies.

Table 9.3 (cont'd)

Factor 7

Adjusted percentage of total variance [1]	4.6
High loadings	
Doubtful market prospects	0.82
Lack of loan security	0.51
Location suitable	0.50

Interpretation: Doubtful market and lack of security offset by suitable location.

Factor 8

Adjusted percentage of total variance [1]	4.2
High loadings	
Small loan	0.95

Interpretation: Project involves small loan.

Factor 9

Adjusted percentage of total variance [1]	3.8
High loadings	
Loan requested for short period	0.90
Likely to generate other aid requests	0.57

Interpretation: Loan over short period, but likely to cause other aid requests.

Factor 10

Adjusted percentage of total variance [1]	3.8
High loadings	
Employment increase unsatisfactory	0.81
Low cost project for special reasons	0.69

Interpretation: Project with low cost but unsatisfactory employment increase.

Factor 11

Adjusted percentage of total variance [1]	3.4
High loadings	
Location not satisfactory	0.73

Interpretation: Project at unsatisfactory location.

Factor 12

Adjusted percentage of total variance [1]	3.2
High loadings	
Financial position of company not satisfactory	0.94

Interpretation: Applicant's financial position unsatisfactory.

1 Proportion of initial total variance (0.781) explained by factors with eigenvalues greater than one before rotation, multiplied by percentage of variance of rotated factors explained by the factor in question.

The results therefore provide some support for the notion that cases with recommendations by only one officer are less likely to have involved conflicting reasons. This in turn may suggest that recommendations made by individual officers tended to be acceptable unless they ignored conflicting reasons which were important to the Department. If true, this would indicate that differences between individual officers regarding the reasons given for recommendations may not have been especially significant in influencing final decisions.[2]

Analysis of Director's recommendations

The officer who could be expected to have been the most significant in the decision process was the Director, since he had the responsibility of making recommendations to the Minister. His recommendations would thus have been crucial to the final decision pattern. It is therefore important to know how important were his recommendations in filtering the views of the rest of the Deaprtment. The distinctiveness of his contribution was analysed by carrying out a factor analysis on the 27 reasons included in the sample of 13 recommendations made by him. Eight factors with eigenvalues greater than 1.00 (there was a sharp break to the next eigenvalue, 0.77) were produced, accounting for 89.8 per cent of the total variance. Applying varimax rotation to the eight factors yielded six factors with eigenvalues above 1.00, explaining 90.3 per cent of the rotated factors' variance.

Results for the six factors are shown in Table 9.4. The main feature is that five factors

Table 9.4

Factor Analysis of Variables included in Director's Recommendations

Factor 1

Adjusted percentage of total variance [1]	21.5
High loadings	
Satisfactory market prospects	0.94
Financial position of company satisfactory	0.78
Likely to generate other aid requests/Loan requested for short period	0.73

Interpretation: Project involving satisfactory finances, market and loan period offset by likely flow-on of aid.

Factor 2

Adjusted percent of total variance [1]	16.4
High loadings	
Output would replace non-decentralised production	0.86
Management rated poor/ Not policy to give loans for machinery	0.81

Interpretation: Replacement of non-decentralised production offset by poor management and inclusion of machinery in request.

Factor 3

Adjusted percentage of total variance [1]	12.5
High loadings	
Would allow new products/ Quasi-service industry	0.87
Financial position of company satisfactory	0.56
Local unemployment/ depressed economy	0.52

Interpretation: Possibility of new products and relief of local unemployment, plus applicant's satisfactory finances, offset by quasi-service nature of industry.

Factor 4

Adjusted percentage of total variance [1]	11.1
High loadings	
Location not satisfactory	0.86
Department encouraged application	0.81

Interpretation: Unsatisfactory location offset by Department's encouragement of application.

Table 9.4 (cont'd)

Factor 5		Factor 6	
Adjusted percentage of total variance [1]	11.1	Adjusted percentage of total variance [1]	8.5
High loadings		High loadings	
Alternative use of factory available	-0.86	Low value of other aid requests generated	0.78
Location suitable/Closure if no aid/Low cost project/Labour supply problems	-0.78	Local unemployment/ depressed economy	0.67
Interpretation: (Not) project involving labour supply problems, offset by likely closure without aid, low cost, and suitability regarding location and alternative factory use.		Interpretation: Project satisfactory in terms of low flow-on of aid and relief of local unemployment.	

1 Proportion of initial total variance (0.898) explained by factors with eigenvalues greater than one before rotation, multiplied by percentage of variance of rotated factors explained by the factor in question.

(1, 2, 3, 4 and 5) of the total of six have high loading variables (with factor scores above $|0.50|$) in conflict regarding the possible direction of the recommendation.[3] This suggests that the Director had a prime role in ensuring that all aspects which were relevant to the Department's objectives in each case were brought out, regardless of whether these were in conflict. Indeed, since a number of these recommendations followed lower level recommendations concerning the same application, this role could be seen as including the placing of lower level submissions into broader departmental and governmental perspective where necessary. The structure of the factors in Table 9.4 supports this view. Three of the new high loading trade off variables which did not appear in the initial factor analysis for all officers (Table 9.1) relate specifically to the Department's administration of policy - the likely flow-on of assistance (factor 1), the eligibility of the industry group for assistance (factor 3), and the prior encouragement of the relevant application by the Department (factor 4).

Number of reasons in each recommendation

The analyses above have focussed on the role of officers' position in the administrative hierarchy in influencing the structure of recommendations. While some of the other potentially relevant attributes, particularly income, could be expected to have been surrogates for officer rank, there are others still which deserve separate consideration. At the same time, while the factor analyses above were shown to provide certain useful insights into the underlying structure of recommendations, the generation of a number of hybrid factors in each analysis does not make the analysis of particular aspects of variations in recommendations particularly straightforward. Two such aspects, the total number of reasons given in each recommendation and the locational orientation of such reasons, are therefore analysed separately. The first aspect was selected because it represents a useful surrogate of both the total size of, and the variety within, each officer's model of the corresponding decision problem, this model being the basic element in structuring the decision in each case. The second aspect was chosen because it is that part of the overall decision structure which is of principal concern here. In this and the next section, therefore, the influence of selected officer attributes on the total number of reasons in each recommendation and on the locational orientation of the reasons is examined. The sample used in each case was the 53 recommendations mentioned at the start of the chapter.

The total number of reasons given in each recommendation was considered to provide a useful indication of the degree of simplification of the real world decision problem made by each officer. Five behavioural attributes were selected as being the most potentially significant, out of those attributes for which data were likely to be obtainable, for explaining variations in the total of reasons.[4] They were tested by being used as independent variables in a stepwise multiple linear regression analysis, with the total of reasons being the dependent variable.

One of the most comprehensive summaries of the range of behavioural attributes which can affect location decision-making has been given by Pred (1967). Some of the most potentially important attributes listed by Pred, such as personal value systems, were not operational in the present context because data could not have been obtained without specially interviewing each officer. Two of the most important of the more measurable attributes listed by Pred are age and education. Higher age and lower levels of education are both hypothesized to lead to more conservative behaviour or, in this context, to fewer decision reasons (although this may not always correspond with greater conservatism). Of the eight officers responsible for the recommendations in the sample, five were over 50 years of age and three were between 40 and 50. A binary-valued sample distribution was thus created. A university degree or professional accountancy qualifications were considered to be the most relevant educational qualifications and a value of one was given if an officer possessed either; in other cases the value was zero.

Pred and other behavioural geographers (for example Golledge, Brown and Williamson, 1972) also stress the importance for location decisions of the amount of experience gained by decision makers through learning processes. For the more complex location decisions in organizations, such as those studied here, the number of years worked within the organization is perhaps a suitable surrogate of learning experience. This measure has been used here. It could be argued that the organizational environment of the Department of Decentralisation and Development is typical of the State public service generally, and that experience gained in the latter outside the Department might also be useful in the making of decisions within the Department. Hence two indices of experience have been included. The first is the number of years, as at 1968, each officer had worked in the Department or its forerunners. Service over 10 years was not counted, since this period was considered to be the maximum over which any relevant learning would have been made. The second index is the number of years, as at 1968, each officer had worked in the State public service generally (including the Department). Here, service over 20 years, rather than 10 years, was not counted since it was hypothesized that any relevant experience outside the Department may have come more indirectly and therefore have taken longer to acquire. The distribution of values for the second index was very polarized, with three of the officers having four years' or less experience in the public service, and the rest having at least 19 years. To avoid a potential skewness problem, this index was converted to a binary-valued variable taking a value of one in the case of 19 or more years of experience, and zero in other cases.

One further attribute was included to reflect past experience: whether or not an officer had ever lived outside of Sydney. This was relevant because the departmental office was in Sydney and it was possible that an officer who had lived outside of Sydney may have had a better appreciation of the industrial development problems of the country towns. This attribute was identified as a suitable modification of Wood's (1970, 136) distinction between natives and non-natives of an area as being the most useful comparison in studies of spatial preference. A value of one was given if the officer concerned had ever lived outside the Sydney Statistical Division, and zero if not.[5]

A stepwise multiple linear regression of the number of recommendation reasons (a) on the five selected attributes as independent variables yielded an equation which indicated that previous residence outside Sydney explained a to a significant degree but in the opposite direction to the hypothesized one: longer outside residence was predicted to decrease the number of reasons.[6] The equation may have been wrongly estimated, however, because of the strong multicollinearity between non-Sydney residence and years of departmental employment ($\underline{r}$ = 0.98). Hence the analysis was repeated with the outside residence variable excluded, and this yielded the following equation:

$$\underline{a} = 5.0000 - \underset{(0.5973)}{1.3171^{*}}\underline{x}_1 \qquad ; \quad \underline{r}^2 = 0.087, \quad \underline{SE} = 1.820$$

* Significant at the 5 per cent level

where $\underline{x}_1$ denotes whether or not the officer has had 19 or more years' employment in the State public service.

The negative coefficient sign is contrary to the hypothesis that greater experience will lead to a more complex model of reality and therefore number of decision reasons. The explanation probably results from the fact that the public service experience variable is positively correlated with officer rank. Thus four of the five officers in the sample who had been employed in the public service for 19 years or more occupied the top four positions in the administrative hierarchy applying to the eight officers in the sample. In turn, these higher positions frequently tended to require recommendations which were in the nature of an overview of the recommendations coming from the regional officers. As such, the higher level recommendations could often afford to be briefer and contain fewer reasons.

<u>Locational orientation of recommendation reasons</u>

In a study of location decisions, one of the potentially most important intra-organizational elements is the extent to which individual decision makers vary in their "space preference", that is, their recognition of location as a relevant factor in the making of decisions. The influence of personal attributes on variations in this preference within the Department, as reflected in the locational orientation of reasons included in the 53 sample recommendations, were analysed using multiple regression again.

The dependent variable used in the regression analysis was whether a locational reason had been included as a reason in the recommendation concerned (denoted 1). Four of the 43 separate reasons identified in the first section of the chapter were regarded as being directly locational, although several others could be considered to have been indirectly locational. The four variables were: whether the location of the project was satisfactory; whether it was not satisfactory; whether there was local unemployment or a locally depressed economy; and whether the factory was likely to close in the absence of assistance. A recommendation containing any one of these variables as reasons was given a score of one; otherwise, zero was scored.

The independent regression variables used were the same as for the analysis of the total number of recommendation reasons. This was because total reasons and the locational orientation of those reasons were hypothesized to reflect similar dimensions of behaviour, with the added variety included within a larger total of reasons being manifested in, inter alia, the inclusion or enlargement of the locational element. The resulting stepwise multiple linear regression analysis, however, failed to generate any significant explanatory variables. One possible reason for this failure may have been possible bias in the reasons included in the recommendations made by the Assistant Regional Planning Officer. The role of this officer, an accountant by training, was mainly to provide a review of the financial aspects of application. The analysis was therefore repeated without the officer's 10 sample recommendations. This resulted in the following equation:

$$\underline{l} = -\ 0.0866 + \underset{(0.0204)}{0.0450^{*}}\underline{x}_1 \qquad ; \quad \underline{r}^2 = 0.106, \quad SE = 0.409$$

* Significant at the 5 per cent level

where $\underline{x}_1$ denotes the number of years of employment in the Department.

The equation predicts, as hypothesized, that the inclusion of location as a factor in recommendations will increase with length of service in the Department. One possible reason is that there may have been a learning process over time as officers became more knowledgeable about the various locations proposed by applicants, through field trips and longer exposure to the information environment within the Department. A second explanation is similar to that postulated to cause total reasons in each case to decrease with total length of public service: the positive association between officer rank and experience in the Department. The three officers who had been 10 or more years in the Department were first, second and fourth in the hierarchy applying to the eight officers analysed. Thus recommendations coming from upper levels could be seen as broadening the decision context by widening the focus of interest from the applicant company itself to its locational context.

DIFFERENCES BETWEEN OFFICERS IN DECISION-MAKING IMPORTANCE

Differences between officers in the nature of their recommendations/decisions are only one part of the explanation of how intra-organizational factors affect the Department's final decisions. Another set of factors relates to differences between officers in terms of their impact on final decisions. Accordingly, this section analyses differences in decision-making importance between officers, using three measures: the acceptance rate of recommendations, the size of requests approved, and the involvement in bargaining with applicants.

