Effects of Mining Collapse on Firm Performance:

Evidence from Australia

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A thesis presented for the degree of Master of Research

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Abstract

This study attempts to discover the extent to which Australian mining companies' firm-level performance is affected by the mining collapse of 2011. To support the findings, this thesis also examines the effects on two related channels: cost of debt and investments. The difference-in-differences methodology is used on a relatively large unbalanced panel dataset comprising almost all mining and non-mining companies (except the financial sector) of the Australian Securities Exchange from 2006 to 2015. The results suggest that the mining companies have experienced a greater reduction in firm-level performance compared with the non-mining companies. The results also show that the mining companies have experienced a greater increase in the cost of debt and a greater reduction in their investments. These findings support previous literature and the expectation that the reduction in performance is associated with an increase in the cost of debt and a reduction in investments. The results are expected to contribute to our understanding of the nature of such sector-based crises on the companies within the sector compared with unaffected sectors. This thesis may have important policy implications for regulators who may bring necessary changes to their policies to assist more vulnerable companies.

Keywords: firm performance, mining collapse, cost of debt, investment, difference-in-differences, Australia

Statement of Originality

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

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Shahzada Imran

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Chapter 1. Introduction

1.1. Background

The Australian economy is unique in many aspects. Unlike most developed countries, the Australian economy has continued to avoid a recession since 1991. Although Australia's Gross Domestic Product (GDP) growth rate has not been consistent, its performance is noteworthy considering the swings experienced by the global economy, especially during the global financial crisis (GFC) and immediately afterwards.

From an annual GDP growth perspective, Australia has hardly been affected by the GFC compared with most other developed countries (see Figure 1). Commodity-based sectors, especially the mining sector, could help Australia avoid such a global crisis and the associated recession (Bashar, 2015). During the recent mining or mineral exploration boom, a few Australian cities contributed most of the growth seen in Australia's economy. Research results[1] by SGS Economics & Planning show that only two cities—Sydney and Melbourne—contributed significantly to the national economy, while other regional areas have been lacking in recent years. During 2015–2016, these two cities generated 67% of national Australian GDP growth. However, in 2010–2011, immediately before the mining collapse, the same two cities contributed only 37% of the GDP growth. In Western Australia, the capital Perth (renowned for its mining resources) contributed over 20% during the same time period. In the aftermath of the mining collapse, Perth's contribution has fallen to just over 5%. This is also an indication of how the mining collapse dramatically changed the overall economies of the cities that were dependent on the mining businesses' success.

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[1] Comparing two different reports: (1) http://www.sgsep.com.au/publications/gdp-major-capital-city-2015-2016 and (2) http://www.sgsep.com.au/publications/gdp-major-capital-city-2010-11 accessed online on April 21, 2017.

