MULTIDIMENSIONAL POVERTY AND

MIGRANT HOUSEHOLDS –

A CASE STUDY OF VIETNAM

By

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ABSTRACT

This project utilises the 'Fuzzy Set Approach" to measure multidimensional poverty of migrant household, especially families left behind, in Vietnam.. Until now the government of Vietnam has applied income and expenditure approaches to identify poor households, these measures that do not fully capture the multidimensional nature of poverty, which are expressed in both income (expenditure) and non-income indicators. Although there have been a number of studies on rural-urban migration, most of them have investigated the determinants and effects of migration on destination areas instead of sending areas of migration. This project, therefore, aims to study the effects of migration on sending areas and thus to contribute to scholarship on migration and ultimately help Vietnamese policy makers to determine suitable strategies to effectively develop poverty alleviation programs and improve the welfare of migrants.

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1. INTRODUCTION

Together with economic expansion, the population and migration growth rates in Vietnam have rapidly increased in recent years. According to the Vietnam Population and Housing Census, Vietnam's population growth rate was 11.3 per cent in one decade (1999 – 2009) Further, the internal migration rate increased more than 50 per cent in two study periods; from 1994 to 1999, 4.5 million people migrated, increasing to 7 million people between 2004 and 2009. The Census of 2009 also showed that 80 per cent of migrants chose large southern cities as their destination, with a large proportion of these people being rural-to-urban migrants. The population of Hanoi – Vietnam's capital city – rose by over 50 per cent, and that of Ho Chi Minh City by over 40 per cent during the period 1999 to 2009 (GSO, 2011). Such migrant flows have had substantial impacts not only on migrant individuals and their families but also on society.

Migration has both positive and negative effects on a society. On the one hand, migration has been recognised by researchers and governments as being an important factor for promoting development, for alleviating poverty, and for increasing urbanization. Many studies have shown that migration helps households both indirectly and directly: directly by increasing the income and consumption of their families in the sending area through remittances and thereby possibly decreasing poverty in these areas; and indirectly by improving the social capital and standard of living in the areas the migrants left (Cox, 1987; Stark, 1991; Winkels and Adger, 2002; Adams, 2006; Acosta et al., 2007; Esquivel and Alejandra, 2007). In the case of Vietnam, Nguyen et al., (2008), Cuong, N.V., (2009), and Nguyen et al., (2011) find, as with many international studies, that migration within the country has positive effects on household income and expenditure.

In terms of negative effects, migration has put pressure on security and safety in migrant-receiving cities because of infrastructure and public service systems becoming overstretched (Duong and Liem, 2011). Urbanization and migration to cities has widened the inequality between urban and rural populations, and migrant and non-migrant households (Dang et al., 1997; De Brauw and Harigaya, 2007). And while for individuals and households migration is important for attaining economic security and

higher welfare, it also has significant social and economic costs for migrants because of the distance from their native land, their families and familiar living environment, that is, they are far away from their support networks (Dang and Nguyen, 2006). These costs diminish migrants' abilities to participate in social activities and often prevent them from accessing social services. This means migrants often become part of a vulnerable community of people who through misfortune contribute to an enlarging pool of urban poor.

Generally, in Vietnam, strategies for sustaining economic and social development prove challenging for policy makers, particularly because approximately 67 per cent of the population is in rural areas, with 22 per cent of them being in poverty compared to urban areas, where the proportion of the population in poverty is approximately 5.4 per cent (GSO, 2012). In the context of the growing rural-to-urban migration flows and the widening inequality between rural and urban areas, it is important for policy makers to be aware of the factors that affect the welfare of migrants and to be conscious of effective instruments and policies that can support and improve the welfare of migrants. To date most studies of migration in Vietnam are have been restricted to migration determinants, the socio-economic characteristics of migrants (Dang et al. 1997; Djamba et al., 1999; Dang et al., 2003; GSO, 2011), and the positive and negative influences of migration on both source and receiving communities in rural and urban areas (Anh et al., 1996; Nguyen and White, 2002; Duong and Liem, 2011). Using the most recent Vietnam Household Living Standards Survey (VHLSS 2012), this study focuses on migrant households left behind to provide an up-to-date picture of poverty in Vietnam and the impacts of migration.

Since the Vietnamese government initiated economic reforms in 1986, the country has experienced economic growth and as a consequence a reduction in poverty. Together with its neighbour China, Vietnam has come to be considered one of the most rapidly growing economies in the world, with an average annual real GDP growth rate of 6.7 per cent between 1996 and 2013 (ADB, 2013), and is now categorised as a lower-middle-income country. This growth has been accompanied by notable progress in poverty alleviation. The percentage of the population that is in poverty has declined from 58 per cent in the 1990s to below 10 per cent in 2010 (Badiani and Baulch 2012). Widening income and expenditure inequality, however, has overshadowed this

impressive performance. This inequality is measured by the Gini index[1] and has risen substantially from 0.33 in 1993 to 0.45 in 2010 (GSO, 2012).

Over time Vietnamese authorities have employed two systems to identify and monitor poverty. The Ministry of Labour, Invalids and Social Affairs (MOLISA) constructed the official poverty rates, which have been aggregated up from commune levels to province levels and national levels. These rates are used to assist the government in developing poverty-alleviation and social-protection policies. The second system is the product of a joint venture by the General Statistics Office (GSO) and the World Bank (GSO-WB). The poverty rates from this system are calculated by estimating per capita consumption measured in consecutive rounds of the Vietnam Household Living Standards Survey (VHLSS). Most international and local studies on the status of Vietnamese poverty are conducted using the GSO-WB rates.

The use of two very different methods to measure poverty and monitor progress has caused some problems. First, although these two approaches have been adjusted over time their standards, initiated in the early 1990s, now seem obsolete. The criteria used to assess the basic needs poverty line were developed using the living standards of the early 1990s when Vietnam was a low-income country. It is thus no longer appropriate to utilise these old standards to identify and screen for poverty given that Vietnam is now a lower-middle-income country (Badiani and Baulch 2012).

Second, these two systems have produced widely different poverty figures. According to Nguyen and Tran (2014), the poverty rates and number of poor households reported by MOLISA[2] significantly differ from those estimated by using information from VHLSS 2010. The poverty rate of Vietnam using MOLISA's poverty line is 10.5 per cent, while that based on the GSO-WB's[3] poverty definition is 20.7 per cent. More than 50 per cent of households classified as poor according to MOLISA's definition are not considered poor according to the GSO-WB methodology. Further, the poverty rates of districts and provinces are inconsistent across these two systems. Despite these differences, both systems do show a general reduction in poverty in Vietnam, and the

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[1] "Gini index measures the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution". This is based on the World Bank's definition (online), available at http://data.worldbank.org/indicator/SI.POV.GINI

[2] For the period 2005–10, the income poverty line of MOLISA is 200,000 VND/person/month for rural, and 260,000 VND/person/month for urban areas.

[3] The GSO and the World Bank's expenditure poverty line for the 2010 VHLSS is 7,836,000 VND/year/person.

discrepancy between the two systems has initiated conversations between the Vietnamese government and local and international researchers.

While the multidimensionality of poverty has increasingly engaged the interest of researchers and scholars from many developed as well as developing countries over recent years (for example, Mexico, Colombia, Chile, as well as in The Philippines and Bhutan), the fact that Vietnam still uses only income or expenditure as the measurement of poverty rates is a problem. The definition of "poor", as outlined in the study by Narayan et al. (2000) or Alkier et al. (2015), incorporates a number of different and intermingled deprivations. A person or a household is classified as poor if their income/expenditure is low, i.e. the economic dimension, or if they are deprived in other social dimensions such as education, health, physical safety, housing, social securities, and so forth. Therefore, the use of traditional unidimensional poverty measurements, as done in Vietnam, is limited for capturing the multidimensional nature of poverty and informing policy makers on poverty alleviation strategies. This discrepancy also makes international comparability difficult, especially in the context of Vietnam's growing integration into the rest of the world.

In this context, the need for a new methodology to measure the multidimensionality of poverty has been proposed by local and international institutions to address the limitations of the two traditional approaches. Applications of the new approach to measuring the multidimensionality of poverty in Vietnam, however, have thus far been minimal. The studies that have been done using new methods have attempted to measure the multidimensionality of the poverty of children in rural compared to urban areas, but a study has not yet been done of the country as a whole (Roelen et al., 2009a, 2010; Roelen, 2014; and UNDP, 2010).

For all the reasons mentioned above, the present research utilises the fuzzy set approach, firstly suggested by Zadeh (1965), in order to form a new instrument to capture the multidimensionality of poverty in Vietnam. Specifically, the current research aims to use this multidimensional poverty index to investigate the impacts of migration on multidimensional poverty in Vietnam, particularly on migrant households, which, for the purposes of this study, are the families that remain after a family member moves. This definition of migrant households is explained further in Section 2.1.

The rest of this thesis is organized in the following five chapters. Chapter 2 is an outline of the definitions of migrants and an empirical review of the impacts of migration on the reduction of poverty. Chapter 3 is an explanation of the definitions and measures of multidimensionality of poverty. Chapter 4 describes the data and methods used in this study, and in Chapter 5 the empirical results are presented.

2. REVIEW OF MIGRATION

2.1 DEFINITION OF MIGRATION

It is worth noting the lack of consistency in the definitions of migration, which makes the comparability of measures of migration more challenging in the literature. One reason for the problem in defining migration is that migration encompasses a variety of physical movements with a spatial and a time aspect (Grawert, 1998; Bilsborrow, 1998). An individual is described as a migrant when he/she (1) moves across a political or administrative border, and (2) has an alteration in "usual residence". According to Bilsborrow (1998), this very strict definition, used to measure migration in sources of population data censuses, obviously has some drawbacks. First, as regards the spatial aspect, the political or administrative border arbitrarily varies, which impairs comparisons of migration flows and rates across countries. For example, other things being equal, a country that has more administrative units will have higher internal migration rates. Second, concerning the time aspect, a movement includes seasonal, temporary or permanent migration. [4] The specific definition, however, eliminates the two former attributes, which are becoming more important to policy makers, because of the "change of usual residence" condition. Many people move to another administrative boundary for a long time but do not change residence.

The availability of research data is another reason for the use of non-standardized definitions among migration studies, many of which have been based on either nationwide statistics, large-scale survey data or small-scale survey data, and each of these types of surveys collect different information about migration (Bilsborrow, 1998). In Vietnam, even the identification of migration based on the most representative large-scale surveys such as the VHLSS has been not consistent over time and across research studies. For example, Cuong (2009) has had to define migrant households through the remittances they receive because the 2002 VHLSS did not gather information about the respondents' migrant status. Meanwhile, Nguyen et al. (2008) considers a person who is 15 years old or above a long-term migrant if he/she was a household member in the 2002 VHLSS but was not a household member

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[4] Seasonal migration comprises a period of a few weeks or months and implies regular return of the migrants. Temporary migration may last for one ore more years. The migrants might come back for holidays from time to time and return to their places of work, but they intend finally to settle at home again. Permanent migration refers to people who leave their homes and never come back (Bilsborrow, 1998)

in the 2004 VHLSS. In the Vietnam Population and Housing Census 2009, the General Statistics Office (GSO) defines migrants as people "whose place of residence 5 years prior to the time of the census is different from their current place of residence".

Given the wide variety of migration definition contexts and the limitations of available sources of data, it is essential that an explicit definition of migration is discussed. One question that related to migrants in the VHLSS 2012 asked: "Is there any member of the family who has left their family during the last ten years?" However, the survey does not ask any questions of the migrants themselves; only of their original household. Thus, the migrant households referred to in this study are households from which any members have moved away to live or work during the last ten years.

2.2 THEORETICAL LITERATURE OF MIGRATION

The core of the economic development issue, in which a steady redistribution of the workforce from underdeveloped areas to the developed areas (Lewis, 1954), has been delineated through the current statistic figures of the UN Department of Economic and Social Affairs (DESA, 2013). By mid-2013, there were more than 231 million people, or 3.3 per cent of the world's population, living outside their country of origin, and approximately 60 per cent of international migrant stock residing in more developed regions. The estimated number of internal migrants is much higher than that of international migrants. McKay and Deshingkar (2014) quote that an estimated 740 million and more internal migrants shifted inside their national boundaries, which is approximately four times the number of international migrants. These empirical figures show that migration has developed as an essential force of the contemporary economic system of the world.

Motivations for and impacts of migration are complex and multifaceted. Numerous theoretical approaches, therefore, have been developed to address the drivers and influences of migration with varied levels of analysis (Massey et al., 1993). Standard neoclassical economics views migration as an individual behaviour used to maximize earnings based on the assumption that potential migrants have perfect information about differences in earnings and probability of obtaining jobs across locations (Ranis and Fei, 1961; Lee, 1966; Todaro, 1969; Harris and Todaro, 1970; and Todaro, 1976). Meanwhile, the "new economic of labour migration" theory (NELM) considers migration as one of the household's risk-minimizing strategies regarding income in the context of different markets (see, for example, Stark and Levhari, 1982; Stark and

Bloom, 1985; Katz and Stark, 1986). And the dual sector theory (Lewis, 1954) conceives that migration is the indispensable and structural adjustment of developing economies in the process of industrialization.

The work of Ernest Ravenstein (1885 and 1889), acknowledged as the earliest migration theorist, who named "The Laws of Migration" and followed by Everett Lee (1966), is regarded as the initiator of the standard neoclassical theory of migration. Abreu (2012) points out that the contribution of Lee (1966) in the literature of migration is his conceptualization of a framework, now well known as "push–pull theory", in which there are four components that influence migration decision-making: (i) characteristics of origin areas; (ii) characteristics of destination areas; (iii) impediments to the process of migration; and (iv) personal characteristics. It is explained simply in that the adverse conditions of the original area, such as low living standards, poverty, excessive taxation and so on, "push" out migrants; while favourable conditions in an outside place, such as the expectation of high remuneration, opportunities for education, health and so forth, are the attractions that "pull" or entice people. Even when the potential migrant's analysis of costs and benefits (favourable and unfavourable factors) associated with moving is positive, the decision may not be taken due to intervening obstacles such as poor health, long distances, or family responsibilities that may prevent individuals from migrating.