Degree of acceptance of recommendations

The extent to which the recommendations of each officer were accepted provides perhaps the clearest measure of influence on the final decisions of the Department. Table 9.5 sets out, for each officer, the total number of sample recommendations and the number which were accepted unequivocally (and whose structure therefore became the final decision structure).

Table 9.5

Acceptance of Recommendations according to Officer Identity

Officer	Sample recommendations	
	Total	Number accepted
A	13	13
B	9	8
C	8	5
D	10	9
E	1	0
F	9	1
G	2	0
H	4	0
I	1	1

It can be seen that almost none of the recommendations made at regional officer level (E to I) were accepted, whereas the Director's recommendations were always accepted by the Minister and those of the next three levels nearly always.[7] This can be linked to the earlier finding that recommendations made above regional officer level frequently introduced conflicting criteria requiring trade offs. The necessity to do so obviously precluded unequivocal acceptance of the recommendations of regional officers.

The fact that recommendations of the regional officers were generally not accepted unequivocally means that a potentially important locational influence was removed. Each officer was responsible for the initial processing of requests from a particular area of the state. If their recommendations had been crucial to the final decision pattern, then differences between officers would have been directly reflected in the decision pattern from one area to the next. There is evidence, though, that the areal differentiation of regional officers' responsibilities had some indirect influence on the locational decision pattern. In particular, one regional officer encouraged two companies to apply for loan assistance for factories at North Richmond, situated within his area of responsibility. When the applications were considered by senior officers, this initial encouragement, given by the Department through the regional officer, proved to be a vital consideration in offsetting what was seen to be an unfavourable location in terms of the Department's objectives.

Size of requests approved

The general lack of full acceptance of regional officers' recommendations indicates that, in terms of influence on final decisions, only differences between officers in the upper levels were important. The remainder of this section therefore focusses on upper level officers, looking first at variations in the size of requests dealt with in approved recommendations, since this is a basic indicator of the importance of decisions.

Perhaps the most potentially useful distinction within upper levels is that between the

Director and remaining higher officers, since the Director had unique authority as final arbiter of recommendations going to the Minister. Thus three of the 13 approved recommendations made by the Director related to requests above $100,000,[8] compared with three out of 22 made by other higher level officers. Similarly, five of the 13 recommendations of the Director involved requests above $50,000, compared with six out of 22 for other higher level officers. Thus there was a tendency for the Director to be involved with higher value requests to a greater extent than other high level officers. This would be expected since incorrect decisions in such cases would have been more costly to the Department. However, 2 x 2 chi square tests using Yates' correction showed that this tendency was not statistically significant at the 5 per cent level. From this and other results in this chapter it seems that the distinctive role of the Director in programmed decisions was not to take over the biggest decisions, but rather to act as the decision maker in cases where conflicts arose in departmental objectives, particularly those involving the administration of policy and any policy implications for other cases.

Involvement in bargaining

For non-programmed decisions, the eight "pure" bargaining sample cases involving improvements on the initially offered assistance perhaps provide the most incisive test of the importance of administrative levels.

In four of these cases, however, it was not possible to determine which particular officer was responsible for the recommendation leading to the improved offer (or the most improved offer, if more than one). In only one of the remaining four cases did the Director appear to be responsible, while in another he was probably jointly responsible with another higher level officer. The other two cases involved other higher level officers (although one of these was not certain). The general uncertainty surrounding the source of recommendations to increase initial offers in bargaining cases resulted from lack of appropriate file notation, more marked than in programmed decision cases.

This lack of written record and the pattern of joint officer involvement suggest that discussions between senior officers, rather than recommendations emanating from single officers, were the chief means of decision-making when bargaining was involved. This pooling of minds would have been a rational decision response in such situations, involving as they did few guidelines from past cases or basic decision rules. In any event the change from programmed to non-programmed decision situations did not involve a shift in the source of decision-making up the administrative hierarchy, unlike the findings of Brown (1971, 95). This is perhaps partly due to the considerable range of criteria within, and variations between, programmed decision cases handled by the Department.

CONCLUSION

The main finding of this study of intra-organizational variables has been the consistent importance of position within the administrative hierarchy as a determinant of the structure of recommendations made and of influence on final decisions of the Department.

The main distinction of importance in regard to officer rank was found to be that between regional officers and officers of higher ranks. Senior officers were, unlike regional officers, willing to embrace conflicting factors and to place applications into a broader context, locational and otherwise. There was also a tendency for the dimensions of decision problems to be narrowed at higher levels in the Department. Thus senior officers acted to pinpoint key, often conflicting, factors of most concern to the Department. This filtering process was pervasive in shaping the structure of the Department's final decisions, since the recommendations of higher level officers were always or usually accepted, whereas those of lower levels were rarely so.

Within the higher ranking officers, the decision role of the Director was less distinctive than might have been expected. He was not involved, for example, in cases involving greater assistance to any more extent than other higher level officers. However, he did appear to be particularly involved in cases which required a trade off between conflicting variables, especially where the variables concerned broader departmental policy and administrative implications, or the locational context of the project concerned. What must remain largely unknown, however, is the extent to which the fundamental value system and aspirations of the Director shaped the trade-off structure and, indeed, the Department's decisions generally, for which he was responsible for final administrative (although not political) approval. Something of the flavour of his general approach can be gained from his comments, in one published interview, that a tendency to rely on precedent was an outmoded approach, although there may be political problems in so doing.[9]

This comment raises a final important issue: the influence of the Minister in the decision-making process. The very confidential nature of the requisite information precludes detailed analysis, though there appear to have been only a handful of cases among the sample studied in which the Minister directly intervened. Moreover, in most of these cases the intervention took place before a formal, final recommendation had come from the Department.[10] Thus the main resolution of final decisions concerning assistance apparently lay within the Department itself. In general the administrative, rather than political (in the formal sense), focus of the decentralisation decision-making process provides a justification for the extensive reliance in this study on departmental file data and the basically quantitative approach which this data enabled.

Footnotes

1. On the other hand, Presthus (1974) has found that such factors are less important than properties such as role and function in shaping the behaviour of North American bureaucrats.

2. The results of the factor analysis of final decisions also support the analysis of standard rule decisions in Chapter 7, indicating that different criteria are considered in different cases. In ten of the twelve factors at least one decision had a factor score of 4.0 or more, while in seven factors there were five decisions or less with factor scores above 1.0. These figures suggest that a number of decisions only contained one or a few of the 12 main dimensions.

3. Assuming that the negative loadings in factor 5 have equivalent positive loadings for some recommendations.

4. Data on these attributes were supplied by the Department of Decentralisation and Development.

5. Data were also collected for one other attribute - whether officers were married or single in 1968. Marital status has been suggested as a determinant of the degree of conservative behaviour. All officers included in the sample were found to be married, however, indicating that marital status was not a determining factor in differences in the total number of reasons given in each recommendation.

6. The equation produced was:

$$\underline{a} = 4.7143 - \underset{(0.5071)}{1.2143^*}\underline{x}_1 \qquad ; \ \underline{r}^2 = 0.101, \ \overline{SE} = 1.806$$

   * Significant at the 5 per cent level

   where $\underline{x}_1$ denotes whether the officer concerned had previously resided outside Sydney.

7. Acceptable recommendations coming from officers below the Director were formally endorsed by the latter before submission to the Minister.

8. All values used have been coverted to June, 1969 equivalents.

9. New South Wales Horizons, January/February, 1973, p.4 (published by the Department of Decentralisation and Development).

10. The handful of cases of ministerial intervention does not include instances in which the Minister merely passed representations from M.P.s on to the Director; as shown in Chapter 8, such representations had a significant influence.

CHAPTER 10

SYNTHESIS AND CONCLUSIONS

The results in the preceding chapters have demonstrated that government location decisions, like private location decisions, can be fruitfully analysed for systematic causative factors within the political framework within which government decisions must be made. At the same time, the processes involved in the example studied here vary significantly from the processes which have been suggested by Townroe (1971), Nishioka and Krumme (1973) and others as applying to the location decisions of industrial entrepreneurs. Hence the need, suggested in Chapter 1, for alternative theoretical and empirical frameworks in the case of government location decisions has been demonstrated.

A model of one such class of decisions, factory loans made by the Department of Decentralisation and Development, is developed below from the results of the previous chapters. The implications of this model, particularly regarding the basic processes involved, are also examined. However, the model is not only limited to just one (albeit the main one) of the classes of assistance decisions made by the Department, but is also static. Thus the nature of the evolution over time of different classes of locational decisions is also discussed, in the light of the foregoing empirical results.

In addition, an attempt is made to marshall the available evidence, econometric and otherwise, in order to suggest some of the deeper mechanisms by which the prevailing politico-economic structure influenced government decentralisation decisions, and within which partial, econometrically-based models like the factory loans one can be set.

A MODEL OF FACTORY LOAN DECISIONS

It is apparent from previous chapters that factory/machinery loan decisions stood out among decisions concerning the various forms of assistance given by the Department of Decentralisation and Development in the 1960s, in terms of the degree of empirical explanation obtained. Housing loans had been excluded because of the apparent uniformity of approval by the Department. Virtually no explanation of variations in grants and subsidies decisions was achieved, probably because of their heterogeneity. As shown in Chapter 2, however, factory loans became the dominant type of decision during the period under study, so that what explanation there is relates to the most important part, locationally and otherwise, of the decentralisation programme.

For this section of the programme, the results obtained in the preceding chapters are sufficiently wide-ranging to allow a model of the decision process to be postulated. This model is shown in Figure 10.1. Factory loans only are included, since machinery loan policy was somewhat unstable and still evolving until the latter part of the study period. The model as shown is necessarily a generalization, and is not meant to imply that all elements were present in all decision cases.

Perhaps the most striking feature of the

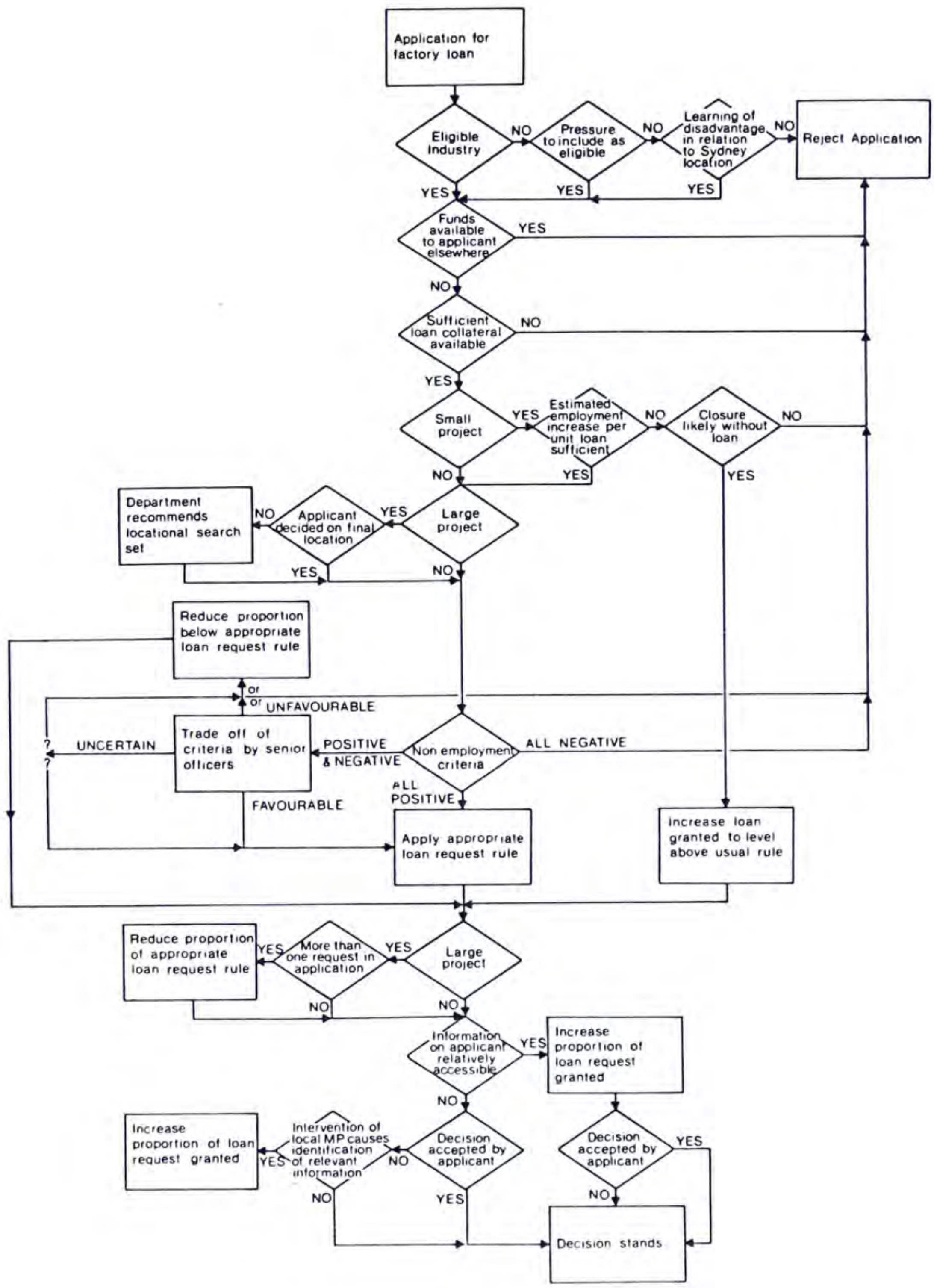

Figure 10.1 A Model of the Factory Loan Decision Process of the Department of Decentralisation and Development

model is that the overall number of decision stages is quite large and the total process thus relatively complex. This is partly a consequence of an attempt to handle a considerable number of relevant criteria by dividing the problem up into separate, manageable steps - an example of the "decomposition" response to decision complexity (Slovic, 1972). Thus there is sequential attention to aspects of the total decision problem, not just to goals as hypothesized for firms by Cyert and March (1973). The number of stages is also partly for diagrammatic convenience, several stages having probably taken place simultaneously in reality, particularly in the middle section involving the primary determination of the proportion of the request to be granted.