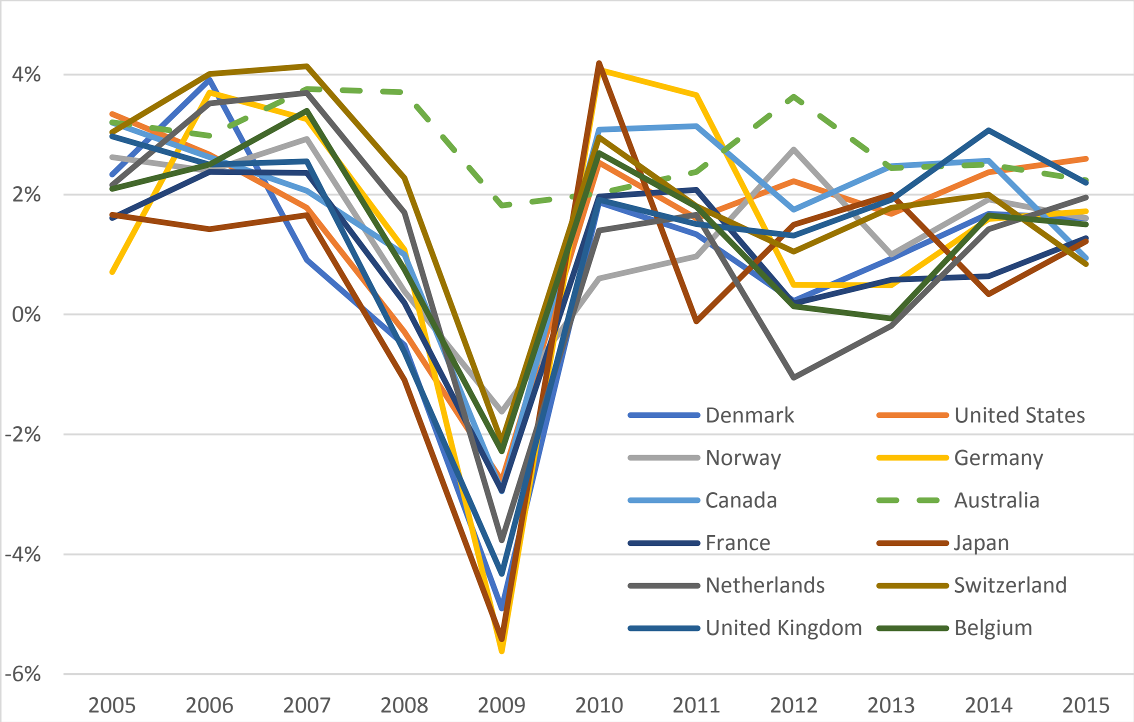

Figure 1. Annual GDP growth rates (%) of some developed countries.

Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 United States (US) dollars. Data are collected from World Bank national accounts data and from the Organisation for Economic Cooperation and Development (OECD) national accounts data files.

The mining boom did not last long after the GFC began (see Figure 2). Although the sudden downturn in the second half of 2008 was temporary which was largely due to economic stimulus programme implemented in China (Robson, 2015), Australian mining companies are still struggling to recover from the 2011 collapse that was caused by a significant drop in international prices for iron ore and other major mining commodities, along with lower Chinese import demand.

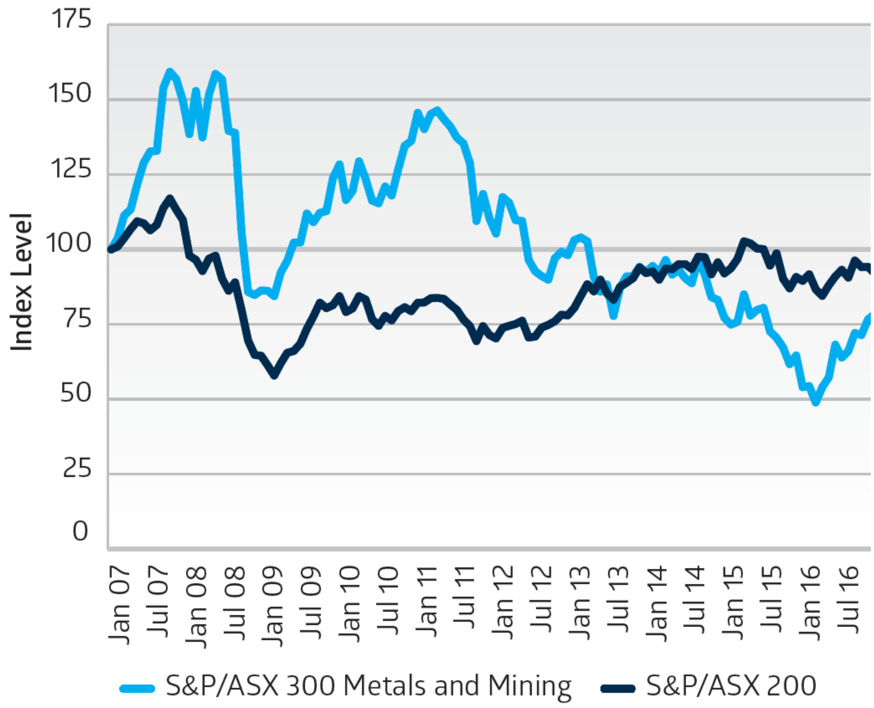

Figure 2. S&P/ASX 200 vs. S&P/ASX 300 Metals and Mining.

The figure has been collected from the Metals and Mining Sector Profile published by the Australian Securities Exchange (ASX). (Source: Bloomberg).

1.2. Methodology and data

This thesis attempts to show the extent to which the mining collapse of 2011 has affected firm-level performance from a book value or accounting perspective and from a market value perspective. To explain and support such performance results in the mining companies compared with the non-mining companies, two important channels are examined: cost of debt and investments. This is achieved by analysing a relatively large, unbalanced panel of firm-level data from 2006 to 2015 of almost all mining and non-mining companies (except the financial sector) of Australia both currently listed and delisted with the Australian Securities Exchange (ASX) using the difference-in-differences (DID) methodology. Additionally, this analysis considers economy-wide data such as the Australian GDP growth rate, individual resources and energy (i.e., mining commodities) export unit value indices and the resources and energy export unit value combined index (R&E Index), iron ore agglomerated export price from Australia to China and mining as a percentage of annual GDP (at current prices).