The other seminal theory of migration is known as "the dual labour sector", which was originally developed by Arthur Lewis (1954) and expanded, among others, by Ranis and Fei (1961), Todaro (1969), and Harris and Todaro (1970). According to Lewis, the economic growth of developing countries involves the transition of labour between two segments: a capitalist sector described as capital intensive and a subsistence sector characterized by labour intensity. Ranis and Fei (1961) suggest that rational individuals elect to move to places where they can maximize their productivity based on: (i) objectives of maximization expected income; (ii) the probability of gaining paid employment in destination places; and (iii) the differences in wages between the destination and origin places. This is supported by Todaro (1969), Harris and Todaro (1970), and Todaro (1976) who contend that it is the modern urban areas with higher wages and lower unemployment due to scarcity of labour that encourage people to move from traditional agricultural areas with lower wages and higher unemployment due to an abundance of labour. The standard neoclassical economic model of Lewis

and its extensions have been rich inspiration for a series of migration literature, and the majority of these studies come to a relatively consistent conclusion that the crucial drivers for migration decision-making are the relative income differentials and perceived probability of obtaining a job (Riadh, 1998).

Despite their vitally important contribution and profound influence on later developments in migration theory, the abovementioned approaches have some limitations. DaVanzo (1980) points out that the main drawback of the standard neoclassical economic theory is that it neglects other non-economic costs and benefits, by which the decisions of potential migrants are influenced. It is obvious that sometimes, in reality, either migration does not arise with the existence of considerable differentials in expected incomes or, conversely, migration remains even without differences in expected earnings. Also these frameworks fail to analyse the considerable remittances flows and the permeation of temporary migration from rural areas (Taylor and Martin, 2001). These limitations have led to new waves in the review of migration in the theoretical literature over the last fifty years.

An alternative approach in analysing migration determinants can be found in the outstanding contributions of Sjaastad (1962) and Schultz (1962). Known as the "human capital approach", the theory treats migration behaviour as an investment in human capital and is a way of addressing these failings. Within this framework, the decision by potential migrants to move is founded on an evaluation of the predictable future flows of benefits and costs (in both *material*, such as food, equipment for travelling, learning a new job, etc. and *psychic* such as homesickness, stress, etc.) that occur with migration. Therefore, migration may still not happen, even if there are significant differences in earnings in the two different locations because the discounted value of expected earnings at a destination does not exceed that at the departure by more than the expenses of migration (Yezer and Thurston, 1976; Molho, 1986). An extension of Sjaastad's and Schultz's models is in the introduction of risk attitudes in the estimation of discount rates (see, for example, Langley, 1974; Hart, 1975) and the hypothesis of migration coming from selectivity of people (Kuznets et al., 1957) that has enlarged on the determinants of migration. Furthermore, the decision-making process of migration is more likely to take place among selective groups of people who have more advantages over other sectors of society, for instance, the wealthier, the younger, the higher educated or trained, etc., and the anticipation of

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higher differentials in earnings (Sahota, 1968). These approaches, along with putting forward various economic, financial and social factors driving decisions on migration, lessen the over-emphasis on differentials in wage in the imperfect labour market of the standard neoclassical economic models.

In recent decades, the increasing awareness of economists that migration is driven by a variety of markets besides the labour market, and by household strategies has predisposed a "New Economics of Migration" (NEM). This new theory seeks to redress the over-simplified assumptions and limited conclusions of neoclassical theory through five main headings (Abreu, 2012):

(1) Family migration decisions are the units of analysis, not individuals;

(2) Families resort to migration as a strategy by which they can both maximize expected incomes and minimize risks to surmount market incompleteness. Katz and Stark (1986) and Lauby and Stark (1988) argue that the lack and underdevelopment of financial and insurance markets in developing countries induce households to elect migration as an instrument for hedging against the risks that might happen during crop production or other employment time. Also, it is the remittances of migrants, according to Stark and Levhari (1982) and Taylor et el. (1996), that help the migrant households with members who are left behind diversify the income resources of the households and lessen financial difficulties;

(3) The relative deprivation of households, as introduced by Stark (1984), is also an important factor influencing migration decisions of the household. This explains the observations that migration rates are higher in areas with higher levels of income inequality (Stark and Taylor, 1989,1991);

(4) The role of information-theoretical considerations in migration decisions is presented. The network theory of migration (Boyd, 1989; Gurak and Caces, 1992) emphasises that social capital such as kinship, friendship and shared community origin, foster the moving decisions of potential migrants by reducing the risks and the financial and psychological costs of migration.

(5) Providing a framework with which to analyse migration as a process of innovation adoption and diffusion.

Migration is an observable pervasive phenomenon in the process of economic development. There is substantial literature that throws light on the determinants of migration; each model reveals its own research objectives, interests and emphases (Massey et al., 1993). Most theoretical frameworks come to a relatively consistent arguments that the typical pattern of migration is underdeveloped–developed area moving, especially rural–urban migration in developing countries. According to the human capital approach, it is likely that the poorest are among the migrant families left behind. Given the fact that 43 per cent of the world's population is living on less than USD2 a day, and 70 per cent – more than 3 billion people – of these poor are living in rural areas (World Bank, 2012b), this study focuses on investigating the migrant households who have been left behind; a more vulnerable and less visible group in an economy.

2.3   IMPACT OF MIGRATION

2.3.1   Impacts on the destination areas

The increasing quantity of research investigating the impacts of migration on migrants, the destination areas, the sending areas, and especially on poverty alleviation in the rural sector, has attracted interest from scholars around the world.

The linkage between migration and economic development is widely recognized in the literature, though the direct influences of migration are not easily obtained due to the constraints of data. It is also worth noting that migration produces both positive and negative effects on the economic development of the destination areas. According to the work of Hamilton and Whalley (1984), Tang and Wood (1999), and Ortega and Peri (2009), among others, migration enlarges the supply of labour in the receiving countries, which leads to increases in employment, production and, consequently, GDP. The estimated results of Borjas et al. (1997), Commander et al. (2004), Chellaraj et al. (2008) and others, also show that migration gives stimulus to the productivity of the host countries from the innovation and specialization of skilled migrants and international graduate students.

On the other hand, there has been intense debate around the view that migration is a source of adverse effects on social and economic outcomes. It is alleged that the increasing flows of migrant labour deteriorate job opportunities and wages of less-skilled natives due to increasing job competition and, as a consequence increase

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unemployment rates (see, for example, Altonji and Card, 1991; Borjas et el., 1992; Longhi et el., 2005, Chiswick, 2005; Klugman, 2009; among others). Also, the destination economy faces an increased fiscal burden and overloaded public services because of the expanding population of migrants (Klugman, 2009). Furthermore, there is empirical evidence of a positive association between migration and disparities in health issues, such as infection diseases, mental illness, and worsening quality of living standards in both the destination and origin areas (Mabey and Mayaud, 1997; Lurie et al., 2003; and Oppong et al., 2006). These conflicting conclusions in empirical results about the influences of migration on the destination have implications for policy makers to develop suitable immigration policies that encourage the moving of labour in order to acquire proven gains and minimize the negative effects from migration.

2.3.2 Impacts on the origin areas

Most empirical studies of the relationship between migration and development in the sending areas involve remittances sent by migrants, especially in the context that remittances have emerged as important sources of finance inflows in developing countries over the last few decades. According to statistics from the World Bank (2014), international remittance flows to developed and developing countries were approximately USD542 billion in 2013, and could reach USD680 billion by 2016. Remittances to developing countries were USD404 billion in 2013 and could reach USD516 in 2016; around 75 and 76 per cent of total global remittances respectively. The empirical findings show that remittances and migration bring both benefits and risks to the members of households who are left behind as well as to the original community and the local economy.

On the one hand, the benefits from remittances are found in a number of studies. For the migrant-sending families, remittances play a significant role in increasing and insuring income, changing consumption patterns and accumulating assets, especially in alleviating the poverty status of migrant households. Take the case of Asia and Africa, where the international migration rate is the highest in the world (DESA, 2013), remittances comprise a large and important proportion of the total income of migrant households, ranging from 32 per cent to 55 per cent (Siddiqui, 2012). Remittances are also used as a source of income insurance through the ability for higher levels of savings for unexpected shocks (Lipton, 1980; Pfau and Giang, 2010;

Kwankye and Anarfi, 2011; Ratha, 2011). Studies on South Africa (Lucas, 1987), Mexico (Black et el., 2003), and China (Rozelle et al., 1999), among others, find that remittances have a positive effect on agriculture productivity and land purchase in the sending areas. Many other studies have found that remittances help households ameliorate the quality of consumption expenditure and make health care and education more accessible (Hugo, 1982; Deshingkar, 2006; Quisumbing and McNeven, 2005; Cuong, 2009), which is especially important for the health and education of the children left behind (Edwards and Ureta, 2003; Yang, 2008; Marx and Fleischer, 2010, Ratha et el., 2011).

In terms of risks, the absence of parents who are migrants has been alleged to have negative impacts on academic, behavioural and emotional issues for the children left behind (Booth, 1995; Giannelli and Mangiavacchi, 2010; and Antman, 2012). The moving of skilled and educated labour from rural to urban areas is known as "the brain drain" from sending areas that might reduce productivity in rural sectors. Furthermore, there has been debate that remittances may be lucrative enough that household members live primarily on their receipt and relinquish productive activities (Gubert, 2000; and Germenji and Swinnen, 2004). It is likely, however, that the losses in human capital are smaller than the gains received from migration (Taylor and Martin, 2001).

Although the number of studies supporting the role of migration in alleviating poverty at the family level is abundant (see, for example, Page and Adams, 2003; Adams and Page, 2005; Taylor et al., 2005; De Brauw and Harigaya, 2007; and Luo, 2008), the poverty measurement used in these studies to estimate the improvement of a household's well-being status are unidimensional poverty approaches, which are based solely on a monetary dimension to measure poverty. While the multidimensional nature of poverty is well acknowledged, it is often suggested that concentrating solely on poverty as one-dimensional; the monetary dimension, may lead to ignorance of several other important respects in the implementation of policies intended to help improve the welfare of disadvantaged groups in society. Hence, this study focuses on the multidimensional poverty measurement of migrant households as a supplement for this lack in the literature.

2.4 MIGRATION IN THE CONTEXT OF VIETNAM

The number of migration studies conducted in Vietnam, until now, is very few, despite the fact that population mobility is of increasing consequence in that country. Not only is it considered the major source of interregional variations in population growth, migration also effects economic and social changes in both origin and destination areas. Being aware of the importance of attaining harmonious distributions of labour and natural resources among economic regions, the government of Vietnam has long sought effective policies regarding manpower and population reallocation. Since Vietnam's reunification in 1975, the government has implemented policies which directly impact migration flows in order to redistribute population and labour across the country, targeted on urban–rural and rural–rural movements instead of motivating rural–urban migration. However, it seems that these explicit polices have not succeeded in their main aims because policy makers over-emphasized the role of policy intervention, which is frequently based on doctrinal assumptions and rarely on empirical observation (Dang et al., 1997).

The increase in the number of individuals moving away from home has accelerated during the last few decades. A simple study by GSO based on the Vietnam Population and Housing Census 2009 forecasts that the interregional migrant population could reach 6 million people – in other words, 6.4 per cent of the total population – by 2019 (GSO, 2011). While the most attractive destination for migrants is still the Southeast region, which has the most developed areas of the country, what was the most important origin region, the Mekong River Delta, has been replaced by the Northern and Coastal Central regions, which are the least developed areas of Vietnam. Therefore, it can be concluded that migrants tend to move away from regions with low levels of income (GDP per capita), high rates of unemployment, and low levels in the Human Development Index (HDI) to regions with high levels of income, low rates of unemployment, and high levels in the HDI (GSO, 2013). These results strongly support the argument that migration is considered as potential opportunities for higher income, better education, employment, and social services.

It is also worth noting that population movement in Vietnam is a highly selective process. Migration occurs among individuals who are fairly young, single, and disproportionately female. While the number of migrants aged 45 years and older was only 10.5 per cent, over 50 per cent of internal migrants were less than 25 years old. The number of migrants

who are single is approximately 70 per cent and close to 62 per cent of migrants are males (GSO, 2013). Furthermore, the Census 2009 also reports that there is no large difference in the level of education between non-migrants and migrants in receiving regions. By contrast, the education levels of migrants are reported to be higher than those of non-migrants in the sending region. In addition, rural to urban migration is the dominant pattern for internal migration and the majority of migrants, approximately 90 per cent, have limited access to public services, for example, education and health care. On the one hand, therefore, it may be concluded that migration patterns in Vietnam could cause wider socioeconomic gaps between the migrant and non-migrant population, and urban and rural areas of the country. On the other hand, movement processes across regions of the country may lead to an expansion of social networks linking the places of sending and receiving of migrants (Dang, 2005).

Furthermore, migrants who move from rural to urban areas are regarded as a group at potential risk of poverty. According to the Vietnam Development Report (2004), the majority of rural–urban migrants are unregistered residents in urban areas. Hence, although migration provides them better opportunities in the destination areas, living in polluted surroundings and having restricted access to public services increases their costs of living, which may outweigh any advantages gained from moving. The fourth-round study of Oxfam's ActionAid (2011) provides more evidence about the vulnerability of migrants living in urban areas. During the economic recessions of the country, migrants who already were charged higher prices for water, electricity, and accommodation were exposed to more danger of instability in their livelihoods due to high inflation rates.

In spite of the relationship between migration and development processes, as proved by various studies around the world, the number of migration studies in Vietnam is very low, especially regarding the multidimensional poverty status of migrants. Therefore, the findings from the present study will contribute to the existing scholarship on migration, and ultimately help policy makers to determine suitable strategies to effectively develop poverty alleviation programs and improve the welfare of migrants.

3. POVERTY: DEFINITIONS AND MEASUREMENT APPROACHES

In the last few decades, the elimination of poverty has been the major benchmark of justification for growth and development of an economy. The principal objective of the Millennium Development Goals (MDGs), established at the Millennium Summit in 2000 and agreed by 149 countries, is that the proportion of the world's population with income less than USD1.25 a day and therefore in extreme poverty, be halved by 2015. While poverty-alleviation strategies have gained overwhelming support, debates about the definition and measurement of poverty are ongoing and vigorous.

3.1 UNIDIMENSIONAL POVERTY MEASUREMENT

Over a century ago, Booth (1903, first published in 1892) and Rowntree (1901) laid the foundation of a traditional definition and measures of poverty by firstly introducing the headcount ratio[5] or poverty line. Since then, theoretical, empirical and methodological research of poverty have been progressively purified to render them more discerning and sophisticated. Several directions have been investigated to obtain a suitable measurement of poverty. Orshanski (1965) and (Hagenaars and Praag, 1985) based their research on the absolute approach, that is, using the basic needs of food, housing and clothing, to develop a poverty line; an income level that distinguishes the poor from the non-poor. The relative approach utilises a comparison of the living conditions of each individual with the prevailing situation in a given society to identify the poor (Townsend, 1979). While the subjective approach defines the poor by peoples' assessment of their own status (Goedhart et al. 1977 and van Praag 1971).