Within this overall structure, there is a basic division between initial satisficing criteria (industry eligibility, availability of funds, and so forth) applying to all loan applications, and later criteria for determining the Department's response to initially satisfactory applications. The latter are the more significant, and the principal type of decision here involves the application of certain loan request rules, in which each application is classified according to industry and location, and a predetermined proportion of the total request applying to that particular classification is then allocated. By 1968/69 the number of such factory loan classifications that could be identified had still only grown to six. This is somewhat more complex than implied under a strictly satisficing approach, but the number of classifications still represents a considerable simplification, for example, over the 42 classifications which would have resulted from the application of all the criteria actually mentioned in final loan recommendations as being relevant. The existence of such rules was seen to be the result of uncertainty about the particular decentralisation benefits which were likely to be associated with each application in the financial year ahead.

The existence of a decision process simplified and rationalized in these ways, within that part of the real world perceived by the Department as being relevant to its decisions, is one indication of the shortcomings of the traditional maximized social welfare function approach (for example, Smith, 1977) to the actual government location decisions analysed here. Another is the continual variation in criteria considered to be relevant in determining deviations (if any) from the loan rules from one case to the next, each relevant set being only a small part of the total criteria considered by the Department at one time or another. Only the sufficiency of employment increase and financial/managerial soundness seem to have been consistently considered (Figure 10.1 could probably be modified to include the latter as a specific element), reflecting two of the Department's stated basic criteria, respectively employment expansion and viability. (The latter criterion was also reflected in the consideration of market prospects in about half of the sample cases.) This focussing process is in contrast to the welfare function maximization model, which implies that the criteria linked to each objective are continuously related to, and traded off against, each other. Part of this concentration on selected criteria was probably due to an implicit recognition that the other possible criteria were indeed not relevant to the particular case. But straight neglect of alternative criteria seems just as likely in many instances, particularly in view of the large number which were used at some point and thus available for further use. More generally, there was a fundamental division in the criteria used to assess large <u>versus</u> small projects, emphasizing the inapplicability of a single welfare function to all cases.

The next feature contradicting the traditional model is the lexicographic ordering of several key decision criteria. Thus the eligibility of the industry concerned was considered before the collateral for, and alternative availability of, loan funds. Then the appropriate decision rule regarding the proportion of requests to be granted was implicitly applied before considering whether other factors should cause the rule proportion to be varied. This hierarchical ordering of criteria is not compatible with the idea of a social welfare function in which criteria are concurrently traded off against each other.

These qualifications of the normative approach using a social welfare function in turn provide support for the relevance of Simon's model of bounded rationality. In detail, however, the decision-making indicated by the study was not just the simple satisficing kind involved in the bounded rationality model. In particular, the classification of loan applications into six types, all having different rules as to the proportion of each request to be granted, goes well beyond the binary classification required by satisficing. Moreover, whether the rule for each type was applied to particular applications was found to involve a more complicated process than the satisficing originally proposed by Simon (March and Simon, 1958) whereby each criterion should be satisfactory before the overall action is regarded as satisfactory. Instead, a situation was found in which criteria were classified as more satisfactory or less satisfactory and traded off against each other to determine, on balance, whether the appropriate request rule should be applied (Figure 10.1).[1] Moreover, the process was further complicated by the fact that the prospective closure criterion appeared to be an overriding one not entering trade off calculations, and the possibility that deviations from the standard rules could be caused by the influence of external decision factors (such as the "visibility" of the applicant and the intervention of MPs).

The virtual absence of intra-organizational factors in the model is noteworthy. The last chapter showed that the chief such factor was simply the status of the Department's officers, whether senior or junior, with the former being responsible for making the decisions which were actually approved and carried out. Within the senior officer grouping, however, it was found that locational criteria were more likely to be introduced only at the two highest levels.[2] The highest ranking officer, the Director, was also the most concerned with discretionary decisions requiring trade offs between criteria, although other senior officers also made such decisions to a lesser extent (as Figure 10.1 indicates). An even more important discretionary power of the Director was the final administrative approval of all decisions within the Department. Since these approvals were almost invariably concurred with by the Minister, the Director's "filter" role here can be seen as potentially very significant in terms of the actual decision pattern which emerged. For these reasons the personal value system and the personality itself (c.f. O'Riordan, 1976, 244) behind the Director's decisions is potentially important. This area remains a virtual unknown, however. No direct data relating to personality assessment were available, and the fact that he had been the only head of the Department since the introduction of the Decentralisation Fund meant that an indirect assessment via comparison with the decisions of other directors was not possible.

Locational aspects

The model in Figure 10.1 contains two direct spatial elements. These are: the comparison, if required, with an equivalent Sydney producer to determine any locational production disadvantage and thereby eligibility for assistance; and the Department's recommendation of locational search sets in the case of large projects having no chosen final location. A number of other locational aspects are, however, implicit in the structure of Figure 10.1.

In perspective, the locational elements of the loan decision process, whether implicit or explicit, reflect two dimensions of the Department's external decision environment: the political dimension, incorporating general community pressures on the Department, and the company size/origin dimension. The external decision environment of governments is important because of their rationale of serving the community. The political facet of decision-making can be expected to be important in all government departments, while the role of the Department of Decentralisation and Development in providing assistance to private sector manufacturers also made company size and origin significant.

The most obvious locational expression of the political nature of the Department's decision environment was the existence of maximum assistance areas, whereby firms locating in places with a declining staple product could receive loans equal to the full value of factory and land. The importance attached to loan assistance in cases where closure would otherwise have been likely can also be seen primarily as a means of forestalling political pressure. In turn, this contained a spatial element: factory closure was more likely in areas peripheral to Sydney, Newcastle and Wollongong. A third manifestation of the political environment was the intervention by members of parliament on behalf of small, local companies applying for assistance, often successfully. This also had a centre-periphery pattern, with firms involved in bargaining with, or challenging, the Department tending to become smaller further from Sydney. Thus the political environment of the Department tended to produce a peripherally oriented industrial pattern, since on balance the maximum assistance areas were more peripheral than not after the changes of 1965/66. More precisely, the political element in the Department's decision process produced a greater locational spread of industrial development, in favour of small indigenous firms, ailing factories and areas with stagnant economies.

The firm size/origin dimension of the Department's decision environment also had several locational implications. The significance of this dimension arose largely from the greater interaction between the Department and large companies, particularly companies not originating in country areas. There was some tendency for large, non-local companies setting up decentralised plants to obtain a set of recommended locations from the Department, reflecting their unfamiliarity and a more thorough consideration of locations where large factories were involved. The Department was concerned to suggest locations that would be efficient for these companies, and such locations were generally those closer to Sydney. Larger companies were also more inclined to participate in bargaining with the Department over assistance levels, but the larger values and greater number of requests involved in their applications tended to reduce bargaining gains. As noted, this had a locational aspect because the larger factories associated with the large bargaining companies were mostly located close to Sydney.

The final locational aspect associated with this dimension concerns the positive bias towards applications for which relevant information was relatively accessible, because they came from someone known personally or because the applicant firm had its headquarters in Sydney, or else was a public or overseas company. Such firms tended to be significantly larger, and to establish bigger factories, than other firms. The first locational implication here is that projects nearer Sydney (a radius of up to 250 kilometers or so) were favoured, since the limited data in Chapter 6 suggests that such locations were preferred by non-country firms to a greater extent than country firms. The second locational result is that the "mental maps" of the preferred applicants in regard to their location selections were reinforced at the expense of the mental maps of other applicants, to the extent that this type of perception differed between the two groups. In short, then, the effect of the Department's greater interaction with large, non-local companies was to reinforce their preference for locations close to Sydney. This stands in direct contrast to the peripheral location tendency produced by political elements.

There were also more direct locational aspects of the loan decision process which are not indicated in Figure 10.1. The 42 criteria used to determine whether the appropriate standard rule should be applied included three which could be considered to be spatial to a greater or lesser degree. These were: whether the location of the project was satisfactory, whether it was not satisfactory (with the reason(s) in each case being given, such as the location in relation to competitors), and whether there was local unemployment or a locally depressed economy.

At least one other element in the model has locational repercussions. It concerns cases where the trade off between criteria produced no clear-cut decision guideline. The uncertainty thereby created acted to increase fluctuations in the proportion of each request granted, all else remaining equal. The uncertainty thus introduced "noise" into the decision pattern. Hence in such cases the spatial distribution of assistance became more random.

In summary, the locational implications of the model can be seen to be varied and extensive. But the structure of the model indicates that locational aspects of the final decision pattern must be placed within the whole decision process to properly understand their evolution.

PATTERNS AND PROCESSES IN GENERAL

Although the above model covers the most significant section of the New South Wales decentralisation programme, it was nevertheless just one part of the overall strategy. In addition, the model itself is static. Since the programme was designed to function as a total strategy for decentralisation, it is desirable to take an overview of the evolution of decision patterns and processes of the programme as a whole in the light of the analytical results of previous chapters.

Evolution of the programme's structure

Three basic dimensions of the programme's structure can be identified for present purposes. These are: the types of assistance available, the range of industries eligible for assistance, and the spatial differentiation involved in assistance policy. The evolution of each of these is briefly compared.

The number of types of assistance showed a steady increase up to the end of the study period in 1969. Occasionally a certain form of assistance was dropped, as happened with the trunk telephone subsidy, but the steady introduction of new forms of aid was predominant. This could be seen largely as a learning response to the relative failure of the programme to achieve a significant measure of decentralisation, and the implicit political pressure this generated. The nature and timing of new forms of assistance appears to have owed something to the evolution of regional policies in the United Kingdom, thus supporting Pfiffner's (1960, 130) views that government decision makers cope with the cognitive strain involved in the selection of strategic alternatives by using imitation or tradition.

Allied with this was a tendency for the range of eligible industries to slowly increase over time. The main process behind these extensions of industry eligibility began as a departmental response to external stress, often caused by severe problems in one or more firms of an ineligible type. The resulting special assistance given by the Department thus created a precedent. If a sufficient number of similar firms subsequently applied for assistance, administrative convenience and the societal and political necessity for equal treatment ensured that such firms were reclassified as eligible. Ineligible industries in which firms were experiencing a locational disadvantage in relation to Sydney (or interstate) producers were not, however, reclassified, possibly because of the unique circumstances of individual cases. Assistance was thus given to disadvantaged firms on a case-by-case basis (Figure 10.1).

The spatial differentiation of policy also increased over the study period, thus replicating similar programmes in the United Kingdom (McCrone, 1969), Sweden and Italy (Sundquist, 1975, 218 and 272). At first all areas were treated equally. Later, areas with declining staple industries became eligible for maximum loan assistance, as experience with the programme grew and a lack of impact from the programme in such areas was perceived. Here also, the potential stress implicit in the political danger of not responding may have been considerable. In 1968/69 a further element of spatial differentiation was added with the lessening of loan assistance for fringe areas around Sydney, as a result of the Department becoming aware of the lesser contribution to decentralisation in these areas.

The increasing differentiation within each of these three dimensions of the programme was materially aided by the ever larger funds which were made available by the government for decentralisation. In turn, this growth in the value of aid would have had the effect of forcing less socially useful projects to be selected, given a steady flow of applications. As against this, the increase over time in the range of assistance and eligible industries would have acted to attract an increase in the number of applications. From 1965 onwards, however, the increase in the total value of aid was much more spectacular than corresponding changes in the structure of the programme, so it may be assumed that over the period the net effect was to cause applications with lower social utility to be approved. (This is perhaps supported by the greater use which the old Secondary Industries Inter-Departmental Committee was able to make of locational criteria in its decisions, in comparison with the Department itself after 1965 when more funds were available.) Thus the decision pattern of the Department moved closer to the laissez-faire decision pattern of the private sector, spatially and otherwise.

Decision processes

The above sketch of the evolution of the programme's structure has pointed to some of the principal processes involved. The first of these, a learning response to the shortfalls of the programme, is in accord with Simon's bounded rationality model. In terms of that model, such a response could be seen as the result of failure to achieve social welfare aspirations with the existing programme structure.

Such an interpretation, however, is perhaps too simplistic in the context of government decision-making in that it ignores the high degree of interdependence between government organizations and their societal environment. Thus the need for changes in policies has to be accepted by the community as well as the organization itself before any changes can take place. Here, Hall et al's (1975) concepts of the legitimacy of proposed policies, the degree to which they support other programmes or associate with other policy issues, and the newness and authority of the ideas behind the policies, are potentially relevant factors in determining acceptability. They were shown to be significant in interpreting the contribution of traffic congestion research to the expansion of the decentralisation programme in 1965/66.