It is noticeable that most empirical studies and policy decisions related to well-being utilise levels of income and expenditure as important determinants of welfare and as proxies for other deprivations (Boadway and Bruce, 1984). Laderchi et al. (1984) argue that because utility maximization behaviour assumption in standard neoclassical economics is typically captured by income and expenditure data, the most commonly used indicators in welfare measurement are monetary. In addition, statistics of income and expenditure are easy to understand and describe the welfare situation of a particular economy. Ravallion (1996) and Blackorby and Donaldson (1980) claim that

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[5] The headcount ratio, proposed by the studies of Booth (1903) and Rowntree (1901), is a proportion of people whose income goes below a special standard, called poverty line.

it is the simplicity of monetary indicators, i.e. headcount ratio, is the main reason why they are favoured over other unidimensional measurements. For example, while headcount ratio provides no information on the severity of poverty or the disparity between rich and poor, Armartya Sen's poverty index with its more desirable characteristics of information on inequality and intensity of poverty is rarely used outside academia (Atkinson, 1999; Haugton and Khandker, 2009).

Nevertheless, there has been a growing realization in welfare studies and policy analysis that using a sole monetary dimension to poverty is associated with certain limitations. First, both expenditure and income-based indicators fail to capture the multifaceted nature of poverty. As Sen (1993) asserts, other features such as living or psychological conditions often affect utility. Hence, monetary expenditure may be an inadequate measure of utility, and utility itself may not be a satisfactory definition of well-being. Furthermore, these indicators disregard individual characteristics such as marriage status or gender (Sen, 1980, 1983), and do not take into account welfare perspectives like education, health or access to public services (Baker and Grosh, 1994), which are of great importance in ascertaining well-being. From such deliberations the multidimensional poverty measurement literature has emerged.

Furthermore, we know that measuring income is not an easy exercise. First, one needs to decide which components to consider as a part of income. For example, should only labour earnings be considered? Or should the benefits derived from social programs be included? If so, how then can we deal with the difference between cash and in-kind benefits? (Anand, 1977; Kangas and Ritakallio, 1998). In this regard, Seidl (1988) points out that income from the black economy or transfer from wealth can change the income measurement significantly. The problem here, however, is not that there can be many variations of a definition of income, but that we do not have any specific reason to choose any one of them. Second, one needs to decide which time period to consider. As monthly income is generally more variable compared to yearly income, income distribution in the population using monthly data can show an entirely different picture compared to one derived from yearly data (Wagle, 2008). Third, an understatement of true income often occurs in household surveys (Deaton, 1997). First of all, it is very difficult for individuals to recall income information perfectly (Anand, Segal, and Stiglitz, 2010), and secondly, individuals may have a tendency to hide information about income. In a recent study, Hurst et al. (2010) find that household

surveys in which anonymity is one of the biggest principles can cause the self-employed to under-report their income substantially as if they are tax reporting forms.

Another drawback of the income approach for capturing poverty is in its dichotomy. That is, it classifies the population into two mutually exclusive groups; poor and non-poor, by instruments named poverty lines or poverty thresholds (Foster et al, 1984). It is not reasonable to assert that a person whose level of income or consumption is just a few cents lower than a given poverty threshold is deprived or poor, whereas another person whose income level is higher than the previous person by just a cent is definitely non-poor. As a stated by Watts (1968, p. 28):

> Poverty is not really a discrete condition. One does not immediately acquire or shed the afflictions we associate with the notion of poverty by crossing any particular income line

Thus, the conversion from a circumstance of completely poor to well-off should transpire gradually. In addition, Sen (1976) points out that a measurement of poverty should capture not only "the incidence of poverty", identifying who is deprived or poor, but also "the intensity of poverty", the allocation of income levels among the poor. Therefore, there has been increasing acknowledgement that the notions of poverty are often vague or imprecise. In other words, the poverty situation of an individual should be regarded as "a matter of degree" instead of a distinct cut-off simply dividing the population into the poor and the non-poor (Betti et al., 2006).

3.2 MULTIDIMENSIONAL POVERTY MEASUREMENT

Regarding the limitations of the unidimensional poverty measurements, especially since the revolution contribution (Sen, 1976), there have been several recent studies put forward by the academic community with various alternative approaches to capturing the multifaceted nature of poverty. In his framework, Sen (1987, 1988) introduces two notions as elementary sources of information in place of income: (*i*) "functionings", denoting the diverse doings and beings of a person, in other words, the realized achievements of an individual; and (*ii*) "capabilities", referring to the individual's autonomy in pursuing and achieving a life that is valued. Applying Sen's capability approach, there have been intense multidimensional measures of poverty put forward. Nevertheless, the increasing attention has been dedicated, to among others, the Multidimensional Poverty Index, as proposed by Alkire and Forster (2011),

and the Fuzzy Set Theory, firstly utilised by Cerioli and Zani (1990), which will be discussed further in the next sections.

3.2.1 The Multidimensional Poverty Index – MPI

The Multidimensional Poverty Index (MPI), an index of sharp multidimensional poverty, is based on the dual cut-off method of Alkire and Foster (2011), known at the AF method. Since first published by the Human Development Report Office (HDRO) in 2010, the MPI has been the inspiration for several studies on its conceptual and empirical merits and problems (i.e. De Neubourg, et al. 2013; Loaiz et al., 2014; Mishra, 2011; Rippin, 2010; Silber, 2011; Alkire and Santos, 2013, among others).

As discussed by Alkire and Santos (2013), since Sen (1976), poverty measurement has involved two steps: (*i*) identify the poor by adding up the number of weighted deprivations; and (*ii*) aggregate information about poverty across society. The AF method also takes into account the abovementioned steps and constructs the MPI based on a combination of a headcount ratio *H*, measuring the proportion of the population that is multidimensionally poor and, with their poverty intensity *A*, measuring the average weighted deprivations among the poor:

$$MPI = H{\times}A = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d}w_j g_{ij}^0(k) \qquad\qquad (1)$$

Let m_{ij} be the achievement of each individual *i = 1, …, n* in each indicator *j = 1, …, d*. A person is identified as deprived in indication *j* when her achievement is lower than the first deprivation cut-off l_j. Let us define deprivation as $g_{ij}^0 = 1$ if $m_{ij} < l_j$ and $g_{ij}^0 = 0$ otherwise. Then, a deprivation score of each individual is the weighted sum of deprivation $s_i = \sum_{j}^{d} w_j g_{ij}^0$, where w_j is the weight of indicator and $\sum_j w_j = 1$. With the second cut-off, named the poverty cut-off *k,* calculated from the share of minimum deprivation an individual must experience in order to be recognized as poor. *H,* (poverty incidence,) is given by $H = \frac{v}{n}$, where *v* is the number of people recognized as poor. Poverty intensity is defined as $A = \sum_{i=1}^{n} s_i(k)/v$. As a result, the MPI, or M_0, (adjusted headcount ratio), is the product of *H* and *A* as formula (1).

According to Santos et al. (2015), the index offers two main desirable characteristics, which are helpful for informing policy: (*i*) it takes into consideration the joint distribution of deprivations, can be decomposed into particular groups and broken down into dimensions; and (*ii*) one of them is robust when the scale of ordinal

variables are altered. Due to its decomposable properties, the MPI helps to directly determine which population groups are the poorest and in which dimension they are mostly deprived. This characteristic is a much more policy-relevant index for policy makers than the Human Development Index (HDI) (Pasha, 2014).

Nevertheless, the MPI also has some limitations (Alkire and Santos, 2013; Silber, 2011). First, this index can lead to a situation in which a lot of information is lost if individuals are not poor, even though they are multidimensionally deprived because they fail to surpass the second cut-off. Second, the MPI shares the dichotomous weakness of the unidimensional poverty measures when it classifies the population as two groups: non-poor and poor. Therefore, this study employs the fuzzy set approach as an alternative to overcome these weaknesses in the MPI.

3.2.2 The fuzzy set approach

It is suggested by Sen (1989) that the theory behind the fuzzy set approach, initiated by Zadeh (1965), can be a powerful and effective technique for addressing the vagueness of deprivation or poverty. The key idea of the theory of "fuzzy sets" is that, according to Deutsch and Silber (2005), there are certain cases for which it is impossible to ascertain which elements belong to a given class and which do not. Thus, an element can belong only partially to a class in which the transition from membership to non-membership. More formally, definitions of classes of objects may not be based on very accurate benchmarks of membership. In other words, the degree of membership encapsulates the degree to which an individual belongs to the set that is defined as poor (Lemmi and Betti, 2006). A fuzzy set described by Zadeh himself (1965, p.339) as "a class with a continuum of grades of membership" hence provides unsurprisingly a perfect framework in which to analyse such a vague and imprecise notion of poverty.

Cerioli and Zani (1990) first endeavoured to utilise the concept of fuzzy sets at the methodological level, in which they describe the typical of an object as "its grades of membership". If we let X be a set of people, then a fuzzy subset Y of X is a set of the pairs $Y = \{x, \mu_Y(x)\}$ for all $x \in X$, where $\mu_Y(x)$, called the membership function of the fuzzy set Y, is an application of the set Y to the closed interval [0, 1]. The value of $\mu_Y(x)$ represents the degree of membership of x in Y. So, $\mu_Y(x) = 0$ means x not membership of Y, $\mu_Y(x) = 1$ indicates full membership, and $0 < \mu_Y(x) < 1$, x

captures the degree of membership or belonging only partially to *Y*. Within this conceptualization, this study assumes that all households in a society are subject to deprivation, but with differing degrees of membership in the poor set. The numbers, lying on the [0, 1] interval that measure a household's degree of membership in the poor set, or the risk of poverty, can be considered an average index for the society (Vemma and Betti, 2002). Such an index does not rely on a poverty line, but is a fairly easy method for developing multidimensional measures of poverty and has taken several forms in the literature (Betti et al., 2006). There are three key fuzzy approaches proposed by Cerioli and Zani (1990), Cheli and Lemmi (1995), and Betti et al. (2006), and these are discussed below.

The Totally Fuzzy Approach – TFA

The Totally Fuzzy Approach, first developed by Cerioli and Zani (1990), proposes two benchmark values $- j_{min}$ and $j_{max} -$ in identifying a membership function, $\mu_j(i)$ of individual (household) i on indicator j. Accordingly, a household would be classified as definitely poor if its indicator j is below j_{min}, whilst the household is definitely not poor if its indicator is above j_{max}. The membership function for each household is within a transition zone $(j_{min} - j_{max})$ where the membership function decreases linearly from 1 to 0:

$$\begin{cases} \mu_j(i) = 1 & if\ 0 < j_i < j_{min} \\ \mu_j(i) = \frac{x_{j,max} - x_{ij}}{x_{j,max} - x_{j,min}} & if\ j_i \in [j_{min}, j_{max}] \\ \mu_j(i) = 0 & if\ j_i > j_{max} \end{cases} \qquad (2)$$

Cerioli and Zani (1990) note that there are three types of variable that should be differentiated when defining the membership function:

(1) Dichotomous variables: A typical illustration for the dichotomous variable is the household's possession of a given good, say, a refrigerator. It can be logically deduced that the subset *Y* would not be a fuzzy set because the membership function will take only one of two values: the value zero when household *i* does not belong to *Y*, and the value 1 in the opposite case.

(2) Ordinal variables: They are the ones, which may take more than two values, where the matter is the order but not the difference between their values. A good example of the use of ordinal variables in investigating poverty would be that in which households are questioned to assess their economic status, the possible categories

being low, medium and high. Then, these values may be reorganized where the higher values indicate a higher risk of deprivation.

Let Z_l be the subset of households who are in a condition of deprivation in regard to the indicator l, with $l = 1, \ldots, k_z$. And let z_l be the set of ordinal variables $z_{1m}, \ldots, z_{pl}$ capturing the state of deprivation of different households in regard to indicator l. Also let Φ_l denote the set of the diverse situations $\Phi_{1l}, \ldots, \Phi_{ls}$ that indicator l may take, and let $\phi_{1l}, \ldots, \phi_{ml}, \ldots, \phi_{sl}$ denote the scores corresponding to these different situations, with an assumption that $\phi_{1l} < \cdots < \phi_{ml} < \cdots < \phi_{sl}$. Within the framework of Cerioli and Zani (1990), the definition of the membership function of household i would be:

$$
\begin{cases}
\mu_{zl}(i) = 0 & if\ \phi_{1l} < \phi_{1min} \\
\mu_{zl}(i) = \frac{\phi_{1l} - \phi_{1min}}{\phi_{1max} - \phi_{1min}} & if\ \phi_{1min} < \phi_{1l} < \phi_{1max} \\
\mu_{zl}(i) = 1 & if\ \phi_{1l} > \phi_{1max}
\end{cases}
\tag{3}
$$

where ϕ_{1min} and ϕ_{1max} represent the lowest and the highest values taken by ϕ_{1l}. Take education levels as an example, if the "education achievement" variable would take six values: (1) "no diploma"; (2) "primary school"; (3) lower secondary school"; (4) upper secondary school; (5) bachelor degree; and (6) higher education degree; then the minimum value can be one, and the maximum value six.

(3) *Continuous variable*: According their work in 1990, Cerioli and Zani suggest two threshold values y_{min} and y_{max} of the continuous indicator, income or expenditure levels. If the value h taken by the continuous indicator for the household i is higher than y_{max} this household would be surely regarded as not being poor and, conversely, if it is smaller than y_{min} this household indubitably would be recognized as poor.

Let H_l denote the subset of households who are in an unfavourable state in regard to the l-th variable with $l = 1, \ldots . k_h$. The membership function for household i is defined by Cerioli and Zani (1990) as:

$$
\begin{cases}
\mu_{hl}(i) = 1 & if\ 0 < h_{il} < h_{1,min} \\
\mu_{hl}(i) = \frac{h_{1,max} - h_{il}}{h_{1,max} - h_{1,min}} & if\ h_{il} \in [h_{1,min}, h_{1,max}] \\
\mu_j(i) = 0 & if\ h_{il} > h_{1,max}
\end{cases}
\tag{4}
$$

Cerioli and Zani (1990) also propose a weight function to aggregate the numerous dimensions by assigning weights to be equal to the inverse of the proportion of households who are "definitely poor" in regard to a given item. More specifically, the smaller the proportion of households showing a low score on a particular item, the larger the weight that should be assigned to such an item in the aggregate set.

$$w_j = \left. ln\left(\frac{1}{h_j}\right) \middle/ \sum_{i=1}^{K} ln\left(\frac{1}{h_j}\right) \right. \tag{5}$$

where h_j denotes the frequency of "definitely poor" phenomenon for dimension j.

The Totally Fuzzy and Relative Approach – TFR

In their valuable work, Cheli and Lemmi (1995) criticise the framework of Cerioli and Zani (1990), known as the totally fuzzy approach (TFA), suggesting this approach suffers from two drawbacks. First, two threshold values are chosen arbitrarily. Second, the adoption of a linear functional form for the membership function is not based on both a theoretical foundation and empirical evidence. Hence, Cheli and Lemmi (1995) propose an alternative approach, called the totally fuzzy and relative approach (TFR), to address the limitations of their precursors' theory. The main advantage of the TFR, when compared with the TFA, is that the TFR does not require the choice of any arbitrary threshold. In addition, while the measure of Cerioli and Zani is a linear functional form, Cheli and Lemmi (1995) recommend a relative measure, taking into consideration the prevailing standards of living in the society.

Call $\lambda = \{\lambda_1, \dots, \lambda_k\}$ the set of indicators of living standards. Let Λ_j be the subset of households experiencing some deprivation according to indicator $\lambda_j = 1, \dots, k$. Let F_j be the cumulative distribution function of variable λ_j. The membership function $\mu_{\Lambda_j}(i)$ may have two forms:

$$\mu_{\Lambda_j}(i) = F_j(\lambda_{ij}) \tag{4}$$

and

$$\mu_{\Lambda_j}(i) = 1 - F_j(\lambda_{ij}) \tag{5}$$

where (4) will be for an increase in the degree of deprivation and (5) for a decrease in the degree of deprivation.

However, these authors also point out that, when the proportion of households identified not poor is high, that is, the risk of poverty or degree of membership is extremely low, the indicator values of poverty may be taken as too high for households who are not considered poor (Deutsch and Silber, 2005). Cheli and Lemmi (1995) therefore suggest the following membership function of a household i:

$$
\begin{cases}
\mu_{\Lambda_j}(i) = 0 & if\ \lambda_{ij} = \lambda_{j(1)} \\
\mu_{\Lambda_j}(i) = \mu_{\Lambda_j}(\lambda_{j(m-1)}) + \frac{F_j(\lambda_{j(m)}) - F_j(\lambda_{j(m-1)})}{1 - F_j(\lambda_{j(1)})} & if\ \lambda_{ij} = \lambda_{j(m)}, m > 1
\end{cases}
\tag{6}
$$

where F_j again represents the cumulative distribution function for indicator λ_j, and $\mu_{\Lambda_j}(\lambda_{j(m-1)})$ represents the degree of poverty to the set Λ_j of a household for which the indicator λ_j takes the value m. In addition, $\lambda_{j(m)}$ with $m=1,\ldots,$ s refer to the different values, arranged by increasing degree of membership, which the variable λ_j may take. Consequently, the membership function takes a zero value when it is at the lowest degree of membership, and a unit value when it is at the highest degree of membership, connected with the deprivation indicator j. Table 3.1 takes ordinal variables as an example, which has m categories in them (j_m indicates m-th category of indicator λ).

Table 3-1 An example of calculation of the membership function

Categories	Relative frequencies	Membership function according to equation (4)	Membership function according to equation (6)
$x_{(1)}$	0.35	0.35	0
$x_{(2)}$	0.05	0.4	0.077
$x_{(3)}$	0.15	0.55	0.308
$x_{(4)}$	0.2	0.75	0.615
$x_{(5)}$	0.25	1	1

While the weight function developed by Cerioli and Zanni (1990) uses the proportion of "definitely poor" households to aggregate the various dimensions, Cheli and Lemmi (1995) propose a weight function using the mean of the membership function value for each dimension as a weight.

$$w_j = \frac{ln\left(\frac{1}{\mu_j}\right)}{\sum_{i=1}^{K} ln\left(\frac{1}{\mu_j}\right)} \qquad (7)$$

where μ_j denotes the average membership function for dimension j. Martinetti's (2000) criticism of this approach is that the weight function of Cheli and Lemmi (1995) is a more generalised relative weight because the average membership function can consist of information from the entire distribution in each dimension.

The Integrated Fuzzy and Relative Approach - IFR

According to Betti and Verma (1999) and Betti et al. (2005, August), the TFR approach of Cheli and Lemmi (1995) has a weakness. In the case of continuous variables, the membership function of deprived households μ_{Λ_j} does not supply any useful information because the mean of the membership functions always equals 0.5, in spite of its distribution. Subsequently, Betti et al. (2006) put forward a modified method, the integrated fuzzy and relative approach (IFR), to overcome the limitation of the TFR approach. In addition, they consider it debatable that the previous fuzzy set theory-based measures contain both monetary indicators and non-monetary indicators in one index, because they see that monetary variables still have a fundamental role in the measurement of poverty (Betti et al., 2002, 2004).

To address these concerns, they combine the TFR approach of Cheli and Lemmi (1995) and the method of Betti and Verma (1999). In IFR approach, the Lorenz function is presented to take into consideration the share of households less poor than the household concerned, this can be acquired from the cumulative distribution function, denoted as L, (as in Cheli and Lemmi, 1995), as well as the proportion of the total income earned by all households less poor than the household concerned, denoted as F, (as in Betti and Verma, 1999). It can be noted that this measure weights the distance *(F – L)* between the line of perfect equality and the Lorenz curve by a function of the household's position in the income distribution, giving more weight to its more deprived end. The indicator presented here is expressed algebraically:

$$\mu_j(i) = [1 - F(j_i)][1 - L(j_i)] \qquad (8)$$

where *F(j)* is a cumulative distribution function and *L(j)* represent the Lorenz function. The authors, Betti and Verma, claim that this measure is more sensitive with regard to the actual disparities in a dimension (e.g. income) compared to the simple cumulative distribution function, which is just the proportion of individuals less poor than the person concerned. Therefore, it can be concluded that the IFR measure as an aggregate index is sensitive to the distribution of each indicator, which means it can satisfy the transfer axiom.

In addition, Betti and Verma (1999) argue that monetary and non-monetary dimensions should be separately measured because monetary dimensions still have a "fundamental role" in poverty research (Betti, D'Agostino, and Neri, 2002; Betti and Verma, 2008). Since integrating into one index is a more attractive strategy for policy makers, they propose the concept of "manifest" and "latent" poverty. The former indicates a subgroup of the population, who is poor for both of the dimensions, the latter being the subgroup that is poor for either one of the dimensions (Betti and Verma, 1999, 2008). For non-monetary dimensions that mainly consist of ordinal and dichotomous variables, they first calculate a deprivation measure for each indicator, d_{ji} (based on the TF method) where *j* indicates each dimension and *i* denotes each individual, and then integrate each indicator into one index using a weight function that is discussed below. To illustrate the steps in the calculation, the present study provides a detailed example in Section 4.2.

The weight *(i)* is estimated by the power of the dimension to distinguish households in the population, that is, by its dispersion; and *(ii)* takes the correlation between the

variables into account to restrict the effect of those dimensions that are highly correlated with the others (Betti and Verma, 2008). In particular, the weight can be defined as follows:

$$w_j \propto w_a \times w_b \tag{9}$$

where w_j is proportional to the coefficient of variation (cv) of deprivation score $d_{j,i}$ for the variable concerned ($w_a \propto cv_j$). Specifically, Betti and Verma (1998) suggest that the coefficient of variation of each dimension's membership function value can be used as the first term, and as the second term the following can be used:

$$w_j^b \propto \left(\frac{1}{1 + \sum_{j'}^{J} \rho_{j,j'} | \rho_{j,j'} < \rho_H} \right) \times \left(\frac{1}{\sum_{j'}^{J} \rho_{j,j'} | \rho_{j,j'} \geq \rho_H} \right) \tag{10}$$

where $\rho_{j,j'}$ is the correlation coefficient between two different indicators, ρ_H is a pre-determined value, and j is the total number of dimensions. The underlying motivations of the previous formula are: (i) the weight is not affected by the inclusion of irrelevant dimensions, (ii) the weight is only marginally changed by small correlations, and (iii) the weight is reduced proportionately to the number of redundant variables. According to Betti and Verma (2008), in practice, the second factor of equation 10 mostly involves only the variable itself (i.e. is reduced to 1), so that the weight of a variable is simply the inverse of the average of correlations with all the variables in the dimension (including the variable concerned itself).[6]

To summarise, the multidimensional poverty analysis in this study is based on the proposed methodology of Betti and Verma (2008) and involves two components: "fuzzy monetary" and "fuzzy supplementary". The different steps that are necessary to construct the integrated fuzzy and relative approach (IFR) are described in detail in Chapter 4.

3.3   SELECTING DIMENSIONS: THEORETICAL AND EMPIRICAL

The capability approach has been extensively acknowledged by its supporters as one of the richer and more comprehensive approaches to welfare analysis, in which there can be a plurality of well-being dimensions that people value and have reason to value. Depending on the place and circumstance, the unit of analysis, and the availability of

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[6] An illustration for estimating weights is presented in section 4.2.1.

data, various applications of the capability approach can be employed within the capability framework. Whereas the answer to the critical question of how dimensions of deprivation should be chosen has not reached consensus among poverty researchers, Sen argues that it is sensible to develop a more agreeable set of dimensions through an extensive literature review than to attempt to find a universal or fixed set of dimensions (Sen, 2004). As a response, in her contributions, Alkire (2002, 2007) matches and compares the approaches to human development utilised in various studies in choosing these dimensions. Alkire (2007) also alleges that one of the strengths of this approach is that it enables welfare researchers to utilise plethora techniques; choosing the most pertinent for each context. However, it is worth noting that there is no individual set of dimensions, combinations of methodologies, or units of analysis that will always be applicable (Alkire, 2007; Sen, 2004). Hence we scrutinise four approaches based on the work of Alkire (2007) to select relevant dimensions for this study.

(1) Narayan et al. (1999) in their work, *Voices of the Poor*, developed from 78 Participatory Poverty Assessment (PPA) reports containing 47 poor countries around the world, present numerous dimensions of poverty that are crucial to poor people themselves. The authors discern four domains of poverty: (i) *material well-being*, which consists of food security and employment; (ii) *psychological well-being*, which includes hopelessness and humiliation; (iii) *state-provided infrastructures*, or public services, such as transportation or dependable water supply; (iv) *assets of poor*, which consists of physical, human, social capital, and environmental assets.

(2) Three essential conditions of human life – having, loving, and being – are depicted in the Comparative Scandinavian Welfare Study of Allardt (1993) as the basic rules for the state of well-being. *Having* refers to material circumstances vital for the survival of human beings, which consists of the deliberation of health, education, employment, working conditions, housing conditions, and economic resources. *Loving* refers to the requirement to interact with other people and to participate in social relations, which includes attachments to family, kin, or contacts with communities, and patterns of friendship. Finally, *Being* implies the need for integration into society, potential indicators of which are political activities, opportunities for leisure-time activities, or the opportunities for a

meaningful work life.

(3) Using the Comprehensive Quality of Life Scale, Cummins (1996) finds that 68 per cent of 173 varied dimensions from the literature on life satisfaction can be integrated into seven headings: *material well-being, health, productivity, intimacy, safety, community,* and *emotional well-being.*

(4) Max-Neef (1991) advocates "Human Scale Development" and focuses on basic human needs, self-reliance, and organic articulation with the environment. He arranges human needs into two groups: existential and axiological. For exploring different human requirements related to poverty, the axiological classification seems useful; it includes nine varied dimensions: *subsistence, protection, affection, understanding, participation, idleness, creation, identity, and freedom.*

On the foundation of the above contributions, the following seven dimensions are identified:

- Education and health are the most basic functionings of human beings and included in almost every research study that adopts the capability approach. It is argued that without education and health, it is impossible for an individual to properly "function" in any society (Anand and Sen, 1997; Duclos, Sahn, and Younger, 2006; Federman et al., 1996).

- An unavoidable factor in consumption-based traditional approaches is housing. According to Orshansky (1965) and Michael and Citro (1995), the cost of housing constitutes a significant part of cost-of-living. In addition, the conditions of housing also matter as housing implies an important functioning of "security" or "protection" in the capability approach (Alderfer, 1969, Blank, 2008).

- Accessing basic services, such as clean water or improved sanitation, is broadly considered as a basic functioning. It is not only one of the important Millennium Development Goals (MDGs) that influence the health of humans, but is also a symptom of poverty (Satterthwaite, 2003; WHO, 2006).

- There is no doubt that the possession of durable goods itself is not a functioning. However, some part of it – for example, owning a television or a car – can be included as a functioning. Townsend (1979) and Callan et al. (1993) argue that the lack of possession of certain goods can be considered as an indication of poverty. According to Boarini and d'Ercole (2006), the possession of durable goods is

"essential to perform every-day life activities". Hence, possession of certain durable good can be considered as a functioning.

- Economic status: Although Brandolini and D'Alessio (1998) argue that economic status is not an aspect of functioning per se, it can be directly related to different functionings, such as buying in healthy food. Thus it is usually included as a dimension in poverty studies (Whelan B., 1993; Whelan C. T., 1993; Kangas and Ritakallio, 1998; Lelli, 2001). Definitely the term "economic status" does not exclusively imply income or consumption. On the contrary, since the notion of functioning encompasses suitable control over resources, numerous forms of economic status can be involved as indicators.

- It is criticised by Anand and Sen (1997) that employment be regarded as an influential functioning because having a job allows an individual an opportunity to interact with others in a society. Maree and De Vos (1975) cites that underemployment is one important root of poverty. Furthermore, a household with any retired member who does not receive retirement income, according to Santos et al. (2015), is a signal of deprivation. Therefore, underemployment and lack of retirement benefits imply improper functionings of an individual in a society.