The other significant factor in the decision process is the effect of stress. Although the bounded rationality model contains a stress factor, this is produced internally within the organization as a result of failure to achieve aspiration levels. Undoubtedly there were elements of this process present within the decentralisation programme. However, externally generated stress was also very significant at certain points in the programme, especially in decisions involving potential exceptions to existing policy. The model element in Figure 10.1 denoting the intervention of the local member is another example. In general, then, Simon's model understates the importance in the Department's decision-making of the interdependence with applicants and the public in general, which concept explains many of the features of the decentralisation programme identified in this study. It arises because governments must take account of the aspirations of the community at large in their evaluation of decision utilities, unlike the private organizations to which Simon's model appears mainly directed.

In this regard, Wolpert's (1970) emphasis on the locational implications for government authorities of stress generated by involved members of the public is attractive. His framework, however, relates to situations of conflict between the government and sections of the community, unlike the decentralisation programme whereby the giving of assistance is mutually beneficial to the government, applicant firms and country communities, and no loss is perceived by the Sydney population. This probably explains the lack of importance of threats (a basic mechanism in Wolpert's schema) in bargaining between the Department and applicant companies.

Moreover, Wolpert's framework appears to largely neglect an aspect of stress which is potentially important in explaining the decision pattern of the decentralisation programme. This is the concept of stress avoidance. Several important features of the programme can be explained in terms of this. Thus the evolution of new policies from exceptions to existing policies is explicable as a desire to avoid having to refuse new requests in which the applicants could point to examples of precedent. Another example of stress avoidance is the giving of assistance to prevent country factories from closing and thereby creating unemployment and local political pressure for relief funds.

The first of these two examples, in particular, in turn suggests that in models of government location decisions a special kind of maximizing behaviour may need to be considered. This is the desire to maximize the favourable political impact of decisions by granting at least some assistance to as many different groups as possible. Similarly, the fact that governments must take direct and full account of the wishes of society in general, with a resulting direct external intervention in the decision process that is not present to any extent in the decisions of private sector organizations, has implications for the construction of distinctive location models for the public sector. In particular, the concept of a social welfare function appears inadequate as a framework of analysis not the least because it does not allow for this possibility of direct interaction, or anticipation of the consequences of interaction, with affected firms and individuals during the decision process.

Relationship with other elements of society

In Chapter 1 the question of the nature of the relationship between government and other elements of society was broached. This is perhaps the most fundamental factor shaping the decentralisation decisions of the New South Wales government.

The financial assistance given to companies through the decentralisation programme could be argued to support the view of Marxian writers who see a primary role of the state as assisting with the capital accumulation process required to drive the capitalist economy (Milibrand, 1973; O'Connor, 1974; Gough, 1975). But the important question here is whether the decentralisation of production in assisted firms would have occurred anyway in the absence of state aid. A survey towards the end of the study period of 87 firms located in country areas of New South Wales found that in only one case was "government assistance" a location factor (Australian Government Publishing Service, 1972, 53). The survey was almost certainly biassed toward larger firms (no stratified sampling was carried out). This lack of influence of decentralisation aid for large projects/companies in the 1960s is confirmed by the six cases involving loans over $100,000 made to the twelve largest applicant companies in the sample. In only one case, involving a location very near Sydney and concern about possible effects on existing producers, was the non-availability of alternative finance confirmed by the Department. (Only two other sample loans over $100,000 for which file data were available were made: one to a new company in which the question of alternative finance was raised, and one to a co-operative facing closure.) The ability of the larger companies to finance themselves is also suggested by the fact that the Department felt able to refuse one or more parts of multiple requests, which were characteristic of large projects and thus large companies. In general, the ready availability of loans for large projects of large companies points to the Department's publicized criterion of regional or state significance, for which only indirect evidence had been obtained in the decision function analyses. Because such loan finance did not appear to be a crucial locational determinant in such cases the decentralisation programme appears to have strengthened the ologipoly capital class by channelling cheap funds to it from the general community.

The location of larger projects in country areas can, then, be seen as a largely laissez-faire outcome. Their particular locations within the country could also be viewed in similar terms. There was no evidence that the Department was able to persuade the larger companies to locate in socially optimal, but less efficient, areas even when it suggested particular towns for companies to investigate. Again, there was evidence in Chapter 2 as to the apparent ineffectiveness of maximum assistance designations in peripheral areas (the North Coast and Broken Hill) in attracting above average shares of new projects. The lack of imposition of social goals on large projects is illustrated by the Department's building of factories for short to medium lease, rather than the usual lending of building funds, for several major textile and clothing ventures. These industries are traditionally subject to considerable output fluctuations, and a short lease enables companies to increase their responsiveness to such fluctuations - albeit at the potential expense of employment in the town concerned (in this instance at least one company did not in fact renew the lease). In sum, the free market pattern of activity of assisted large companies was not discernably altered by the Department. The notion here of a dialectic, in which the government and oligopoly capital were at once in unity and conflict, does not appear valid. Among the reasons for this is probably the provision of decentralisation incentives by other Australian states (notably Victoria). Thus the New South Wales government's position was not a fully monopolistic one, unlike the theoretical position described in the opening chapter.

The implications of decentralisation assistance for smaller projects and companies, usually local in origin, were probably very different. Finance for the in situ expansion of existing firms was usually involved and thus not within the scope of the survey cited above with its negative finding about government assistance. Smaller companies have access to a more limited range of finance sources, and are regarded as greater risks because of their higher failure rate within a given industry. This lack of alternative sources of funds for small applicant companies was confirmed by the

Department in nearly all cases, thus confirming the crucial role of departmental funding. This enabled the Department to pursue social goals in a number of cases such as by providing assistance to otherwise marginal industries in places where the Department had met little success such as Cobar, Parkes, Mudgee and the far North Coast. On the other hand, the generally local nature of the small firms meant that the extra incentives in maximum assistance areas had little effect in increasing small company applications, since departmental assistance of any kind would have been welcome in the absence of alternative finance. The notion of a dialectic is probably more valid here, since the provision of government finance "interfered" with the laissez-faire industrial pattern by enabling small country firms to expand beyond the limits imposed by the capitalist financial sector.

Finally, there is at least one piece of indirect evidence of the influence on decentralisation policy of client groups within society. The areas in which loans to the full value of requests (the "100 per cent" areas) were first introduced by the Labour government in 1960 were Lithgow, Maitland and Cessnock. Each of these towns had an important, but declining coal mining sector at the time, a sector traditionally providing a strongly unionized and pro-Labour work force. The designation of these towns as maximum assistance areas could be seen as a political response to the problems of a group with significant influence within the ruling party. The designation of the North Coast as a "100 per cent" area by the new Liberal-Country Party government in 1965 could be viewed in similar terms. The government decentralisation portfolio was given to the Country Party. An important part of the latter's political base was centred on the dairying industry, which in 1965 was experiencing long term structural difficulties. Its largest production area was the North Coast, so that extra support for this region was a response to the needs of constituencies which had helped the party to win office.

Once such major parameters of the decentralisation programme (including most importantly, its size) had been set by the minister or state cabinet, however, decisions concerning the operation of the programme emanated almost solely from within the Department through its bureaucrats. Thus the "state" was in this case itself composed of at least two separate elements - politicians and bureaucrats - which each had distinctive relational roles with other societal elements.

RESEARCH IMPLICATIONS

A large part of this study was directed toward developing a predictive programming model of the decentralisation decision process. While encouraging results were achieved with the model in regard to loan expenditure, it has been shown to inadequately reflect the mechanisms of the decision process. In the first place, the concept that decentralisation funds are allocated by the constrained maximization of a single utility function is inadequate, as discussed earlier. The principal objection is that decision criteria vary from one case to another. Nevertheless, the disaggregation of the utility function according to size of request was shown to remove a significant proportion of the heterogeneity in criteria between cases, and a larger sample size may have allowed this to have been carried further. A bigger sample size may also have enabled the pattern of the grants form of assistance to be explained, by modelling each sub-type of grant separately, although in general the utility function approach will be less applicable the more criteria variation there is from case to case. Concomitantly, the incorporation of separate utility functions (each specific to one type of case) into a single iteration of the model was shown to be feasible.

Another deficiency of the programming model as structured here was that results were distorted by the exclusion of the financial contributions of local government and the applicants themselves to projects outside maximum assistance areas. It was suggested, however, that suitable constraints could be built into the model to take account of this. Another potential objection to the programming model is that it optimizes criteria simultaneously, unlike the posited decision process shown in Figure 10.1. However, algorithms are available for solving programming models using a hierarchical optimization procedure (Krouse, 1972). In general, then, the programming model is potentially capable of simulating the loan decision process to a fair extent, but further testing is obviously required. What is really needed, however, is a model which predicts the locational pattern of assistance without requiring details of the individual assistance applications being modelled. Such a model would come closer to governments' own situation in this type of programme, of uncertainty about the nature of future requests.

More widely, there seems a need for researchers into organizational location decisions to attempt to test beyond the simple linear additive utility/payoff frameworks that have been implicitly used up to now. The success in this study of a linear additive approach stands in contrast to the results of recent research into spatial behaviour at the level of the individual (Piccolo and Louvière, 1977). It would be instructive to know here, for example, whether the utility constructs of organizations represent a simplification of the constructs of the individuals within organizations. Another need, which was only partially met in this study, is the development of fuller theories and frameworks of decision-making in situations of interdependence between governments, industrialists and the community in general.

In general, the results and conclusions of the study as a whole require testing in similar situations of government assistance to private industry. Variations from government to government in external constraints on decision-making may be important, for example (North, 1977, 165), while the relationship between organizational structure and decision strategy is a potentially fruitful area of research (Rees, 1972, 202).

Finally, reference should be made to perhaps the most difficult aspect of government location decision analysis: the role of individuals and groups within the relevant organization. No overall quantitative framework for studying this area was available for the present study, but as suggested in the previous chapter intra-organizational variables may be crucial in determining the final decision pattern. The question of the experiences, attributes and values of the officials responsible for getting decisions through in each organization is an important one (Rees, 1972, 202; Prentice, 1976, 233), although this may be less so in very larg government departments with a given "style" of decision-making. At a time when geographers are increasingly looking to behavioural approaches in the study of government and other organizational location decisions, the analysis of full personal and group behavioural variables within organizations, such as suggested by Pred (1967), ought to be given priority. This study was not able to be as comprehensive as desired in regard to attributes, while personal values and coalition formation had to be ignored. Despite such shortcomings, however, it is hoped that this study has contributed some insight into the location decision-making of governments and thus in turn contributed towards the understanding necessary for better decisions about social welfare.

Footnotes

1. Conceptually, this could be considered to include cases involving all positive or all negative criteria and thereby not requiring a trade off (Figure 10.1), since at least the intention of making a trade off was present.

2. This is not evident in Figure 10.1, since it does not distinguish between locational and other criteria.

APPENDIX 1

APPLICATION FORM COMPLETED BY COMPANIES APPLYING FOR DECENTRALISATION LOAN

Application for Term Loan

1. Name of company and address of registered office.
2. Amount requested and purpose for which finance is required.
3. Period for which the loan is required.
4. Security which can be offered for the loan. (Please give the address of any property concerned, and provide latest Valuer General's valuation.)
5. Date of incorporation of company.
6. Names and addresses of all directors.
7. Are any directors employed by the company and in what capacity? If so, what salaries are paid?
8. At what bank does the company transact its banking business? (Give details of security for overdraft held by the bank.)
9. Has your company applied elsewhere for the finance now sought? If so, where, and with what result?

10A Is the company a subsidiary or associate of another company? If so, state the company concerned.

B What products does the company manufacture?

C Location of markets for products manufactured. Type of transport used for raw materials and finished goods.

D Is it intended to produce any new lines? If so, please list.

E Does the company hold any agency, franchises or licence agreement? If so, give particulars.

F Will the project involve expenditure on machinery? If so, to what extent and what arrangements have been made to obtain this finance?

G What arrangements are proposed to ensure the availability of sufficient working capital?

H What is the company's present labour force?

Occupation	Male	Female

I Are any additional employees to be engaged when this project is completed?

Occupation	Male	Female

11. This application should be accompanied by the following:

A Trading, manufacturing, profit and loss accounts and balance sheets for at least the past three trading years.

B Budgeted (estimated) turnover, costs and net profits for each of the first three years after implementation of the expansion

APPENDIX 2

QUESTIONNAIRE SENT BY DEPARTMENT OF DECENTRALISATION AND DEVELOPMENT TO ASSISTED FIRMS

Questionnaire D.9220

1. Staff employed
   a) Managerial and Office
   b) Factory
   (If assistance granted more than once, please indicate approximate total employment prior to each granting.)

Before Assistance First Granted			Present			Any Proposed Increase		
Males	Females	Total	M	F	T	M	F	T

2. Principal products manufactured by the company immediately before Government assistance was first granted.

3. New lines produced by the company following receipt of assistance.

4A Were manufacturing operations now carried out transferred from some other centre such as Sydney?

Yes

No

If YES, furnish particulars, including date of transfer.

4B What proportion of total operations were transferred?

0-25%

26-50%

51-75%

76-99%

100%

C <u>Annual turnover as percentage of total Labour Force</u>:

Male ....%

Female ....%

D Total annual absenteeism (days lost)

Male ....%

Female ....%

5A <u>Principal reason</u> operations were commenced in present location

5B Any other factors which influenced establishment in present location

C Was the founder(s) of the company a local man?

Yes

No

If the answer is YES for 5C did he work or has he worked in industry outside present location?