For the reason that all dimensions above are normatively defined, we need to select more concrete indicators for the dimensions. It also worth noting that it is in the selection of indicators that the process inevitably shows arbitrariness. Nevertheless, this does not imply that the rigour of methodology of the study is not strengthened. On the contrary, as mentioned by Foster (1984) and Sen (1981), because of the underlying plurality and vagueness that encompasses the notion of poverty, the presence of arbitrariness should be seen as necessary. Based on preceding empirical studies, the present study selects each indicator by adopting the advice of Sen in that "Openness to critical scrutiny, combined with public consent, is a central requirement of non-arbitrariness of valuation in a democratic society" (Sen, 1997, p.206). A detailed list of the variables used in this study is provided in Chapter 4.

4. METHODOLOGY

4.1 DATA SOURCE

The analysis in the present study utilises the Vietnam Household Living Standards Survey (VHLSS), conducted nationwide in 2012. The survey covers 9,399 households that were asked about income, expenditure and other issues in 3,133 communes and wards. The VHLSS 2012 is a comprehensive survey that is representative of the whole country, the region, and the urban and rural populations. The household survey includes detailed information on different aspects of living conditions, comprising household-level income, expenditure, housing conditions, and household demographics, as well as the health, education, employment of the household members.

Of the sample of 9,399 households in the 2012 survey, 2,937 identified as migrant households. Due to the main intention of the VHLSS 2012, it was not particularly designed for the analysis of migration; the collected information on migration is focused only on the level of education, occupation, wage, the reason for moving, and remittances. In addition, where the heads of migrant households where there are former members who are migrants were interviewed, the migrants themselves were not respondents. The aim of this present study, nevertheless, is to evaluate the multidimensional poverty of the households the migrants have left behind. Thus, we believe that the VHLSS 2012 is a valuable source of data to enhance our understanding of the multidimensional poverty of the migrant household in Vietnam.

4.2 CONSTRUCTING FUZZY MEASURES OF DEPRIVATION IN DIFFERENT DIMENSIONS

As mentioned in Section 3.2.2, two components are used in this study to measure multidimensional poverty: "fuzzy monetary" and "fuzzy supplementary".

4.2.1 Fuzzy monetary

Let a Lorenz function of income indicator M be $L_M(.)$ and cumulative distribution function $F_M(.)$, then the membership function for individual i can be calculated by following formula below:

$$\mu_i = FM_i = (1 - F_M^i)(1 - L_M^i) \qquad (11)$$

Household incomes are equivalised using the modified – OECD scale, which is constructed by assigning points to each member in a household. The fist adult in the household has a weight of 1 point, each extra member who is 15 years or older is assigned 0.5 of a point, and each member under the age of 15 is given 0.3 of a point. Equivalised household income is derived by dividing total household income by a factor equal to the sum of the equivalence points allocated to the household members.

4.2.2 Fuzzy supplementary

(1) Identification of items:

In addition to the degree of membership in monetary income, the level of deprivation in non-monetary dimensions of households and individuals can be described by a host of indicators. Choosing appropriate supplementary dimensions is extremely important because they bear on instrumental power. It is expected that the chosen dimensions are effective implements to alleviate one or more other domains of deprivation and inequality. On one hand, the potential indicators that a measure of living standards might reflect are broad, covering infrastructure, housing materials, possession of durable goods, health status, education level, and basic services. Moreover, according to Alkire (2007), the dimensions of work, empowerment, culture, social relationship, the living environment, and safety from violence are important considerations. On the other hand, limitations of available data constrain dimensions. Therefore, with the intention of maximizing the available information in the VHLSS 2012 as well as based on analysis about choosing dimensions in this section, the selected domains in this study include 22 indicators grouped into seven dimensions: education, health, housing, assets, services, economic status, and underemployment and retirement benefit. A detailed list of the variables is provided in Table 4.1.

Table 4-1 List of dimensions

Dimension	Indicator	Deprived when…	Weight
Income (*FM*)	Equivalised income		
Education (*FS Education*)	• Schooling achievement of adults (d_1)	• Households where no member 15 years or older has achieved a minimum schooling level, defined as: - complete lower secondary school for people between 20 and 59 years, and - complete primary school for people of 60 years or more	0.075
	• School attendance of children (d_2)	• Households where there is at least one child or adolescent (6 to 15 years) not attending school.	0.925
Health (*FS Health*)	• Financial difficulties (d_3)	• Household where there is at least one person who was sick for the last 12 months but the household did not afford to cover all health care expenses for he/she.	0.89
	• Health insurance (d_4)	• Household where there is at least one person who do not have health insurance or free health care certificate.	0.11
Housing (*FS Housing*)	• Precarious roof (d_5)	• Households with dirt floor or precarious roof	0.289
	• Precarious wall (d_6)	• Households with wall materials (waste, cardboard, tin, cane, palm, straw, other materials).	0.160
	• Housing tenure (d_7)	• Households which live in a borrowed or rented house	0.551
Basic services (*FS Service*)	• Water (d_8)	• Accessible clean water	0.148
	• Sanitation (d_9)	• Households with some of the following: - toilet or latrine not connected to piped sewer system or septic tank; - shared toilet facility; - no toilet facility (bush/field). - shared toilet facility; toilet or latrine flushed without treatment to surface, river or sea.	0.135
	• Energy (d_{10})	• Households with no access to electricity for lighting	0.718
Durable assets (*FS Durable Asset*)	• Vehicle (d_{11})	• Household does not own any bike or motorbike	0.857
	• Telephone (d_{12})	• Household does not own any telephone, including mobile phone	0.089
	• TV (d_{13})	• Household does not own any black or colour television	0.034
	• Radio (d_{14})	• Household does not own any radio	0.020
Economic status (*FS Economic*)	• Food (d_{15})	• Household whose own judgment of their consumption on food over the last 30 days was insufficient to meet their needs	0.180
	• Foodstuff (d_{16})	• Household whose own judgment of their consumption on foodstuff over the last 30 days was insufficient to meet their needs to meet their needs	0.097
	• Electricity (d_{17})	• Household whose own judgment of their consumption on electricity over the last 30 days was insufficient to meet their needs	0.164
	• Water (d_{18})	• Household whose own judgment of their consumption on water over the last 30 days was insufficient to meet their needs	0.244
	• Housing (d_{19})	• Household whose own judgment of their consumption on housing over the last 30 days was insufficient to meet their needs	0.156
	• Clothes, footwear (d_{20})	• Household whose own judgment of their consumption on clothes or footwear over the last 30 days was insufficient to meet their needs	0.143
	• Savings (d_{21})	• Household does not any savings	0.016
Underemployment and Retirement benefit (*FS U-R*)	• Underemployment (d_{22})	• Household where there is at least one member who is in labour age (15 – 65 years) do not have any paid job	0.325
	• Social protection (d_{23})	• Households where there is at least one retired member (65 years or more) who does not receive pension.	0.675

The standard health indicators used by the UNDP in the construction of the Human Development Index (HDI) or in previous empirical studies have usually used adult and child malnutrition and mortality rates of infants or under five-year-olds in a household (Alkire and Santos, 2014), or health conditions, that is, whether there is the presence of disability or of chronic illness among family members (Martinetti, 1994; 2000). However, it is unfortunate that there is no such information collected in the VHLSS 2012 which can be used to directly measure this health dimension. Therefore, the health dimension in the present study comprises instead two indirect indicators. The first identifies a household as in poverty regarding health if, in the last 12 months, there is at least one person who was sick but the family could not afford to cover all necessary health care expenses. The second indicator identifies a household as deprived in health when there is any household member who does not have health insurance or a free health care certificate. The financial difficulties with health treatment indicate a function failure, which may have a negative influence on physical development and make any individual susceptible to other health intimidations. A household that did not have a sick member during past 12 months is identified as non-deprived in the dimension of financial difficulty.

As mentioned in Section 3.3, and used in numerous poverty analyses, housing and accessibility to basic services comprised an avoidable part of minimum cost-of-living (for example, Fiadzo et al., 2001; Battiston et al., 2013; Santos et al., 2015). For the housing dimension, all members of a household are considered deprived if they are living in (i) a rented or borrowed house; or (ii) a house with a dirt floor or (iii) a house with a precarious roof. In terms of basic services, there are two indicators that are linked to health and also recognized as important in the MDGs: clean water and improved sanitation.

Four indicators depict the durable assets dimension: having a motorbike or bicycle, telephone, television, and radio. A household is identified as deprived in the domain of durable asset ownership if it does not have any one of the abovementioned goods. It is argued in various studies that there are positive relationships between declines in poverty and ownership of such durables (see, among others, Sahn and Stifel, 2000, Heltberg and Tarp, 2002; Stifel and Christiaensen, 2007). Whenever a household has a

missing value for any item, this study assumes that the household does not own the item.

Despite the fact that the requirement to take for granted the subjective perception of people in well-being judgment is quite debatable, Martinetti (2000) put forward a claim that including the subjective indicator of well-being does not substitute but complements our judgment and allows us to compare the findings developed from the combination of subjective and objective assessment criteria. The present study, hence, proposes the economic status dimension with five indicators that state a subjective perception on a household's own condition or assessment by a family's representative member, usually the household head, about the level of contentment concerning sufficient consumption of essential goods, such as food, water, electricity, housing, clothes and footwear. In addition, the economic status dimension is also measured by the seventh indicator that refers to the household's savings ability.

Underemployment and the retirement benefit dimension is the result of two indicators: (i) underemployment; identifying a household as underemployed if there is any member who is of working age who does not have a paid job; and (ii) retirement benefit; identifying a household as deprived if there is any member who has retired from the workforce and is not receiving a pension. A household where there is no member of retired status is considered non-deprived in the retirement benefit indicator.

(2) Transformation of the items into the [0, 1] interval

A deprivation score is determined for each dimension by the formula:

$$d_{j,i} = \frac{Z - z_1}{Z - 1} \qquad\qquad 1 \leq z_i \leq Z \qquad\qquad (12)$$

where Z is ordered categories of some deprivation indicator j, with $z = 1$ representing the most deprived, and $z = Z$ the least deprived situation. Let z_i be the category to which individual i belongs. However, most variables in this study are binary indicators. Hence, $d_{j,i} = 1$ (deprived) or $d_{j,i} = 0$ (non-deprived).

(3) Calculation of weights within each dimension (each group)

The weights of each item are calculated within each dimension distinctly by formula (9). For convenience, the scaling of the weights sums to 1.0. Then, a deprivation score is computed for each dimension ($\gamma: 1, 2 \dots \Gamma$):

$$S_{\gamma,i} = \sum_{j \in \gamma} W_j (1 - d_{j,i}) / \sum_{j \in \delta} W_j \quad (13)$$

(4) Construction of the fuzzy deprivation measure in each dimension

As in the fuzzy monetary approach, we have three alternative definitions for an individual's degree of non-monetary deprivations FS_γ^i.

i. The proportion of individuals who are less deprived than i:

$$\mu_i = F_{S,i}^{(\gamma)} = \left(1 - F_I^{(\gamma)}\right) \qquad (14)$$

where F_I^γ is a distribution function of S estimated for individual i, dimension γ.

ii. The share of the total non-deprivation S assigned to all individuals less deprived than i:

$$\mu_i^\gamma = F_{S,i}^{(\gamma)} = \left[1 - L_i^{(\gamma)}\right] \qquad (15)$$

where $L_i^{(\gamma)}$ represents the value of the Lorenz curve of S for individual i in dimension γ, calculated according to the form below:

$$\left[1 - L_i^{(\gamma)}\right] = \frac{\sum_{j,s_j>s_i} w_j s_j > s_i}{\sum_{j,s_j>s_i} w_j} \qquad (16)$$

iii. A combination of the previous two forms similar to equation 11:

$$\mu_i^\gamma = FS_i^{(\gamma)} = \left[1 - F_i^{(\gamma)}\right]\left[1 - L_i^{(\gamma)}\right] \qquad (17)$$

4.3   EXAMPLE OF THE VARIOUS STEPS IN THE METHODOLOGY

The present study randomly selected 10 household units from the data set to explain the steps involved in the calculation of the fuzzy measures. The raw data is presented in Table 4.2. Variables $d_{11} - d_{14}$ correspond to the indicators of the durable asset dimension as defined in Table 4.1, each coded as 1 = deprivation, and 0 = no deprivation; the last variable reported is the household equivalised income.

Table 4-2 Deprivation scores on 4 items for a small sample of households

code	d_{11}	d_{12}	d_{13}	d_{14}	$S_{durable\ asset}$	EquiIncome
1	0	0	1	0	0.5967	3,378
2	0	0	0	0	1	2,860
3	0	1	1	1	0.0703	1,830
4	0	0	0	1	0.5967	2,900
5	0	0	1	0	0.5967	2,860
6	0	0	1	1	0.1933	2,100
7	0	0	0	1	0.5967	2,471
8	0	0	0	0	1	3,382
9	1	1	1	1	0	1,340
10	0	0	0	0	1	3,400
Weights	*0.070*	*0.123*	*0.403*	*0.403*		

The item deprivation scores $d_{j,i}$ are used to construct the dimension scores S according to formula (12), using the item-specific weights given in the last row of Table 4.2. The weights sum up to 1 within each dimension. Note that scores S are "positive" scores, indicating lack of deprivation.

The weights shown in the last row of Table 4.2 are calculated by equation (9). First, we compute the coefficient of variations in each indicator w_a presented in Table 4.3. To get w_b , we take the average correlation of each item from Table 4.3. It is worth noting that, as observed by Betti and Verman (2008), because the second factor of equation (10) mostly is decreased to 1, w_b is simply the inverse of the average of the correlation with all indicators in the deprivation dimension to which it belongs. The scaling of the weights sums to 1 for convenience. The detailed calculation of weights is shown in Table 4.4.

Table 4.5 presents the particular procedures by which the calculation of membership functions to the fuzzy monetary (FM) in equation 11, and to the fuzzy supplement (FS) in equation (17) were made.

Table 4-3 Correlation of 6 items for a small sample of households

	d_{11}	d_{12}	d_{13}	d_{14}
d_{11}	1	*0.6667*	*0.3333*	*0.3333*
d_{12}	0.6667	1	*0.5*	*0.5*
d_{13}	0.3333	0.5	1	*0.2*
d_{14}	0.3333	0.5	0.2	1

Table 4-4 Calculation of weights

	d_{11}	d_{12}	d_{13}	d_{14}
Average of CVs	0.583	0.667	0.508	0.508
Inverse	1.714	1.500	1.967	1.967
CV*Inverse	0.171	0.300	0.984	0.984
Weights	0.070	0.123	0.403	0.403

Table 4-5 Calculation steps of "Fuzzy supplementary" measures for the cases in Table 4.2.

code	S durable asset	1-F	1-L	FS	code	EquiIncome	1-F	1-L	FM
9	0	1	1	1	9	1,340	1	1	1
3	0.0703	0.8889	0.9876	0.8778	3	1,830	0.8889	0.9273	0.8243
6	0.1933	0.7778	0.9533	0.7415	6	2,100	0.7778	0.8439	0.6564
4	0.5967	0.3333	0.531	0.177	7	2,471	0.6667	0.7458	0.4972
7	0.5967	0.3333	0.531	0.177	5	2,860	0.5556	0.6322	0.3512
1	0.5967	0.3333	0.531	0.177	4	2,860	0.4444	0.5186	0.2305
5	0.5967	0.3333	0.531	0.177	1	2,900	0.3333	0.4035	0.1345
2	1	0	0	0	8	3,378	0.2222	0.2693	0.0599
8	1	0	0	0	2	3,382	0.1111	0.135	0.015
10	1	0	0	0	10	3,400	0	0	0

4.4 AGGREGATION ACROSS DIMENSIONS OF DEPRIVATION

The following step, after reaching a decision on the methodology of multidimensional poverty measurement, is to identify the mechanism of aggregation across diverse dimensions. The crucial question on using aggregated measures is that of how much aggregation is acceptable. On the one hand, it is often neither feasible nor valuable to examine separately all the aspects of all the information. On the other hand, there could be misleading and meaningless results when decreasing all the information to a sole index (Betti and Verma, 2008). Hence, depending on the context, an appropriate level of aggregation is developed, which holds a balanced view but is also useful to expose the meaning and implications of the information. Since the membership function is the key component of a fuzzy set, Zadeh (1965), Betti et al. (2005), and Betti and Verma (2008), among others, argue that one can utilise an extension of union and intersection operations of a typical set theory, that is the maximum and the minimum operators respectively, to calculate the overall index of the dimensions of poverty.

Suppose that we have clear benchmarks for differentiating poor from non-poor in both monetary and non-monetary dimensions. Therefore, an individual can be categorised in four cases as presented in Table 4.6.

Table 4-6 Situation of a hypothetic individual in traditional approach

Poverty dimension		Monetary	
		Poor (1)	Non-poor (0)
Non-monetary	Poor (1)	0	0
	Non-poor (0)	1	0

Source: Betti, Cheli, Lemmi, and Verma (2005)

However, without those benchmarks, Table 4.6 should be restructured as Table 4.7, consistent with the theory of fuzzy set, where $\mu_{i,xy}$ is the membership function of the individual i in the intersection $x \cap y$.

Table 4-7 Situation of an individual in fuzzy set approach

Poverty dimension		Monetary		
		Poor (1)	Non-poor (0)	Total
Non-monetary	Poor (1)	$\mu_{i,11}$	$\mu_{i,01}$	FS_i
	Non-poor (0)	$\mu_{i,10}$	$\mu_{i,00}$	$1 - FS_i$
	Total	FM_i	$1 - FM_i$	1

Source: Betti, Cheli, Lemmi, and Verma (2005)

As we already know, FM_i and FS_i, are suitable methods with which to specify $\mu_{i,xy}$ and allow us to analyze the fuzzy poverty measure. In standard fuzzy operations, the intersection of fuzzy sets described as $\mu_{A \cap B}(x) = min[\mu_A(x), \mu_B(x)]$, is the minimum of membership functions; the union is defined by the maximum of membership functions: $\mu_{A \cup B}(x) = max[\mu_A(x), \mu_B(x)]$, and the complement by the deduction as $\mu_{Ac}(x) = 1 - \mu_A(x)$ (George and Bo, 2008). In order to complement the standard operation, Betti and Verma (2005) propose "bounded operation" which expresses the intersection as $\mu_{A \cap B}(x) = max[0, \mu_A(x) + \mu_B(x) - 1]$. Thus, Table 4.7 can be reconstructed as Table 4.8.

Table 4-8 Fuzzy joint distributions by composite operation

Poverty dimension		Monetary		
		Poor (1)	Non-poor (0)	Total
Non-monetary	Poor (1)	$min(FM_i, FS_i)$	$max(0, FS_i - M_i,)$	FS_i
	Non-poor (0)	$max(0, FS_i - FM_i,)$	$min(1 - FM_i, 1 - FS_i)$	$1 - FS_i$
	Total	FM_i	$1 - FM_i$	1

Source: Betti, Cheli, Lemmi, and Verma (2005)

From Table 4.8, the fuzzy intersection of monetary poor and non-monetary poor – $min(FM_i, FS_i)$ – is regarded as "manifest" or "intensive" poverty which is the propensity to both monetary and non-monetary poverty. Since this indicates a situation where two dimensions of deprivation occur simultaneously to one household, it can be

considered more intense poverty. Conversely, the complement of the "non-poor for both dimensions" $- 1 - min(1 - FM_i, 1 - FS_i) = max(FS_i, FM_i) -$ can be called "latent" or "extensive" poverty, which implies a household that has experienced at least one of the two dimensions of poverty (Betti and Verma, 1999, 2004; Betti et al., 2005, Betti and Verma, 2008).

4.5   ROBUSTNESS OF THE INTEGRATED FUZZY AND RELATIVE APPROACH - IFR

One of the crucial roles of multidimensional poverty measures is to become a tool for informing decision-making and public policy, i.e. to monitor poverty alleviation. In this case, it is crucial to have a sense of robustness of the measure of alteration in weighting structures used. That is, we have to test whether the poverty ordering of observations is stable to changes in items and dimensions' weights. While dominance analysis is used to test the robustness of pairwise comparisons such as the dual poverty cut-off in the MPI, rank robustness analysis assesses overall rankings with regard to the initial weight structures. Nevertheless, according to Alkire et al. (2015), since the stringency of the former and the fact that it may not hold for a considerable number of the pairwise comparisons, the present study employs two gentler tools to test the robustness of IFR measures: the Spearman rank correlation coefficient ($R\rho$), and the Kendall rank correlation coefficient ($R\tau$), the two most widely used rank correlation coefficients (Alkire et al., 2015).

5. FUZZY POVERTY MEASUREMENT AND DISCUSSION

5.1 THE POVERTY PROGESS OF VIETNAM

Vietnam currently has a population of about 90 million people; approximately 61 per cent of whom reside in rural areas (GSO, 2014). Table 5.1 shows that the country experienced the average annual real GDP growth rate of 6.4 per cent between 2004 and 2013 (ADB, 2014), with low unemployment rates.

Table 5-1 Economic and poverty indicator of Vietnam

	2002	2004	2006	2008	2010	2012	2013
Per capita GDP [a] (million VND)	6,775	8,836	12,813	18,986	24,822	36,559	39,954
Labor force participation rate [b] (%)	50.7	51.8	71.0	75.5	77.4	76.8	77.5
Unemployment rate [b] (%)	2.2	2.1	4.9	3.6	2.9	2.0	1.9
Poverty headcount rate (%)							
GSO-WB poverty line	28.9	19.5	16	14.5	n.a	n.a	n.a
National line[7] [c]	n.a	18.1	15.5	13.4	14.2	11.1	9.8
$2 per day (2005 PPP) [d]	68.73	60.39	48.08	43.32	16.84	12.45	n.a

Source: a, b: Asia Development Bank, 2014; c: General Statistics Office, 2005, 2008, 2010 and 2012;
d: World Bank Data, 2014; n.a: not available.

Furthermore, according to the report of the World Bank (2014), labour force participation rates in Vietnam are among the highest in the world. Before the economic reforms initiated in 1986, Vietnam was the poorest country in the world with a per capita GDP of US$98 (in current prices) in 1990 accompanied by famine, hyperinflation and a trade embargo by the west (Mishra, 2011). In less than thirty years, the country has developed to now be classified as a lower-middle-income country with an estimated per capita income of US$2,028.

In parallel with the rapid expansion of the economy, the achievements in poverty reduction and improvement in social indicators have been remarkable by any criteria.

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[7] Poverty rate is estimated by income of household

The Government's poverty lines (1,00VND/per person/per month)
	Urban	Rural
For the period 2006 – 2010	260	200
For the period 2011 – 2015	500	400

The number of people living under the poverty line, whether evaluated in terms of an internationally comparable line, US$2 per day, or using national poverty lines, has reduced sharply. By the standards of national poverty, for example, the poverty rate dropped nearly by a half during the period 2002 – 2013; from above 18 per cent in 2004 to below 10 per cent in 2013 (Table 5.1).

Table 5-2 Vietnam's HDI values, Health Indicator and Education Indicators

	1980	1990	2000	2005	2010	2011	2012	2013
Human Development Index	0.463	0.476	0.563	0.598	0.629	0.632	0.635	0.638
Life expectancy at birth (years)	55.7	61.1	72	73.8	75	75.2	75.4	75.9
Mean years of schooling (years)	4.3	4	4.5	4.9	5.5	5.5	5.5	5.5
Expected years of schooling (years)	8.7	7.9	10.4	11.1	11.9	11.9	11.9	11.9

Source: United Nation Statistics Division, 2014

In other non-income indicators of well-being, Vietnam has also achieved impressive success by being placed among the medium human development countries. The citizens of the country today are much better educated, with 97 per cent of people having completed primary school (UNICEF, 2014), and the average years of schooling for adult people aged 25 years and older is 5.5 (Table 5.2). The indicator of a healthy and long life, life expectancy at birth, also reports substantial gains, rising by 36 per cent between 1980 and 2013. All of these results in the HDI value show a gradually increasing trend from 0.463 in 1980 to 0.638 in 2013; an increase of 38 per cent or average annual increase of 5 per cent.

The Vietnam government has also run national target programs on hunger elimination and poverty alleviation with specific objectives: (1) that the number of poor households reduces to below 10 per cent and there is no household relapse into chronic hunger; and (2) that poor communes have acceptable vital infrastructure such as a medical station, public electricity, schools, etc. This national target program has received financial support from different international organizations, e.g. World Bank, Asia Development Bank, International Monetary Fund, etc. A series of policies and projects consisting of support in terms of education, health care, social security, agricultural land-use tax exemptions, and housing, has been implemented during

recent years. These policies and projects make valuable contributions to helping the poor escape poverty in Vietnam (Badiani and Baulch, 2012).

The determination of budget allocations for poverty reduction programs is based on the official poverty lines constructed by MOLISA, since that agency is appointed by the government to have prime accountability for poverty-alleviation programs and policies for the country. Since 2005 MOLISA has employed a cost-of-basic-need approach to calculate the national poverty lines and this has provided an up-to-date picture of poverty in Vietnam. Overall, the same characteristics of the poor are found in the 1990s and 2012: low levels of education, rural residence, and physical and social isolation. In addition, the number of poor persons has been increasingly linked to ethnic minority populations in recent years. Therefore, during the past three decades, numerous programs aimed to raise levels of education and diversify income sources have been designed and launched in rural areas, particularly the Midlands and Northern Mountains where the majority of the ethnic minority living (Passingham et al., 2002; Fan et al., 2004; Baulch et al., 2007).

Nevertheless, it is argued that the MOLISA's poverty line is much lower compared to international standards. For example, the national poverty lines based on MOLISA's approach in the period 2006–2010 is US$0.515/per person/per day,[8] which is approximately one-fourth by comparison with the internationally comparable poverty line of US$2 per day. Furthermore, as mentioned in Section 1, policy makers engaged in poverty alleviation strategies are constrained by the use of a unidimensional poverty measurement, or the monetary approach, rather than being informed by the multidimensional nature of poverty. As can be seen in the next section, the empirical results indicate that regions identified as the poorest of the country according to the MOLISA's income measurement report, have better poverty levels in other dimensions when compared with the regions considered richer in terms of the income dimension. Hence, the more comprehensive measurement methodologies proposed in this study will assist policy makers to more accurately target resources at the appropriate specific groups.

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[8] The average exchange rate of the period 2006 – 2010, according to ADB (2014), is 16,816 VND/USD.

5.2 FUZZY AND MULTIDIMENSIONAL POVERTY MEASURES IN VIETNAM

Our analysis has been carried out on the 2012 cross sectional wave of the Vietnam Household Living Standards Survey (VHLSS 2012). The survey comprises a sample of 42,980 individuals from which there are 6,325 migrants, and 9,399 households with 2,937 left behind migrant households, representing the whole of Vietnam and the 6 economic (or administrative) regions into which Vietnam is divided. In order to analyse the extent to which poverty in multiple dimensions tends to overlap for households, the fuzzy sets provide three useful techniques for aggregation: averages, intersection, and union. This study utilises all of them to examine multidimensional poverty in Vietnam.

Table 5-3. Descriptive statistics for fuzzy measures

	Median	Mean	Standard Deviation
FM	0.384	0.421	0.311
FS Education	0.000	0.150	0.182
FS Health	0.189	0.126	0.152
FS Housing	0.000	0.117	0.293
FS Basic services	0.000	0.251	0.307
FS Durable Asset	0.033	0.171	0.184
FS Economic Status	0.006	0.132	0.306
FS U-R	0.000	0.235	0.300

Firstly, simple descriptive statistics for the IFR measures are shown in Table 5.3. The average level of propensity for monetary poverty is higher than that of non-monetary dimensions. Thus, it can be said that the monetary dimension presents more problems for the population than non-monetary dimensions. Besides, the mean of the FS non-monetary measures are smaller than the median of the FM measure, which suggests that the distribution of the FM measure heads more toward membership function value

one; definitely poor. Considering these two observations, it can be conjectured that the FM measure is the more appropriate focus for policy than the FS measure. However the income measure of poverty used by MOLISA is not necessarily the right method by which to inform policy makers, since it reports only economic well-being and not human well-being (Baliamoune, 2003).

It can be helpful to realize how this proposed measurement method performs by using the relationship between the membership functions of varied dimensions as a reliable indicator of how the measure reflects reality. Since analysing every indicator simultaneously is not an effective way to look into the relationships, Table 5.4 reports the correlations between the FM measure and the membership functions for each dimension.

The first interesting finding from the Table 5.4 may be the fact that most correlation coefficients, except the relationship between the income dimension, the FM measure, basic services and durable goods domains, (r = 0.452 and r = 0.5, respectively), are much smaller than a half. This observation seems to strengthen the case for the multidimensional perception because it indicates that monetary variables are not necessarily good proxies for well-being, let alone the best, which has been argued in much of the research (Anand, 1977; Callan et al., 1993; and Ringen, 1988, 1995). Secondly, there are four statistically insignificant correlations (*p-value > 5%*) - between education and health, education and housing, underemployment and retirement benefit and health, and durable goods and underemployment and retirement benefit, which seems unexpected because it is repeatedly argued in several studies that they are closely interconnected, especially health and education (Ross and Wu, 1995; Strauss and Thomas, 1995; and Cutler and Lleras-Muney, 2006). Last but not least, is the unexpected negative relationship between the monetary and education dimensions. Though further analysis is beyond the scope of this dissertation, this finding seems to affirm the complexity of multidimensional poverty.