D Location of markets for products manufactured

6A What percentage (approx.) of purchases of materials for manufacture by value comes <u>directly</u>* from sources located:

	Per Cent
Within the metropolitan area	....
Within 150-mile radius of the factory	....
Within the State but outside 150-mile radius of the factory	....
Interstate	....
Overseas	....
TOTAL	100%

*e.g. steel purchased from a merchant in the metropolitan area would be "metropolitan" even though it originates in another State.

6B What percentage (approx) of sales of finished products goes directly* to locations:

	Per Cent
Within the metropolitan area	....
Within 150-mile radius of plant	....
Within the State but outside 150-mile radius of the plant	....
Interstate	....
Overseas	....
	100%

*e.g. goods sold to an exporter in the city would be "metropolitan", not "overseas".

7. Type of transport used for raw materials and finished goods. (Please indicate percentage for each type)

A Raw Materials		B Finished Goods
.....	Rail	.....
.....	Road	.....
.....	Air	.....
.....	Sea	.....

8. Whether any particular transport problems are experienced? If so, give details.

9. Economic effects on your company of the revised exemption from payment of Road (Co-ordination) Tax to the present 150 miles limit.

10. Did the company receive financial assistance from banking, institutional and/or other sources in the implementation of its development? If so, give details.

11. Is the company contemplating any further developments in the near future?

12. Any other relevant details:

APPENDIX 3

CHOICE OF VARIABLES FOR EMPLOYMENT GROWTH ANALYSIS

The number of variables chosen as potential determinants of employment increases in assisted firms represents a compromise between the large number of possible factors which could have been included on the one hand and lack of data and small sample sizes on the other. In particular, the low number of establishments in most of the industry groups meant that there was a danger that correlations describing unique situations and with little predictive power could arise if too many variables were included, even after reduction to a smaller number of factors for the final regression analyses. For this reason the number of variables included in a particular industry group was generally limited to about twice the number of establishments (observations) in that group, although this was not possible for some groups. Table A.1 lists the variables selected for each group, these variables being those assessed as the most potentially important for predicting employment growth. (Those variables selected for which all, or all but one, sample establishments in a group had the same value were eliminated from the statistical analysis of that group. With all values the same the variable would have had no predictive capacity, while a single deviant value would merely act as a surrogate for the establishment concerned.)

The approach adopted in choosing particular variables was an eclectic one similar to that of Keeble and Hauser (1971), with factors suggested by both industrial location theory and previous empirical location analyses being considered. In addition, since the emphasis here was on selecting variables which could explain employment change, potentially relevant elements from economic growth theories and studies were also considered. At the same time, to the extent that a favourable location is conducive to growth, the purely locational variables identified here will obviously be potentially relevant in explaining employment change, as is recognized in several of the change studies referred to in this Appendix (e.g. Keeble and Hauser, 1971; Burrows and Metcalf, 1971). The rest of this Appendix discusses the choice of individual variables, which are considered within broad groups of location/growth factors for analytical convenience.

Raw material/market/transport factors

These form the basis of classical location models of economic activity, such as those of von Thunen, Weber and Losch.

The importance of raw materials on the location of an industry is a function of several factors, such as relative weight, fragility and perishability (Isard, 1956; Linge, 1963). A number of empirical studies (for example, Greenhut and Colberg, 1962; McMillan, 1965) have distilled such factors into the central ones of the transport cost of raw materials and the availability of raw materials, which is closely linked with transport costs but implies the presence of sufficient actual or potential supplies within a certain distance. Accordingly, two principal raw material variables were developed: the average rail freight cost of delivering one ton of a particular raw material to the proposed industry location from all producing areas within a 150-mile radius, weighted for differences in production levels between areas; and the production of a particular raw material within a 150-mile radius of the proposed location. The raw materials considered potentially relevant here were timber, fruit and vegetables, cereals and lucerne. Because of the different marketing environment of wool, a further variable, the freight cost to the nearest wool selling centre, was also considered. The main problem with the inclusion of such raw material variables is that each is only relevant to a specific type of factory, whereas the sample establishments in each of the two industry groups concerned (building materials, and food and timber products) show a wide variation in their raw material requirements. Hence an analysis using these as explanatory variables in the two industry groups could produce meaningless predictive relationships for at least some of each group's sample establishments. No raw material variables were therefore selected for analysis.

A closely related set of location factors is the cost and availability of fuel and energy, as discussed in various theoretical (Isard, 1956; Greenhut, 1956) and empirical (McMillan, 1965; Burrows and Metcalf, 1971) studies. The first variable considered for inclusion under this heading was the freight rate for coal from the nearest coalfield. A previous field survey by the author of about 100 manufacturers in central and Southern New South Wales, however, revealed that coal was a significant fuel in only a few industries. The variable was thus omitted for the same reason as the raw material variables. The availability of town gas was also considered (following Linge, 1963, for example), but the author's field survey revealed only scattered usage of gas for fuel, while the availability of bottled LPG gas in the 1960s reduced gas users' needs for locally-produced supplies. Another potential fuel variable, the cost of diesel oil, was not included because of its potentially high statistical collinearity with one of the selected variables, distance to dominant metropolitan area. The price and/or supply of electricity have been cited in the empirical studies of Greenhut and Colberg (1962) and McMillan (1965). New South Wales data were only available in regard to average electricity costs in each area, and these do not necessarily reflect the price negotiated with the large consumers for which electricity costs might be a significant locational factor; while supply, quantity and reliability is not a locational factor since nearly all areas are connected to the state grid. These considerations meant that no fuel and energy variables were selected.

The size and proximity of markets are traditional elements of location models, notably that of Losch (1959). Empirical studies have confirmed their importance in influencing location decisions (such as in the country areas of New South Wales by Fielding, 1967, and Department of Decentralisation and Development, 1969). Market factors operate at two general scales, the local market level and the non-local market level, with different variables embodying each.

At the local level, the most obvious variable for representing market strength is the population of the town where the factory is (or may be) located (as used by Linge, 1963, for example) so that the first variable selected was urban area population. Urban population can also serve as a proxy variable for the strength of external economies (Neutze, 1965; Webber, 1972, 212) such as labour availability (Moseley, 1974, 112) and access to supplies, business services and business information generally; alternatively town population could represent external diseconomies in some circumstances (Estall and Buchanan, 1966, Chapter 5). In studies of locational change the change in town population is also potentially important (Burrows and Metcalf, 1971). Thus variable 2 is the percentage annual change in urban area population. Local markets, however, are not necessarily circumscribed by the urban area of the factory in question.

In practice the location of neighbouring establishments producing the same goods sets the limit to the area over which a factory has a marketing advantage. Assuming that the boundaries of market areas are equidistant between competing establishments variable 3 was therefore defined as the population of local government areas not nearer other similar establishments, these areas being the lowest level for which figures are published.[1] Again, as this is an analysis of employment change, the percentage annual change in variable 3 was added as variable 4. Furthermore, regional growth theory applying Keynesian concepts indicates that local consumption of local production is dependent on local income (lagged by one or more periods), via the marginal propensity to consume (Hartman and Seckler, 1967). In New South Wales differences in per capita income between non-metropolitan urban areas are probably small, so that it is for industries relying mainly on local rural demand that income is likely to be significant as an extra indicator of local market size in addition to population. The only industry group analysed here in this category is engineering (local markets). Variable 5, rural sector income in local government authorities not nearer other similar establishments, was therefore applied only to the engineering (local markets) group. As with the two local market population variables, a change variable, the percentage annual change in variable 5 was added as variable 6 and again applied only to the engineering (local markets) group. Within this group, however, the product mix varies greatly between establishments, partly because of the bespoke nature of production and entrepreneurial differences in skills and innovation, but also partly because of the nature of rural production in each establishment's hinterland. The author's field survey cited above and evidence from the Department of Decentralisation's files suggested that a distinction between mixed sheep/grain production areas and other farming areas was significant in terms of local engineering production differences, particularly in the manufacture of implements and storage items.[2] Hence variable 7, the percentage of the primary production work force in local government authorities not nearer other similar establishments which lives in sheep/grain growing areas, was added as the final local market variable.

At the non-local market level distance assumes a greater relative importance. A fusion of the effects of distance to, and size of, potential markets is achieved by the concept of market potential (Smith, 1977, 232), which Duncan (1959) and Keeble and Hauser (1971) for example have found significant in explaining manufacturing location. Variable 8 is therefore an index of national market potential applied to the four industry groups with primarily non-local markets, the national scale being preferred to south eastern Australia or state levels because broad surrogates for the latter, in the form of metropolitan distance variables, were also selected for analysis. Of all non-local markets of Australian country industries, the nearest metropolitan area is usually the most important.[3] Hence metropolitan distance is important in determining the profitability of non-local sales, a factor also considered in studies of non-metropolitan industries in other western countries (Bogue, 1950; Duncan, 1959; Hampton, 1968; Burrows and Metcalf 1971; Keeble and Hauser, 1971). Thus variable 9 was specified as the road distance to the dominant metropolitan area. Besides reflecting non-local market opportunities metropolitan distance is to a certain extent also a surrogate for branch contact with parent plants or headquarters and proximity with outside processors, suppliers and repairers. For engineering plants the iron and steel base price locations of the country's only producer, BHP, are also relevant. Variable 10, the road distance to the nearest steel base price point, was thus added for such establishments. For branch plants in the clothing and shoe industries, where fashion changes can necessitate speedy supply, overnight trucking access to the main metropolitan factories carrying out finishing operations, or to metropolitan outlets generally, may be important. Hence, for establishments in the textiles, clothing and shoes group, variable 11, whether the establishment is within overnight trucking distance of the dominant metropolitan area, was included. Metropolitan access is improved by major trunk road locations, and these should, therefore, be attractive for certain industries

(Keeble and Hauser, 1971) such as clothing and shoe manufacturing and some types of footloose industries. In New South Wales, the Hume Highway provides the best metropolitan access since it links the nation's two largest cities, Sydney and Melbourne. In the case of establishments in the textiles, clothing and shoes group and the miscellaneous group (which includes footloose industries), then, variable 12, whether the urban area is on the Hume Highway, was selected. The costs of transport to markets, however, not only depend on distance but also on the structure of freight rates (Isard, 1956; Greenhut, 1956; Smith, 1971). Hence variable 13, the rail freight cost from the nearest station to Sydney, was added for establishments in the two engineering groups (Sydney rather than dominant metropolitan area being used because New South Wales Government Railway freight rates are structured so as to generate rail freight between Sydney and border areas within the (road) hinterlands of Melbourne or Brisbane). In addition, the quality of transport services is being increasingly recognized as an influence on manufacturing growth (Stevens and Bracket, 1967, 9-10; Keeble, 1976, 54-59). In New South Wales the economy rail express (bulk loading) service to Sydney provides cost, time and other advantages to rail freight shippers (Gould and Smith, 1961) and thus represents a higher quality service. Variable 14 was therefore defined as the number of days per week on which the urban area receives rail express service, applied to the four groups most likely to be influenced either in input or output terms (both engineering groups; printing and packaging; and textiles, clothing and shoes).

Several other transport variables were also considered for selection. The extent to which each town is a road or rail route node, for example, is sometimes mentioned as a potential manufacturing growth factor (Burrows and Metcalf, 1971), but in Australia the transport node function, particularly for railways, is dominated by the capital cities (Logan, 1966). In addition, road nodes were considered to have a partial surrogate in variable 3 in terms of local nodal effects. The quality of road freight services, as measured by whether a town had a daily road freight service to its dominant metropolitan area, was also considered[4] but not included because no complete data were available. In the New South Wales situation a further potential influence was the existence in the 1960s of road co-ordination tax, payable on interstate truck journeys of more than 50 miles in competition with rail transport. Thus, manufacturers within 50 miles of the state border could use road transport for interstate shipments without being subject to co-ordination tax. The number of sample establishments in this zone was low, however, and an appropriate variable was therefore not included. Distance to the nearest seaport was also considered for selection, but this would have imputed a misleading significance to the minor parts (Ballina, Maclean, Coff's Harbour, Trial Bay and Eden) because of their specialised trade and very small size[5] compared to the major ports of Sydney/Botany Bay, Newcastle and Port Kembla for which a distance variable (number 10) was already included. Nearness to an airport is being increasingly mentioned in overseas studies (MacMillan, 1965; Keeble, 1968) as a plant location factor, but urban area population, variable 1, was considered to represent an adequate surrogate for the quality of a town's air services.

Labour factors

These are traditionally regarded as a basic influence on plant location. They can be broadly divided into cost aspects and availability aspects. In United States studies cost aspects have been found to be important in manufacturing location. Wage rate differences between areas, for example, are frequently cited as a locational determinant (Greenhut and Colberg, 1962; Mueller and Morgan, 1962; McMillan, 1965; Whitman and Schmidt, 1966). Within New South Wales, however, state and national industrial courts have set uniform minimum wage rates, either in the form of the national basic (minimum) wage or separate industry/craft minima. Thus wage variations are not a factor in location within the state's country areas. United States studies also bring out the importance of another labour cost factor, the degree of unionism in different areas (McLaughlin and Robock, 1949; Mueller and Morgan, 1962). In New South

Wales country areas, union influence within a given industry does not, with one exception, vary significantly from one location to another because unions are organized on a state basis. The exception is Broken Hill, where the Barrier Industrial Council, composed of union representatives, exerts a strong influence over the city's economic life.[6] As no sample establishments were located in Broken Hill, though, a unionism variable was not included.