Table 5-4 Correlation coefficients for each dimension's membership functions

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)	FM	1							
(2)	FS Education	0.025*	1.000						
(3)	FS Health	-0.090*	0.020***	1.000					
(4)	FS Housing	0.202*	-0.004***	-0.060*	1.000				
(5)	FS Basic Services	0.452*	0.041*	-0.069*	0.249*	1.000			
(6)	FS Durable Asset	0.542*	-0.036*	-0.108*	0.308*	0.414*	1.000		
(7)	FS Economic Status	0.312*	0.052*	-0.063*	0.190*	0.261*	0.210*	1.000	
(8)	FS Underemployment & Retirement Benefit	0.084*	-0.156*	-0.014***	-0.098*	-0.096*	0.010***	-0.057*	1.00

Level of significance: 1%: *; 5%: **; and 10%: ***

Table 5.5 reports the average values of fuzzy poverty measures proposed in Section 3.2.2 for the entire country and for the 6 economic regions. In light of the argument by Cerioli and Zani (1990), the average values of membership functions equivalent to the monetary dimension and to the seven non-monetary dimensions in the Table 5.5 are used to explain the rates of poverty and deprivation.

At the country level, it is clear that there are no considerable disparities among the fuzzy measures of poverty in the seven FS dimensions. The ranking of administrative regions, across dimensions of poverty, is highly consistent. Table 5.5 also shows that the higher average levels of income move in line with lower rates of deprivation and poverty. The exception, however, is in deprivation rates in the health, underemployment and retirement benefit dimensions. The highest value of fuzzy measures (most deprivation) in the FS health and the FS underemployment and retirement benefits do not follow the lowest levels of income as anticipated.

The pattern of the FM measure is relatively consistent with the ranking among the six economic regions issued by official statistics and based on the monetary approach to poverty measurement. First of all, the region of the South East and the region of the Red River Delta are better off according to the monetary poverty dimension in the FM indicator. It is also worth noting that the two most active and important economic urban areas, Hanoi (the Vietnamese capital) and Ho Chi Minh City, are located at the Red River Delta and the South East regions, respectively. In contrast, the mountainous

region of the Midlands and Northern Mountains, where the majority of Vietnam's ethnic minorities reside, seems to be worse off, with the lowest value of the FM measure. As mentioned earlier, the income approach takes into consideration only the incidence of poverty with the dichotomy of poor and non-poor individuals or households. On the other hand, since its conversion of the generalised Gini index (Betti et al., 2006), the FM approach offers the ability to disclose some aspects of inequality and poverty intensity as well.

Table 5-5 Mean Values of Fuzzy and Multidimensional Poverty Measures in Vietnam

	Vietnam	Urban	Rural	Red River delta	Midlands and Northern Mountains Central	Northern and Coastal Centrals	Central Highlands	South East	Mekong River delta
Poverty rate (%)	11.1	4.3	14.1	6	23.8	16.1	17.8	1.3	10.1
FM	0.421	0.24	0.49	0.15	0.574	0.461	0.43	0.236	0.432
FS	0.169	0.16	0.17	0.2	0.15	0.145	0.17	0.137	0.198
FS Education	0.15	0.15	0.15	0.08	0.16	0.156	0.18	0.139	0.153
FS Health	0.126	0.12	0.13	0.08	0.114	0.104	0.11	0.124	0.132
FS Housing	0.117	0.08	0.13	0.11	0.238	0.04	0.06	0.132	0.214
FS Basic services	0.251	0.08	0.32	0.24	0.419	0.168	0.25	0.063	0.325
FS Durable Asset	0.171	0.11	0.2	0.11	0.252	0.163	0.2	0.136	0.182
FS Economic Status	0.132	0.08	0.15	0.12	0.243	0.119	0.2	0.09	0.112
FS Underemployment & Retirement Benefit	0.235	0.26	0.22	0.08	0.143	0.263	0.17	0.275	0.266

The information in Table 5.5 indicates that there are less differences among the six economic regions for household units in the population concerning the unweighted means of combination of seven non-monetary dimensions with the FS indicator. Looking more closely at the results for each single dimension, however, inequality among regions is substantial marked. The region of the Red River Delta, in comparison to the other regions, presents the best situation in terms of the housing and economic status dimensions. However, the Red River Delta's average values of fuzzy measurement referring to the health dimension performs the worst among the six regions. This points out the difficulties in covering health expenses and having health insurance or a free health care certificate, which is recorded one of the highest rates in the country. The region of the South East also reports the best results in the monetary approach, as well as in most of the non-monetary dimensions, although its measurement in underemployment and retirement benefit presents the worst situation compared to the other regions. Conversely, the region of the Midlands and Northern Mountains has the worst values for nearly all indicators as presented in Table 5.5; however, its underemployment and retirement benefit dimension is in the best situation among the regions. Furthermore, it is surprising to find that the region of the Mekong River Delta, one of the two primary rice growing zones and from where the majority of Vietnam's rice is exported, shows as the second-least deprived in most of the non-monetary dimensions.

For the purpose of studying the overlap between non-monetary and monetary measures of poverty across the country, the intersections and union of aggregation operations, as proposed in numerous contributions in the literature on fuzzy measurement of poverty, are utilised in this study (see, for example, Martinetti, 2000; Martinetti, 2006). As mentioned in Section 4.4, the measures of "manifest" or "intensive" deprivation and the "latent" or "extensive" deprivation are calculated by the following equations:

$$Manifest_i = Intensive_i = min\ (FM_i, FS_i)$$

and

$$Latent_i = Extensive_i = max\ (FM_i, FS_i)$$

Table 5-6 Measures of intensive deprivation

Variable	Total	Urban	Rural	Red River delta	Midlands and Northern Mountains	Northern and Coastal Central	Central Highlands	South East	Mekong River delta
Intensive Education	0.108	0.075	0.121	0.078	0.135	0.122	0.126	0.071	0.115
Intensive Health	0.096	0.079	0.102	0.107	0.081	0.092	0.083	0.085	0.111
Intensive Housing	0.077	0.027	0.098	0.004	0.198	0.027	0.046	0.032	0.14
Intensive Basic Services	0.196	0.049	0.255	0.155	0.366	0.143	0.207	0.043	0.232
Intensive Durable Asset	0.136	0.083	0.181	0.099	0.181	0.142	0.144	0.089	0.154
Intensive Economics Status	0.096	0.041	0.119	0.047	0.202	0.094	0.14	0.04	0.077
FS Underemployment & Retirement Benefit	0.149	0.121	0.16	0.16	0.105	0.181	0.104	0.125	0.17

First, the figures present in Table 5.6 implies the common propensity to poverty in both measures, in other words, in both monetary and non-monetary aspects, this number can be interpreted as the propensity to more "intense" poverty. The higher values indicate the more intensive poverty of both dimensions. Concerning income and basic services simultaneously, the Vietnamese experience the most overlapped deprivation with the intensive value of 0.198. The rural population has much higher intensive rates across all dimensions by comparison with the urban. The region of the Midlands and Northern Mountains shows the highest values of intense poverty in most domains, especially in basic services. The exception is the health dimension, which has the lowest overlapped rates in comparison with the other regions' values.

Additionally, it would be informative to consider the concepts of "latent" or "extensive" poverty since they can describe the maximum scope of poverty in the society. As the concept of extensive poverty can be understood as a union of two different kinds of poverty, the numbers in Table 5.7 can be interpreted as the maximum propensity to the wider concept of poverty. Thus, according to that interpretation, the extensive poverty value of durable assets implies that the households of the country are exposed to at least one of the two deprivation aspects: income or durable assets by the degree of 0.436 on average.

To take a further step in analysing multidimensional poverty, the IN/EX ratio is a valuable indicator for examining the degree of overlap between monetary and non-monetary domains at the household level. This ratio, which varies from 0 to 1, is the intensive deprivation index expressed as a percentage. It is easy to figure out that the higher the values of the IN/EX ratio, the higher the degree of overlap in the varied types of deprivation.

Table 5-7 Measures of extensive deprivation

Variable	Vietnam	Urban	Rural	Red River delta	Midlands and Northern Mountains	Northern and Coastal Central	Central Highlands	South East	Mekong River delta
Extensive Education	0.463	0.316	0.523	0.396	0.598	0.496	0.479	0.303	0.47
Extensive Health	0.451	0.284	0.519	0.397	0.606	0.474	0.453	0.274	0.452
Extensive Housing	0.461	0.299	0.526	0.356	0.614	0.473	0.439	0.336	0.505
Extensive Basic Services	0.477	0.269	0.561	0.424	0.626	0.487	0.472	0.255	0.524
Extensive Durable Asset	0.436	0.267	0.509	0.354	0.582	0.471	0.444	0.279	0.448
Extensive Economics Status	0.457	0.28	0.528	0.374	0.615	0.486	0.483	0.286	0.466
Extensive U – R	0.507	0.386	0.556	0.436	0.611	0.543	0.491	0.385	0.528

Table 5-8 Measures of the overlap ratio

Variable	Vietnam	Urban	Rural	Red River delta	Midlands and Northern Mountains	Northern and Coastal Central	Central Highlands	South East	Mekong River delta
IN/EX Education	0.233	0.237	0.231	0.197	0.226	0.246	0.263	0.234	0.245
IN/EX Health	0.213	0.278	0.197	0.270	0.134	0.194	0.183	0.310	0.246
IN/EX Housing	0.167	0.090	0.186	0.011	0.322	0.057	0.105	0.095	0.277
IN/EX Basic Services	0.411	0.182	0.455	0.366	0.585	0.294	0.439	0.169	0.443
IN/EX Durable Asset	0.312	0.311	0.356	0.280	0.311	0.301	0.324	0.319	0.344
IN/EX Economics Status	0.210	0.146	0.225	0.126	0.328	0.193	0.290	0.140	0.165
IN/EX U - R	0.294	0.313	0.288	0.367	0.172	0.333	0.212	0.325	0.322

In Table 5.8, it is clear that the abovementioned ratio is higher in regions with higher levels of deprivation, and lower in areas with lower levels of deprivation. While the region of the Midlands and Northern Mountains, in particular, takes the highest measures of the "overlap" ratio (IN/EX ratio), the region of the South East, conversely, has the lowest values of this ratio. These results imply that households in regions of high relative poverty, in the region of the Midlands and Northern Mountains, for example, are more likely to face higher possibilities of propensity to poverty in both monetary and non-monetary aspects. In contrast, the analysis of multiple dimensions of poverty provides more insight values in the absence of overlapped deprivation in areas where levels of relative poverty are already low.

Figure 5-1 Participation in social support programs by region (%)
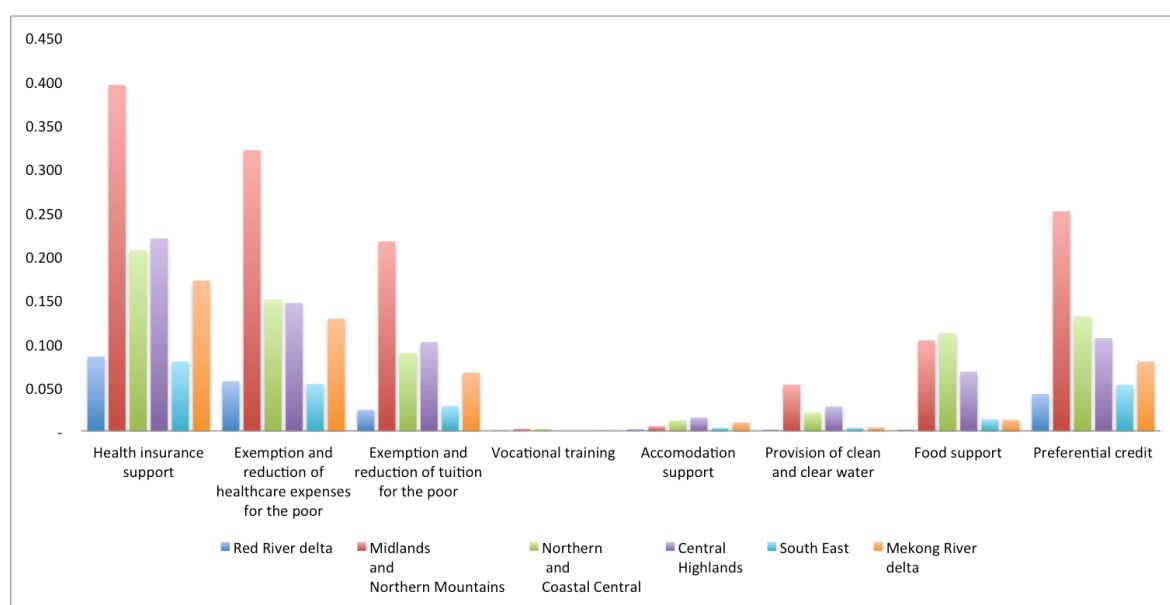
Figure 5.1 reports the percentages of poor households that have benefited from social support programs in the year 2012. As mentioned earlier, the poor households were selected by locality based on MOLISA's income poverty line, hence Figure 5.1 indicates that such social programs concentrated on enhancing the financial capacity of poor households, with support for health and education expenditure as well as access to preferential credit. The poorest region, the Midlands and Northern Mountains, has the highest rates of participation in most programs, whereas the overlap ratios of fuzzy measurements show that this region is not only the most deprived in the income dimension, but also in other non-income dimensions such as

housing, basic services, and economic status. Figure 5.1 reports extremely low percentages of participation of poor household in programs related these dimensions (accommodation supports, provision of clean and clear water) in the Midlands and Northern Mountains region. Therefore, the overlap ratios can give real insights into the difficulties disadvantaged households suffer, and into the call for strategies to address interconnected deprivations.

5.3 FUZZY AND MULTIDIMENSIONAL POVERTY MEASURES OF MIGRANT HOUSEHOLD IN VIETNAM

The VHLSS 2012 includes 2,937 households that have had former members migrate, and 6,325 people who have moved away from home, which accounts for 14.5 per cent of the total 42,980 respondents. The analysis of fuzzy and multidimensional poverty of migrant households in this study is based on the information from 2,937 households left behind, defined as migrant households.