In New South Wales labour availability factors can be important determinants of non-metropolitan industrial location, as Fielding's (1967) survey of 65 factories indicates. Several possible surrogates measuring labour availability exist. The best measure of immediately available labour is probably the number of unemployed, an indicator that has been used by Keeble and Hauser (1971) for example. Thus variable 15 was defined as the percentage of the urban area work force unemployed ("not at work"), while variable 16 was taken as the percentage of the urban area male work force unemployed ("not at work"). The two variables were included in the analysis for the food and timber products (non-local markets) and engineering (non-local markets) groups, which had the largest average establishment employment size and therefore presumably a need for larger labour pools, and the textiles, clothing and shoes group, for which labour availability is a traditionally key location factor. For the clothing and shoe components of the latter group the availability of female labour is particularly important, so for this group variable 17, the percentage of the urban area female work force unemployed ("not at work"), was added. Female unemployment is not a complete measure of the potential labour pool, however, because the female activity rate (female work force (employed and unemployed) as a percentage of the female population of employable age) varies according to existing employment opportunities (Bowers, 1970, 52). A new factory might thus be able to draw on female labour which comes into the work force as a result of the new job opportunities. To reflect this, variable 18, measuring the female population of employable age not in the work force and defined as the number of females aged 15-59 minus the female work force, as a percentage of the urban area population, was also added to the textiles, etc group analysis. The existence of skilled labour of different types may also be an important location factor, as a number of empirical studies have shown (Luttrell, 1962; Mueller and Morgan, 1962; Spiegelman, 1964; Keeble and Hauser, 1971). No published data on the skill composition of the labour force are available for New South Wales urban areas. As a proxy, variable 19, whether the urban area had a technical college course providing training in the industry skills most appropriate to the applicant firm, was selected. It was included in the analysis for both engineering groups, printing and packaging, and textiles, etc because a high proportion of the work force in these groups is skilled. The variable was also included in the food and timber products (non-local markets) group analysis because the typical establishment here is relatively large and produces standardised articles, so that machinery is specialised and extensive and the need for machinery maintenance employees is high. Other factors potentially affecting the quality of the labour force, such as the general level of education (Burrows and Metcalf, 1971) and health (Greenhut, 1956) in a community were not included because of the difficulty of obtaining data and the likelihood, in any case, that differences between country towns are not significant because of uniform standards arising from the provision of education and health facilities by state, rather than local, government.

Economic structure/external economies factors

Economic growth theories suggest that economic structure is an important concomitant of growth (Hoover and Fisher, 1949; Rostow, 1960). This has been given spatial expression notably in the concept of the growth pole, with its "propulsive industries" as the nucleus of development (Richardson, 1969, 417). The potential significance of economic structure on manufacturing growth and location at the sub-national level has been confirmed in a number of empirical studies. The existing level of activity in the same industry at a particular location, for example, has been shown to be an important factor in the location/growth in several studies (Thompson and Mattila, 1959, 85; Mueller and Morgan, 1962; Kuklinski, 1967, 3), with higher activity beneficial in encouraging a concentration of suppliers or customers, or labour pools with appropriate skills. To reflect this, variable 20, the percentage of the urban area work force in the same Census industry group, was included in the analyses for the four industry groups employing a high proportion of skilled labour: printing and packaging; textiles, clothing and shoes; and both engineering groups.[7] The level of activity in other industries at the same location may be significant for similar reasons, in providing markets (Linge, 1963) or supply sources, or a nucleus of skilled labour (Luttrell, 1962, 62). The inclusion of a series of appropriate variables denoting the proportion of the urban area's work force employed in each industry group, would however have tended to influence the factor structure produced as the initial analysis stage for each group to an extent not justified by the probable general influence of other industries in the New South Wales country town situation (c.f. footnote 7). On the other hand the inclusion of a single index of industrial specialization (as in Keeble and Hauser's (1971) study), which provides an indicator of perhaps the most important effect of other industries on a new country town plant viz the extent of competition for labour, is perhaps warranted. Because of the relatively small town sizes in the sample, a high degree of specialization would point to the presence of one or two large establishments, representing potential sources of competition for labour for the new plant. This will be more important if the new firm is a large employer. Thus for the three industry groups with the largest average sample establishment sizes - food, etc., engineering (non-local markets), and textiles, etc - variable 21, an index of the urban area's industrial specialization, was added.

More disaggregated economic structure variables seem warranged in the case of metal-working industries. For engineering plants other than the very largest and most integrated the importance of other local metal-working establishments of certain kinds can be particularly high (Luttrell, 1962, 65), even in country areas judging by the evidence from the author's earlier field investigation. The latter revealed the importance of local foundries, precision engineers and electroplaters in particular in carrying out specialised processes for other engineers. For the two engineering groups of sample establishments, then, the following variables were included: whether the urban area had a foundry (variable 22); whether the urban area had an electroplating works (variable 23); and whether the urban area had a precision engineering works (variable 24). The earlier field investigation also brought out the significance of local steel wholesalers, so for sample engineering establishments variable 25, whether the urban area had a steel wholesaler, was also added. Local foundries and precision engineering works can also be valuable in quickly making new parts for broken or worn machinery in non-engineering industries, as the field investigation also demonstrated. Thus variables 22 and 24 were also included in the analyses of the food, etc and textiles, etc groups, for which such local facilities are probably more important because of their relatively greater number of larger and more mechanised establishments.

Amenity/infrastructure factors

Amenity factors are receiving increasing attention as determinants of manufacturing location and growth, with the emphasis changing from infrastructure factors to "quality of life" variables such as climate and recreation facilities (Chisholm, 1962; Keeble, 1976, 288). This new emphasis is also appropriate for New South Wales where infrastructure elements have tended to have a negative location influence, with the few towns (if any) lacking a particular infrastructure requirement being ruled out of further consideration. Overseas studies encompassing infrastructure factors have pointed to water availability, quality and cost (Greenhut and Colberg, 1962; McMillan, 1965; McGregor, 1970) and sewerage and waste disposal facilities (Greenhut, 1956; Greenhut and Colberg, 1962) as location factors in some cases. In New South Wales, however, almost all urban areas have sewerage facilities; virtually none of the sample establishments were major users of water, while in any case available water supplies appear sufficient to meet significant urban development in all the state's settled non-metropolitan areas (Hobbs and Woolmington, 1966); there was no evidence in the author's earlier survey or in replies to the Department's questionnaire

(Appendix 2) that water quality was a location factor for the respondent firms;[8] water costs are high only in the far west of the state (notably at Broken Hill (Linge, 1963, 49)) where it has been isolation, rather, that has produced an absence of industrial development; and while waste disposal facilities may sometimes be a consideration, these are difficult to quantify and have a partial surrogate in the north coast location variable (discussed below). US studies have also cited other infrastructure factors, notably land price and availability (Spiegelman, 1964; McMillan, 1965), and the availability of industrial buildings (Kuklinski, 1967, citing a major survey of US plant location decisions). Land availability or price are also occasionally location factors in New South Wales country towns (Fielding, 1967; Department of Decentralisation and Development, 1969, 80). But land availability is difficult to quantify, and state-wide price information was not available (unimproved capital values could not be used because of varying bases of valuation between local councils). Similarly the availability of premises has been a location reason for some New South Wales country factories (Department of Decentralisation and Development, 1969, 60), but again no relevant data were available. Thus land and buildings were not included as analytical variables, although the likely extent of any resulting regression misspecification was considered to be small.

The increasing significance of environmental quality, particularly in regard to climate and urban amenities (Garwood, 1953; Ullman, 1954; Stevens and Brackett, 1967, 11), for industrial location reflects its growing influence on managerial and labour residential location preferences because of increasing leisure time and real incomes, together with the decreasing importance of transport costs in industrial production. In New South Wales the north coast, with its beaches and warm climate, is regarded as the most amenity-attractive country area for industrialists.[9] Hence variable 26, denoting whether the urban area is on the coast north of Sydney, was added. Of all urban amenities, a local university is perhaps the most important in influencing the residential location preferences of New South Wales country people (Doddridge and Holland, 1970). As only one country town (Armidale) contained a university in the 1960s, however, no corresponding variable was included.

Government financial factors

These operate at two levels: state and local. At the state level, taxes in the 1960s were levied at uniform rates throughout New South Wales. Decentralisation incentives offered by the state government did, of course, vary spatially. Since these form the dependent variables of the present study, equivalent independent variables were not included. Another important form of assistance given by the state government has been Treasury loan guarantees to particular businesses. Such a guarantee could be significant in allowing an enterprise to expand, but a corresponding variable was not added because none of the sample enterprises received such a guarantee during the period of analysis. At the local government level the main potential financial factor, taxes, are "generally a relatively unimportant influence on industrial location" (Smith, 1971, 54). This conclusion is reinforced in the New South Wales situation by the low share of local taxes in total business payments in comparison with the United States, for example. In any case, published figures of local rates (the predominant form of local taxation) per dollar of unimproved or improved capital land value vary widely between New South Wales local councils because of different land valuation yardsticks. Local council incentives to industry, other than loans to industries in conjunction with the state government under the decentralisation programme,were minimal in the 1960s.

Sub-group classification

In order to obtain industry groups which each contained a sufficient number of sample establishments, it was in some cases necessary to aggregate establishments whose locational requirements varied to some extent. To model such intra-group differences dummy variables were added, identifying particular types of establishments hypothesized as having certain location/growth tendencies at variance with those of the group as a whole (although not so different as to warrant inclusion in another group). In the building materials group, the most important distinction is probably that between establishments using clay or concrete as raw materials, and those using inputs more easily transported over longer distances. For this group, variable 27, whether the establishment made concrete or clay products, was added. The food and timber products group contains a clear division between food producers and timber product manufacturers, so variable 28, whether the establishment produced timber products, was included for this group, The engineering (local markets) group includes some repair establishments. These are distinct from metal product manufacturers in terms of labour intensity and their reliance on a relatively fixed market with recurring demand requiring little innovation. Two distinct types of repair establishments were analysed. Corresponding variables identifying each type were therefore included for the local engineering group: variable 29, whether the establishment was an engine (non-aircraft) repair works; and variable 30, whether it was an aircraft engineering establishment. Establishments in the printing and packaging group were distinguished by variable 31, whether the establishment carried out package manufacturing. Textile establishments in the textiles, clothing and shoes group were separately identified using variable 31, whether the establishment produced textiles, mainly because the proportion of male labour is greater than that of clothing or shoe factories.

Internal factors

An important recent development in manufacturing geography has been the increasing emphasis on factors internal to the firm as influences on location patterns (Townroe, 1972; Hamilton, 1974). In an analysis at the establishment level, such as the present one, it is therefore desirable to include variables acting as surrogates for such internal factors.

The financial position of the applicant firm is one obvious potential determinant of employment change in a new or existing establishment. Although some financial variables, such as the value of stocks, are related to various of the external variables already selected (for example, Webber, 1972, 211-212), other factors such as corporate strategy and entrepreneurship are also significant influences. Such internal factors can therefore be reflected by the inclusion of financial variables; at the same time, financial variables themselves may be crucial in governing growth prospects. Two of the generally accepted financial ratios for measuring the financial structure of a business were included (see Carroll, 1973): current assets to current liabilities (variable 33), and pre-tax profits to shareholders' funds (variable 35). Another ratio, long term liabilities to shareholders' funds, was modified (to form variable 36) to take account of the effect of adding the prospective government and local council loans to existing long term liabilities. Some of the other accepted financial ratios had to be excluded because they required sales data, which was available for only a few of the sample firms. A non-ratio measure, the value of working capital, was also considered desirable because of its importance as a potential constraint on expansion, and therefore included as variable 34. A variant of this measure was also included (as variable 37) to take account of the drain on working capital caused by paying back decentralisation loans, the variable being defined as the value of working capital minus the annual value of repayments on the prospective government and local council loans. To allow for the financial burden and generated by the applicant company's own contribution to the decentralisation project outside the government's maximum assistance areas, the percentage of the loan request to be contributed by the applicant company was added as variable 38.

Non-financial characteristics of the applicant company may also be significant determinants of employment change decisions. The type of ownership (public or private), for example, has been shown by Townroe (1972, 264) to be related to several location decision-making activities. Variable 39, whether the company was under public or overseas ownership, was therefore included (overseas firms being equated with public companies because their ownership status was not known). The locational origins of a company may be important, with local origins suggesting a lesser knowledge of alternative, and perhaps more suitable, locations. Hence variable 40, whether the company is a locally originating one, was added. Conversely, if the establishment is a branch plant a large number of potentially suitable locations may be investigated if ties with the parent plant are important (Townroe, 1972, 267), while employment prospects may be either improved, because of information and expertise available elsewhere in the company, or else made less certain because the company is able to switch production between its various plants. Accordingly, whether the establishment has a branch plant was included as variable 41. Contrasting with branch openings are transfer moves. The latter could be hypothesized to have lesser employment prospects because of greater reliance on local sources of information (Townroe, 1972, 265) and the greater risks of going out of business if unforeseen difficulties arise from the move. To reflect these hypotheses, variable 42 was selected: whether the establishment represents a new location for the migration of all or most of the company's operations. One type of company for which employment risks are greatest are new firms. Working capital advances from banks, for example, may depend on personal qualities (Jervis, 1957, 200-201), while commercial experience of various kinds may be lacking. Thus variable 43 was defined as whether the company was newly established at the time of the application. Another external factor stressed widely in economic literature is the possibility of economies of scale in production. Thus investment in an existing large plant offers the possibility of economising on labour overheads, for example, and achieving a given production with a smaller work force increase. To reflect this possibility, employment in the establishment at the time of the application for decentralisation assistance was added as variable 44. Finally, managerial quality has been shown to be a significant influence on plant location and growth in various studies, such as Townroe (1972, 268-269) and Williams (reported in McIlwraith, 1974). No objective criterion of the managerial quality of the applicant firms was available. The Department's own assessment was, however. Despite the possibility of misjudgement due to inaccurate or incomplete information this assessment was included as variable 45, defined as whether the Department assessed the applicant company's management unsatisfactory.

Footnotes

1. Where more than one competing establishment was located in the urban area a division by the number of such establishments was necessary (Table A.1, footnote 37).

2. For example, wheat production is restricted to mixed sheep/grain areas, and production of bulk storage bins/sheds for wheat is common in such areas but virtually absent elsewhere.

3. As evidenced, for example, by replies to the appropriate question in the Department of Decentralisation's questionnaire to assisted firms (Appendix 2).

4. The potential importance of this variable is indicated by the fact that one US industrial location survey with 2,000 respondents listed good truck transport as the most important determinant in selecting a "specific area or site" (McMillan, 1965, 240).

5. In 1968/69 the total trade of the five ports mentioned was only 264,800 tons compared with 7.2 million tons for Botany Bay, the next smallest port (Maritime Services Board of New South Wales, 1969).

6. For instance, the BIC restricts the job opportunities of married women to ensure employment for single women.

7. Local customer or supplier relationships were not considered as relevant in choosing the groups to which the variable should be applied, since the author's earlier field survey and replies to the Department's questionnaire (Appendix 2) both showed that most intermediate outputs and processed inputs of country factories went to or came from non-local areas.

8. Another survey of 87 country firms by the Department showed that in only one case was "water" a reason for the existing factory location (Department of Decentralisation and Development, 1969, 60).

9. For example, the amenity factor was the main reason why one large firm included in the sample decided on the north coast as the area to which to move its Sydney operations.

Table A.1

Variables Selected for Explanation of Employment Change, by Industry Group

(x indicates selection; (x) indicates variable selected but omitted from analysis because group sample values were all the same, or the same with one exception)

Variable	Group						
	Building materials (local markets)	Food and timber products (non-local markets)	Engine-eering (non-local markets)	Engin-eering (local markets)	Printing and packaging	Textiles, clothing and shoes	Miscel-laneous
Market/transport variables							
1. Urban area population[1]	x	x	x	x	x	x	x
2. Percentage annual change in urban area population[2]	x	x	x	x	x	x	x
3. Population of local government areas (l.g.a.s.) not nearer other similar establishments[3]	x	x	x	x	x	x	x
4. Percentage annual change in variable 3[2]	x			x	x		
5. Rural sector income in l.g.a.s. not nearer other similar establishments[4]				x			
6. Percentage annual change in variable 5				x			

Table A.1 (cont)

	Building materials (local markets)	Food and timber products (non-local markets)	Engin-eering (non-local Markets)	Engin-eering (local markets)	Printing and packaging	Textiles, clothing and shoes	Miscel-laneous
7. Percentage of primary production work force in l.g.a.s.not nearer other similar establishments which lives sheep/grain growing areas[5]				x			
8. Index of national market potential[6]		x	x			x	x
9. Road distance to dominant metropolitan area[7]	x	x	x	x	x	x	x
10. Road distance the nearest steel base price point[8]			x	x			
11. Within overnight trucking distance of dominant metropolitan area						(x)	
12. Whether urban area or Hume Highway						(x)	x
13. Rail freight cost from nearest station to Sydney[9]	x	x	x	x	x	x	x

Table A.1 (cont)

	Building materials (local markets)	Food and timber products (non-local markets)	Engineering (non-local markets)	Engineering (local markets)	Printing and packaging	Textiles, clothing and shoes	Miscellaneous
14. Number of days per week on which urban area receives economy rail express service[10]			(x)	x	(x)	x	
Labour variables							
15. Percentage of urban area work force unemployed ("not at work")[1]		x	x			x	
16. Percentage of urban area male work force unemployed ("not at work")[1]		x	x			x	
17. Percentage of urban area female work force unemployed ("not at work")[1]						x	
18. Number of females aged 15-59 minus female work force, as percentage of urban area population[1]						x	
19. Whether urban area had technical college course providing training in industry skills most appropriate to applicant firm[11]		(x)	(x)	x	(x)	x	

Table A.1 (cont)

	Building materials (local markets)	Food and timber products (non-local markets)	Engineering (non-local markets)	Engineering (local markets)	Printing and packaging	Textiles, clothing and shoes	Miscellaneous
<u>Economic structure/external economies variables</u>							
20. Percentage of urban area work force in same Census industry group[1, 12]			x	x	x	x	
21. Index of urban area industrial specialisation[13]		x	x			x	
22. Whether urban area had foundry[14]		(x)	(x)	x		x	
23. Whether urban area had electroplating works[14]			x	x			
24. Whether urban area had precision engineering works[14]		x	(x)	x		(x)	
25. Whether urban area had steel wholesaler[14]			x	x			
<u>Amenity variables</u>							
26. Whether urban area on coast north of Sydney	(x)	(x)	(x)	(x)	(x)	(x)	(x)

Table A.1 (cont)

	Building materials (local markets)	Food and timber products (non-local markets)	Engineering (non-local markets)	Engineering (local markets)	Printing and packaging	Textiles, clothing and shoes	Miscellaneous
Sub-group classification variables							
27. Whether concrete/clay products establishment	(x)						
28. Whether timber products establishment		(x)					
29. Whether engine (non-aircraft) repair establishment				x			
30. Whether aircraft engineering establishment				x			
31. Whether package manufacturing establishment					(x)		
32. Whether textile products establishment						x	
Internal variables							
33. Ratio of current assets to current liabilities[15]	x	x	x	x	x	x	x
34. Working capital (current assets minus current liabilities)[15, 16]	x	x	x	x	x	x	x

Table A.1 (cont)

		Building materials (local markets)	Food and timber products (non-local markets)	Engineering (non-local markets)	Engineering (local markets)	Printing and packaging	Textiles, clothing and shoes	Miscellaneous
35.	Pre-tax profits as percentage of shareholders' funds[15, 17]	x	x	x	x	x	x	x
36.	Long term liabilities, including government decentralisation loan, as percentage of shareholders' funds[15, 18]	x	x	x	x	x	x	x
37.	Working capital minus annual value of repayments on government decentralisation loan[15, 19]	x	x	x	x	x	x	x
38.	Percentage of loan request to be contributed by applicant company	(x)	(x)	x	x	(x)	x	x
39.	Whether public or overseas company or subsidiary thereof	(x)	x	(x)	(x)	(x)	x	(x)
40.	Whether locally originating company	(x)	x	x	x	(x)	(x)	x
41.	Whether branch plant	(x)	(x)	x	x	(x)	x	x
42.	Whether establishment represents new location for migration of all or most of company's operation	(x)	(x)	(x)	(x)	(x)	x	x

Table A.1 (cont)

	Building materials (local markets)	Food and timber products (non-local markets)	Engin-eering (non-local markets)	Engin-eering (local markets)	Printing and packaging	Textiles, clothing and shoes	Miscel-laneous
43. Whether newly established company[20, 21]	(x)	(x)	(x)	x	(x)	(x)	(x)
44. Employment in establishment[21]	x	x	x	x	x	x	x
45. Whether Department assessed management as unsatisfactory[21]	(x)	x	x	x	(x)	x	x
Number of variables included in analysis:	12	18	22	30	13	26	17

Footnotes

1. Figures are those for the preceding population Census for which figures were available at the time of the loan approval.

2. Calculated as total percentage change between the preceding Census population and the latest available annual population estimate at the time of the loan approval, divided by the number of years since the preceding Census. If the latest available population figure is a Census figure the change since the prior Census is used.

3. Distance is calculated using sealed or formed road distance, by the most common route, between the approximate population centres of gravity in each authority. Where centres of gravity are approximately equidistant between competing establishments, the local government area populations have been split between the two. Where an urban area had more than one establishment of the same kind, the total population of the area not nearer to similar establishments in other urban areas is divided by the number of competing establishments in the urban area concerned, and the resulting population allocated to each establishment.

4. Incomes are based on the latest available data (at the time of the loan approval) on the average taxable incomes of New South Wales residents with income from either personal exertion income but not salaries and wages, or both salaries and wages and other personal exertion income, in the following categories: sheep grazing; sheep/grain growing; other primary production. The dominant primary category, among the three mentioned, in each local government area in the urban area hinterlands (as defined for variable 3) is derived from Atlas of Australian Resources maps of Dominant Land Use and Agricultural Production. Where two categories are of approximately equal dominance, the local government area is regarded as having equal shares of each type of production. The rural sector income in each local government area is calculated by multiplying the average New South Wales income in the dominant primary production category by the number of primary production workers at the latest Census for which figures were available at the time

of the loan approval. To allow for the effects of time on money values, the income totals were adjusted for annual changes in average weekly earnings in New South Wales. (This was considered preferable to adjusting for price changes since rising average real incomes over time would tend to reduce the industrial employment resulting from rural incomes which only rose in line with price changes.)

5. Calculated as the number of primary production workers in those local government areas in the urban area hinterland (as defined for variable 3) with primary production dominantly sheep/grain growing (splitting local government areas where necessary, as for footnote 4), as a percentage of the total number of primary production workers in the urban area hinterland.

6. Using Australia as the total area under consideration.

7. The dominant metropolitan area is regarded as being Sydney, except for those urban areas which previous commodity flow studies (Smith, 1962; Woolmington, 1965) have indicated are within the hinterlands of Brisbane or Melbourne.

8. The relevant steel base price points set by the Broken Hill Proprietary Co Ltd are Sydney, Port Kembla (Wollongong), Newcastle, Brisbane and Melbourne.

9. Since rail traffic between country factories and Sydney is important mainly in terms of despatches of finished goods to Sydney, or receipts of spare parts or components used in production, the first class merchandise rate, which is the normal rate for small quantities has been preferred. Source: New South Wales Government Railways (1966).

10. Information is based on 1961 and 1968 railway timetables, with data from the timetable closest to the date of the loan approval being used in each case.

11. The appropriate course in the case of establishments in the first two groups is taken as mechanical engineering, since the maintenance and repair of machinery is perhaps the most important skilled job in such establishments. Where no course among those supplied by the Department of Technical Education is considered appropriate for the establishment concerned,

no course is regarded as being needed. In such cases an appropriate course is regarded as being "present".

12. The industry groups used in the relevant censuses are founding, engineering, etc; ships, vehicles, etc; textiles and fibrous materials (not dress); clothing, knitted goods, boots, etc; food, drink, tobacco; sawmilling and wood products (not furniture); paper, printing, etc; other.

13. Calculated as $\sqrt{(\sum_{\underline{i}=1}^{\underline{n}} p^2_{\underline{i},\underline{j}})}$, where $p_{\underline{i},\underline{j}}$ is the percentage of the total work force of urban area $\underline{j}$ which is employed in census manufacturing group $\underline{i}$ and $\underline{n}$ is eight, the total number of census manufacturing groups.

14. Refers to the position at the time of the loan approval.

15. Figures are taken from most recent balance sheet or profit and loss account supplied by applicant company, or are estimates of the position at the time of loan approval in the case of newly established companies.

16. Value in June 1969 terms, using the change in the level of the Consumer Price Index for Sydney between the quarter containing the date of loan approval and June 1969 as the basis of adjustment.

17. The value of the proprietor's wages is excluded from the pre-tax profits figure, if such wages are known to have been included. A nominal wages value of \$3,000 per proprietor per annum is given if the actual value is not known. Shareholders' funds are regarded as having a value of 1 if the actual value is zero or negative.

18. The government decentralisation loan value includes the value of the matching loan from the local council, where applicable. Housing loans are not included, however, since repayments would have been able to be recouped by rental payments to the company. Shareholders' funds are subtracted from the long term liability figure if the balance sheet has included them.

19. Loan repayments include repayments on matching loans from the local council, where applicable. The terms of council loans are assumed to be the same as those of Department of Decentralisation loans. Housing loan repayments, however, are excluded (see previous footnote).

20. Excluding newly established subsidiary companies.

21. Refers to the position at the time of the loan approval.

Sources

Variables 1 (part), 2 (part), 3 (part), 4 (part): Bureau of Census and Statistics Estimated Population of Municipalities and Shires at 30th June, 19-- (issued annually).

Variables 3 (part), 4 (part), 5 (part), 6 (part), 7 (part), 22, 23, 24, 25: Universal Business Directories (various editions - New South Wales; 1973 - Victoria and Queensland).

Variables 5 (part), 6 (part), 7 (part): Department of National Development (1953, 1957).

Variables 5 (part), 6 (part): Commonwealth Government Printer (1964, 1965, 1967); Bureau of Census and Statistics (1969b).

Variable 8: Holmes (1972).

Variable 13: Regional Industries Section, Department of Decentralisation and Development (personal communication).

Variable 19: Department of Technical Education (various editions).

Variables 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, 45: Files of Department of Decentralisation and Development.