Table 5.9 compares average levels of education and age of VHLSS 2012 non-migrant and migrant households grouped by urban, rural and six economic areas. At the country level, the migrated former members, as expected, acquire higher levels of education as well as being much younger than the members left behind. In addition, on average, figures of migrant households also indicate that they obtain higher average education levels and are older than that of non-migrant households. These statistics are consistent with the theoretical literature of migration, which argue that migration occurs among individuals who are younger, with higher levels of education and work experience (Sahota, 1968; Vakulabharanam and Thakurata, 2014).

The fuzzy measures presented in Table 5.10 indicate some interesting information. While the migrant households seem to be better off in most non-monetary dimensions except the underemployment and retirement benefit dimensions, their fuzzy measures of income poverty are worse off than those of the non-migrant households, where there was any member having moved away from home. These observations are consistent with numerous research studies on the positive relationship between migration and improvement of non-monetary dimensions of migrants households (see, for example, Skeldon, 1997; Adams and Page, 2005; McKenzie and Sasin, 2007; and Wang and Cai, 2008).

Table 5-9 Age and education level of migrant and non-migrant households by region

Variable			Vietnam	Urban	Rural	Red River delta	Midlands and Northern Mountains	Northern Central and Central Coastal Highlands	Central Highlands	South East	Mekong River delta
Education level	Non-migrants Household		1.6	2.4	1.3	2.3	1.3	1.7	1.3	1.8	1.1
	Migrant Household	Migrated members	2.6	3.5	2.5	3.2	2.4	2.9	2.4	2.5	1.8
		Left-behind members	1.6	2.3	1.4	2.1	1.6	1.8	1.5	1.6	1.0
Age	Non-migrants Household		29.7	31.5	28.9	32.3	27.1	29.3	26.5	31	30.7
	Migrant Household	Left-behind members	39.5	39.5	38.2	41.9	37.3	38.8	36.5	38.1	36.8
		Migrated members	32.2	32.5	30.8	32.1	29.7	30.7	30.7	32.1	31.7

Table 5-10 Fuzzy Measures of migrant and non-migrant household by region

Variable		Vietnam	Urban	Rural	Red River delta	Midlands and Northern Mountains	Northern and Central Coastal Central	Central Highlands	South East	Mekong River delta
FM	Non-migrants	0.416	0.230	0.501	0.323	0.603	0.454	0.422	0.226	0.431
	Migrants	0.433	0.282	0.478	0.388	0.497	0.474	0.444	0.279	0.433
FS Education	Non-migrants	0.176	0.165	0.182	0.156	0.188	0.190	0.204	0.149	0.181
	Migrants	0.091	0.099	0.088	0.077	0.085	0.098	0.083	0.090	0.103
FS Health	Non-migrants	0.127	0.120	0.129	0.165	0.112	0.105	0.107	0.124	0.134
	Migrants	0.126	0.120	0.125	0.147	0.119	0.103	0.120	0.126	0.128
FS Housing	Non-migrants	0.176	0.097	0.150	0.102	0.275	0.160	0.202	0.142	0.186
	Migrants	0.160	0.041	0.093	0.128	0.190	0.168	0.192	0.107	0.173
FS Basic services	Non-migrants	0.255	0.070	0.340	0.212	0.461	0.177	0.255	0.065	0.321
	Migrants	0.244	0.090	0.289	0.274	0.307	0.153	0.241	0.051	0.332
FS Durable Asset	Non-migrants	0.176	0.107	0.207	0.102	0.275	0.160	0.202	0.142	0.186
	Migrants	0.160	0.103	0.177	0.128	0.190	0.168	0.192	0.107	0.173
FS Economic Status	Non-migrants	0.143	0.077	0.173	0.080	0.261	0.128	0.206	0.095	0.119
	Migrants	0.108	0.079	0.116	0.066	0.196	0.102	0.160	0.068	0.098
FS U - R	Non-migrants	0.207	0.239	0.192	0.236	0.121	0.228	0.141	0.251	0.231
	Migrants	0.296	0.338	0.284	0.279	0.200	0.322	0.270	0.381	0.330

Overall, the picture of poverty in both urban and rural areas shows that families in rural areas, migrant and non-migrant households, with higher fuzzy measures in most dimensions, are more deprived than those in urban areas. However, one surprising difference can be found. Whereas the non-migrant households in rural areas, as anticipated, have a higher propensity of poverty in the education dimension in comparison with urban areas, levels of deprivation in the education dimension of the migrant households are lower in rural compared to urban areas. The situation of rural migrant households, as far as the education dimension is concerned, is much better than that of non-migrant urban households with FS values for education and the overlap ratio being 0.088 and 0.141, respectively. Furthermore, rural areas and the region of Midlands and Northern Mountains, which is regarded as the poorest areas of the country, are in better condition in terms of the monetary dimension than the urban areas and other regions of the country, while the opposite is true for the majority of non-monetary dimensions.

It is also worth noting that the measures of the FS underemployment and retirement benefit indicator in rural areas reports lower degrees of deprivation, indicating higher employment in both migrant and non-migrant households than that in urban areas. On the other hand, across all regions of the country, the level of underemployment and retirement benefit deprivation of migrant households is higher than that of non-migrant households. More detailed figures about the employment status of migrated former household members show that at the time of moving away home, migrated former members in paid jobs account for nearly 70 per cent of those who migrated (see Appendix 1). It is can therefore be suggested that migrated members are the main labour force of migrant families. Furthermore, the proportion of migrated former members who send money home is approximately 73 per cent, which assists migrant households to diversify their income resources. This suggests that the disincentives to participating in the labour force for members left behind may be an explanation for the high degree of deprivation in the underemployment and retirement benefit dimension. However, further investigation into the reasons for these observations are beyond the scope of this study.

Table 5-11 Measures of intensive deprivation by regions and migrants

Variable		Vietnam	Urban	Rural	Red River delta	Midlands and Northern Mountains	Northern Central and Central Coastal	Central Highlands	South East	Mekong River delta
Intensive Education	Non-migrants	0.127	0.082	0.147	0.094	0.163	0.149	0.142	0.074	0.135
	Migrants	0.066	0.054	0.070	0.050	0.064	0.075	0.064	0.057	0.078
Intensive Health	Non-migrants	0.095	0.079	0.102	0.107	0.080	0.092	0.080	0.085	0.112
	Migrants	0.098	0.080	0.103	0.107	0.083	0.091	0.094	0.087	0.109
Intensive Housing	Non-migrants	0.086	0.030	0.111	0.005	0.219	0.037	0.050	0.034	0.146
	Migrants	0.059	0.019	0.070	0.002	0.143	0.012	0.032	0.022	0.130
Intensive Basic services	Non-migrants	0.202	0.048	0.273	0.138	0.407	0.153	0.210	0.045	0.235
	Migrants	0.182	0.055	0.219	0.189	0.258	0.126	0.193	0.034	0.228
Intensive Durable Asset	Non-migrants	0.135	0.081	0.190	0.090	0.191	0.138	0.139	0.090	0.157
	Migrants	0.138	0.088	0.164	0.116	0.154	0.149	0.160	0.087	0.149
Intensive Economic Status	Non-migrants	0.104	0.039	0.134	0.047	0.221	0.101	0.144	0.042	0.082
	Migrants	0.080	0.046	0.090	0.046	0.152	0.083	0.125	0.032	0.067
Intensive U - R	Non-migrants	0.129	0.105	0.140	0.145	0.093	0.157	0.087	0.112	0.150
	Migrants	0.192	0.168	0.199	0.189	0.138	0.222	0.171	0.185	0.206

Table 5-12 Overlap Ratio by regions and migrants

Variable		Vietnam	Urban	Rural	Red River delta	Midlands and Northern Mountains Central	Northern and Coastal Central	Central Highlands	South East	Mekong River delta
IN/EX Education	Non-migrants	0.2718	0.2637	0.2740	0.2590	0.3014	0.2944		0.2464	0.2825
	Migrants	0.1445	0.1646	0.1406	0.1194	0.1504	0.1379		0.1842	0.1704
IN/EX Health	Non-migrants	0.2118	0.2895	0.1933	0.2804	0.1262	0.1978		0.1793	0.2489
	Migrants	0.2120	0.2488	0.2051	0.2497	0.1555	0.1870		0.2007	0.2411
IN/EX Housing	Non-migrants	0.1849	0.0994	0.2067	0.0145	0.3384	0.0781		0.0990	0.2844
	Migrants	0.1290	0.0623	0.1408	0.0044	0.2712	0.0249		0.0722	0.2652
IN/EX Basic services	Non-migrants	0.4312	0.1886	0.4810	0.3461	0.6194	0.3208		0.4497	0.4548
	Migrants	0.3672	0.1731	0.3999	0.3988	0.4729	0.2522		0.3933	0.4238
IN/EX Durable Asset	Non-migrants	0.3126	0.3159	0.3668	0.2727	0.3128	0.2976		0.3164	0.3514
	Migrants	0.3103	0.2944	0.3349	0.2928	0.3034	0.3072		0.3477	0.3313
IN/EX Economic Status	Non-migrants	0.2285	0.1444	0.2478	0.1326	0.3435	0.2109		0.2967	0.1759
	Migrants	0.1728	0.1473	0.1774	0.1122	0.2810	0.1678		0.1493	0.1437
IN/EX	Non-migrants	0.2621	0.2881	0.2542	0.3497	0.1473	0.2986		0.1816	0.3066
U - R	Migrants	0.3583	0.3730	0.3548	0.3961	0.2456	0.3875		0.3146	0.3892

Looking more closely at each poverty domain, the large differences between migrant and non-migrant households across urban, rural and the six economic regions become clearer. First of all, in terms of the monetary dimension, the migrant households in rural regions as well as in the region of Midlands and Northern Mountains, in contrast to the other regions of Vietnam, report a lower average level of deprivation, although the migrant households in these region are still in the worst situation in the country. Therefore, it can be concluded that migration seems to be a potential way to improvement of migrant family income.

As far as the basic services domain is concerned, the two main rice growing areas of the country, the regions of the Red River Delta and the Mekong River Delta, take a contrary direction to the other regions, that is, the migrant households show higher degrees of deprivation compared to non-migrant households. When combined with the overlapped indexes, Intensive Basic Services and IN/EX Basic Services in Tables 5.11 and 5.12, respectively, one can observe that only migrant households in the region of the Red River Delta suffer a higher level of deprivation overlap between the monetary and basic services domains than do non-migrant households. Furthermore, the migrant households in the Red River Delta region report higher degrees of deprivation, not only in the simple fuzzy measures but also in the overlap ratios in housing and durable assets domains; approximately 40 per cent and 29.3 per cent, respectively. These two observations point to problems in accessing the basic services of water, sanitation, energy, and the possession of durable assets for migrant households in the Red River Delta region. These empirical findings prove that migrant households are vulnerable groups in the case of Vietnam. However, there has been not a suitable specific program that focuses on this vulnerability.

5.4 ROBUSTNESS OF INDICATOR WEIGHT

To evaluate whether or not the empirical fuzzy measurement is robust when weights are altered, this study runs two analyses related to the pairwise comparisons, Spearman rank correlation coefficient (R) and the Kendall rank correlation coefficient ($R\tau$).

Table 5-13 Spearman correlation coefficient and Kendall correlation coefficient

Dimension	Spearman correlation coefficient ($R\rho$)	Kendall correlation coefficient ($R\tau$)
Education	0.9986	0.9968
Health	0.9939	0.9895
Housing	0.9976	0.9809
Basic services	0.9873	0.9628
Durable asset	1.0000	1.0000
Economic status	0.9896	0.9577
Underemployment and Retirement benefit	0.9742	0.9441

First, the fuzzy supplementary dimensions are estimated with equal weight structures, i.e. are given equal weights to every indicator in each non-monetary dimension. Then, the results are gathered from two weight structures for each dimension, one calculated from equation (9) and the other from equal weight structures. Although the fuzzy poverty estimates are influenced by alternative weights, the household rankings are highly robust to such changes. Spearman correlation coefficient ($R\rho$) and Kendall correlation coefficient ($R\tau$) report a minimum value of 0.97 and 0.94, respectively (Table 5.13). Hence, the empirical results appear to be a valid instrument for informing poverty policies.

6. CONCLUSION

Defining and measuring poverty is not a straightforward research topic that can be solved thoroughly by one study, since the interpretation essentially rests on contexts within a society (Orshansky, 1965; Sen, 1992; Townsend, 1985). This indicates that efforts to formulate a universal definition of poverty might really end up being pointless, not to mention useful insights. Moreover, a the notion of multidimensional poverty appears to make this challenge even more difficult in that it raises a new question of deciding the proper dimensions for poverty (Alkire, 2002; Clark and Hulme, 2005; Kakwani & Silber, 2008; Robeyns, 2005).

The present study utilises the capability approach, which underlines actual functionings of individuals in society as a theoretical breakthrough for the challenges of measuring the multidimensional poverty of migrant households. Although the approach is still not enough to obtain an acceptable list of human capabilities and functionings that can be proxy compositions of multidimensional poverty, this research examines empirical studies that investigate the various dimensions of human well-being. The intention of this research is also to compile a more agreeable list of dimensions, and to determine seven domains of poverty as well as 22 empirical indicators that capture the concept of multidimensional poverty.

Applying the Integrated Fuzzy and Relative (IFR) approach to the Vietnam Household Living Standard 2012 data, the empirical results show that the simple dichotomy feature of the monetary approach to poverty is not enough to capture the vague, complex, and multidimensionality of poverty, and the fuzzy measures seem to represent the situation of household well-being more adequately. Particularly, the fuzzy measures at least offer sufficient justification on which we can elucidate the definition of poverty. Although the present study demonstrates that the fuzzy measures can be varied roots of important information on poverty, the limitation of this study is in the selection of dimensions for a multidimensional poverty measurement, which still lacks levels of objectivity and transparency to inform policy makers due to the unavoidable arbitrariness. In addition, it is suggested that further studies should be focused on an investigation of the dynamics of multidimensional poverty to provide more vital insights to the diverse poverty experiences of households, which is one important component of multidimensional poverty.

APPENDIX 1

	Freq.	Per cent	Cum.
Having paid job	4,308	68.11	68.11
Studying	1,014	16.03	84.14
Unemployment	807	12.76	96.9
Other	196	3.1	100
Total	**6,325**	**100**	

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