Variables 40, 43, 44: Department of Decentralisation and Development questionnaire, 1969 (Appendix 2).

APPENDIX 4

FACTOR ANALYSIS OF ESTABLISHMENT VARIABLES: FACTOR LOADINGS, EIGENVALUES AND PROPORTION OF TOTAL VARIANCE

Group 1

Factor 1

Eigenvalue	6.186
Proportion of total variance	0.516
High loadings	
Town population	0.924
Working capital	-0.922
Working capital minus annual repayments of Government and council loans	-0.935
Current assets: current liabilities	-0.942
Road distance to metropolitan area	-0.989

Interpretation: Low working capital associated with location in large town close to metropolitan area

Factor 2

Eigenvalue	3.454
Proportion of total variance	0.287
High loadings	
Pre-tax profits as % of shareholders' funds	0.931
Initial employment	-0.859
Previous annual % change in town population	-0.951
Previous annual % change in hinterland population	-0.985

Interpretation: Profitable, small establishment in slow-growing area

Group 1 (cont)

Factor 3

Eigenvalue	2.360
Proportion of total variance	0.197
High loadings	
Long term liabilities plus Government and council loans: shareholders' funds	0.813
Rail freight cost to Sydney	-0.944

Interpretation: location remote from Sydney

Group 2

Factor 1

Eigenvalue	8.486
Proportion of total variance	0.447
High loadings	
% of male work force unemployed	0.840
Working capital	0.832
% of work force unemployed	0.814
Economic potential index	-0.805
Town specialization index	-0.807
Initial employment	-0.909
Previous annual % change in town population	-0.947
Road distance to metropolitan area	-0.954

Interpretation: North Coast location

Factor 2

Eigenvalue	4.945
Proportion of total variance	0.260
High loadings	
Whether timber products establishment	0.945
Whether public company	0.945
Quality of management	0.729
Rail freight cost to Sydney	-0.719
Whether locally originating company	-0.945

Interpretation: Non-local, public timber company

Group 2 (cont)

Factor 3

Eigenvalue	2.666
Proportion of total variance	0.140
High loadings	
Current assets: current liabilities	0.951
Whether town has precision engineer	-0.757
Town population	-0.761

Interpretation: High working capital ratio associated with small town location

Factor 4

Eigenvalue	1.818
Proportion of total variance	0.096
High loadings	
Working capital minus annual repayments of government and council loans	0.946
Working capital	0.942

Interpretation: High working capital

Factor 5

Eigenvalue	1.086
Proportion of total variance	0.057
High loadings	
Long term liabilities plus government and council loans: shareholders' funds	0.887

Interpretation: High gearing of funds

Group 3

Factor 1

Eigenvalue	8.203
Proportion of total variance	0.357
High loadings	
Shortest road distance to metropolitan areas, Newcastle or Wollongong	0.982

Group 3 (cont)

Factor 1 (cont)

Road distance to metropolitan area	0.923
Rail freight to Sydney	0.830
% male work force unemployed	0.819
% work force unemployed	0.795
Whether town has electroplater	0.795
Previous annual % change in town population	0.785
Quality of management	-0.795
Economic potential index	-0.934

Interpretation: Economically disadvantaged remote location with high unemployment

Factor 2

Eigenvalue	6.377
Proportion of total variance	0.277
High loadings	
Whether locally originating company	0.934
Whether branch plant	-0.798
Town specialization index	-0.835
% of town work force in same industry group	-0.854
Whether operations had been shifted	-0.934

Interpretation: Local company in non-industrial service

Factor 3

Eigenvalue	4.228
Proportion of total variance	0.184
High loadings	
Long term liabilities plus government and council loans: shareholders' funds	0.735
Working capital	-0.952
Working capital minus annual repayments of government and council loans	-0.953
Initial employment	-0.962

Interpretation: Small company

Group 3 (cont)

Factor 4

Eigenvalue	2.760
Proportion of total variance	0.120
High loadings	
Current assets: current liabilities	0.908
Town population	-0.825

Interpretation: High working capital ratio associated with small town location

Factor 5

Eigenvalue	1.433
Proportion of total variance	0.062
High loadings	
Pre-tax profits as % of shareholders' funds	0.916
% contribution of company to total loan funds used	-0.700

Interpretation: High profitability

Group 4

Factor 1

Eigenvalue	8.471
Proportion of total variance	0.292
High loadings	
Working capital	0.974
Working capital minus annual repayments of government and council loans	0.964
Town population	0.937
Economy rail services per week	-0.971

Interpretation: Location in large town with poor transport services and associated high working capital needs

Group 4 (cont)

Factor 2

Eigenvalue	5.194
Proportion of total variance	0.179
High loadings	
Availability of appropriate technical college courses in town	0.909
Road distance to metropolitan area	-0.746
Population of hinterland	-0.809
Whether aircraft engineering establishment	-0.842

Interpretation: Remote location but in town containing suitable technical college courses

Factor 3

Eigenvalue	3.915
Proportion of total variance	0.135
High loadings	
Initial employment	0.851
Current assets: current liabilities	-0.883
Whether new company at time of government loan	-0.899

Interpretation: Established, large company

Factor 4

Eigenvalue	3.113
Proportion of total variance	0.108
High loadings	
% contribution of company to total loan funds used	-0.741
% of town work force in same industry group	-0.744
Whether engine repair establishment	-0.967

Interpretation: Company which is not engine repairer

Group 4 (cont)

Factor 5

Eigenvalue	2.264
Proportion of total variance	0.078
High loadings	
Previous annual % change in town population	0.891
Quality of management	0.814
Whether town has foundry	-0.781

Interpretation: Well-managed company in rapidly growing town

Factor 6

Eigenvalue	1.681
Proportion of total variance	0.058
High loadings	
Whether in mixed cereal/sheep area	0.891
Rural sector income per capita	-0.777

Interpretation: Location in mixed cereal/sheep area

Factor 7

Eigenvalue	1.300
Proportion of total variance	0.044
High loadings	
Long term liabilities plus government and council loans: shareholders' funds	0.811

Interpretation: High gearing of funds

Group 5

Factor 1

Eigenvalue	8.953
Proportion of total variance	0.689
High loadings	
Current assets: current liabilities	0.774

Group 5 (cont)

Factor 1 (cont)

Previous annual % change in town population	-0.834
% of town work force in same industry group	-0.862
Pre-tax profits as % of shareholders' funds	-0.920
Hinterland population	-0.973
Road distance to metropolitan area	-0.995
Previous annual % change in hinterland population	-1.000

Interpretation: Location in small, slowly growing district close to metropolitan area

Factor 2

Eigenvalue	4.047
Proportion of total variance	0.311
High loadings	
Working capital	0.980
Working capital minus annual repayments of government and council loans	0.980
Town population	0.881
Long term liabilities plus government and council loans: shareholders' funds	-0.812
Rail freight cost to Sydney	-0.858
Initial employment	-0.995

Interpretation: New branch plant of public company (see text)

Group 6

Factor 1

Eigenvalue	8.690
Proportion of total variance	0.334
High loadings	
Road distance to metropolitan area	0.994
Rail freight cost to Sydney	0.971
Economy rail services per week	0.780
Town population	-0.884

Group 6 (cont)

Factor 1 (cont)	
Economic potential index	-0.989
Interpretation: Location in small remote town	
Factor 2	
Eigenvalue	6.435
Proportion of total variance	0.248
High loadings	
Long term liabilities plus government and council loans: shareholders' funds	0.981
Initial employment	0.808
% of town work force in same industry group	0.746
Availability of appropriate technical college courses in town	0.728
Pre-tax profits as % of shareholders' funds	-0.973
Interpretation: Company in weak financial position	
Factor 3	
Eigenvalue	4.473
Proportion of total variance	0.172
High loadings	
Current assets: current liabilities	-0.759
Working capital	-0.946
Working capital minus annual repayments of government and council loans	-0.946
Interpretation: Low working capital	
Factor 4	
Eigenvalue	3.216
Proportion of total variance	0.123
High loadings	
% work force unemployed	0.982
% male work force unemployed	0.982
% female work force unemployed	0.950
Whether branch plant	0.704
Interpretation: Location in town with high unemployment	

Group 6 (cont)

Factor 5

Eigenvalue	1.972
Proportion of total variance	0.076
High loadings	
Whether public company	-0.769
Quality of management	-0.769
Town specialization index	-0.979

Interpretation: Location in town with low economic specialization, usually associated with private companies

Factor 6

Eigenvalue	1.214
Proportion of total variance	0.047
High loadings	
Whether textile establishment	0.807
% of company to total loan funds used	-0.707

Interpretation: Textile establishment

Group 7

Factor 1

Eigenvalue	4.252
Proportion of total variance	0.304
High loadings	
Whether town on Hume Highway	0.801
Whether operations had been shifted	0.782
Current assets: current liabilities	-0.904

Interpretation: Company in weak financial position (see text)

Factor 2

Eigenvalue	3.183
Proportion of total variance	0.227
High loadings	
Economic potential index	0.959
Town population	0.878
Rail freight cost to Sydney	-0.920

Interpretation: Location in large town close to Sydney

Group 7 (cont)

Factor 3

Eigenvalue	2.387
Proportion of total variance	0.171
High loadings	
% contribution of company to total loan funds used	-0.799
Whether branch plant	-0.892
Interpretation: Non-branch plant	

Factor 4

Eigenvalue	1.438
Proportion of total variance	0.102
High loadings	
Whether locally originating company	-0.737
Initial employment	-0.936
Interpretation: New, non-local establishment	

Factor 5

Eigenvalue	1.054
Proportion of total variance	0.076
High loadings	
Previous annual % change in town population	0.832
Quality of management	0.807
Interpretation: Location in rapidly growing town (see text)	

APPENDIX 5

ESTIMATION OF QUEANBEYAN POPULATION GROWTH GENERATED BY 1968/69 LOAN ALLOCATIONS

In order to estimate the effect of implied assistance to Queanbeyan totalling $114,189 in 1968/69 on that centre's growth, the analysis of employment increase per $1,000 of loan assistance (denoted an N) previously developed was used again. The full company data required by the relevant regression equations in order to estimate N were only available for one of the three sample Queanbeyan requests, although its predicted loan of $41,956 was a substantial proportion of the Queanbeyan total. The request came from a firm in industry group 1 (building materials - local markets). The predicted value of N using the appropriate regression equation was -15.45. Values for the other five 1968/69 factory/machinery loans relating to Queanbeyan (including the other two sample loans) were based upon the N values which had already been estimated for sample requests in the pre- 1968/69 period.[1] The five Queanbeyan loans in question were from firms in industry Groups 1, 4 (engineering products - local markets) and 7 (miscellaneous category), and the highest estimated N values for the 1965/66 - 1967/68 period in the respective

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[1] The original regression estimates were used, without using the Department's adjustment for differences in labour and capital intensity between industry groups.

groups were 0.68, 0.83 and 0.99. So that the danger of underestimating the impact on Queanbeyan's growth would be minimized, it was assumed that the value of N in each of the four cases was 1.0, or slightly greater than any recorded pre- 1968/69 values for similar establishments. The direct employment increase generated by the implicit 1968/69 loan allocations was then estimated by multiplying the appropriate N value in each case (assuming a value of zero for the request for which full regression data were available) by the corresponding loan value, in thousands of dollars (using the predicted loan allocation values for the three sample requests, and actual values otherwise), and summing. The total increase thus derived was 72.

The next step was to estimate the size of multiplier employment increases, if any, resulting from this direct increase. None of the 1968/69 Queanbeyan loans belonged to the "other" Census manufacturing group, in which basic employment increases had previously been found to generate other basic employment increases in the paper, etc. group. While the previous basic : non-basic analysis of indirect (type (b)) multiplier changes resulting from changes in basic employment led to the conclusion that there was no statistical evidence for the existence of any such indirect multiplier effect in the New South Wales urban areas sampled, alternative construents such as input-output analysis suggest that some indirect flow-on is inevitable. The problem is to determine how much of this flow-on will accrue locally. The author has previously used static basic : non-basic employment data broadly to validate the often-held view that one basic employee will be matched by a further local non-basic employee in non-metropolitan centres (Searle, 1973, 203). All except one of the six 1968/69 loan allocations applying to Queanbeyan were primarily for production serving local, rather than non-local, markets. If local market activities are regarded as being largely endogenously determined, that is, as being part of local flow-ons generated originally by externally determined activities, the multiplier effects of such activities will be less than those of the exogenously determined activities themselves such as basic industry production. Further, if the broad 1:1 basic : non-basic relationship is taken to indicate the maximum extent of potential flow-on, then it could be assumed that the production enabled by the six loan allocations in question generated a maximum of half of this. That is, the assumed direct employment increase of 72 was assumed to produce a further indirect increase of 36.

Finally, the population growth resulting from the total assumed employment increase of 108 was estimated. The dynamic nature of the problem made it theoretically preferable to base the estimate on extrapolations of changes in, rather than on the current levels of, the Queanbeyan population : work force ratio. The most up-to-date figures of changes in population in relation to work force, however, were the Census data of 1954 and 1961. These were not considered suitable for use here, since the work force increase included a secular component reflecting an increased female work force participation rate. The 1961 population : work force ratio of 2.38:1.00 was consequently considered to provide a more accurate guide to multiplier population increases, despite its static nature. Applying this ratio to the total assumed employment increase yielded a population increase of 257.

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