An industry-wide recession is not a common economic event (as opposed to a whole economy-wide crisis). The mining sector collapse in Australia is a relatively rare industry shock to its economy. Mining collapse is such a big economic event that it is beyond the control of any individual firm. Therefore, we can consider this to be a natural experiment. Thus, the use of the DID methodology is an appropriate choice for this study. DID estimation has become an increasingly popular method to estimate causal relationships (Bertrand, Duflo, & Mullainathan, 2004). The great demand in application of DID estimation comes from its simplicity, as well as its potential to circumvent many of the endogeneity problems that typically arise when making comparisons between heterogeneous elements.

1.3. Main findings

The results suggest that, due to the mining collapse, the performance of mining companies has been significantly negatively affected compared with the performance of the non-mining companies. Following the mining collapse in 2011, book value or accounting-based performance indicated by return on assets (ROA) on average has decreased by about 5% to 6.5% and return on equity (ROE) on average has decreased by 10% to 14% for the mining companies compared with those of the non-mining companies (excluding the financial companies). Conversely, market value performance measured by Tobin's Q ratio on average has decreased by 68% to over 75%. Annual total stock return on average has decreased by 62% to about 67% for the mining companies compared with the non-mining non-financial firms following the mining collapse.

Two related channels are explored to support the study's findings in the performance effects. The results suggest that the mining collapse also had a similar adverse effect on the cost of debt and investments of the mining firms. Following the collapse, the cost of debt (measured as interest expense divided by average total debt) for the mining companies seemed to increase from 15% to about 20% on average. This indicates that these firms have experienced increased difficulty in borrowing money. Firm investments (measured as capital expenditure divided by total assets at the beginning of the year) of the mining companies have also suffered, decreasing by 3.3% to nearly 5%. As an additional robustness measure for the firm investments, we have looked at change in property, plant and equipment (commonly used as collateral against borrowing) to total assets ratio which has decreased by about 1.8% to 2.6% for the mining companies. This indicates a similarly adverse situation for both borrowing and investments by the mining companies compared with other companies.

In summary, the results show that the mining companies have experienced a greater increase in the cost of debt and a greater reduction in their investments. This supports prior literature and the author’s expectation that the reduction in performance is associated with the increase in the cost of debt and a reduction in investment.

1.4. Contributions

Apart from papers published by the Reserve Bank of Australia (RBA) such as in Downes et al. (2014) and Battellino (2010), few studies have been conducted on the recent mining collapse in Australia. Although some RBA papers cover the mining industry, these mostly examine the macro-level situations as opposed to firm-level situations. This study may be the first to examine firm-level performance surrounding the recent mining collapse in Australia. Thus, it is an attempt to fill that gap.

Moreover, this study attempts to quantify the extent of performance effects for the affected industry compared to the unaffected industries. In addition to looking at performance effects, the thesis has covered two related channels – cost of debt and corporate investments and similarly quantified the effects. The results are expected to also contribute to our understanding of the nature of such sector-based crises on the companies within the sector compared with unaffected sectors in an economy.

1.5. Thesis organisation

The remainder of this thesis is now outlined as follows. Chapter 2 provides a brief overview of the Australian mining industry. Chapter 3 contains the related literature review along with the development of hypotheses. Chapter 4 describes the sample data, variable measures and the chosen methodology. Chapter 5 presents the empirical results and discussions and Chapter 6 summarises and draws a conclusion to the thesis.

Chapter 2. The Australian Mining Industry – A Brief Overview

2.1. Background

Australia is one of the leading mining nations in the world in terms of discovered resources, production and export of its mining commodities. For several mining commodities, Australia has the highest-ranking position in the world (see Table 1).

Table 1

World Ranking of Australia's Major Mining Commodities[2]

	World Ranking for Resources	Percent of World Resources	World Ranking for Production	Percent of World Production
Iron Ore	1	29	1	38
Gold	1	17	2	9
Lead	1	40	2	9
Nickel	1	24	5	9
Rutile	1	42	1	50
Uranium	1	29	3	10
Zinc	1	28	3	7
Zircon	1	67	1	31
Bauxite	2	22	1	31
Brown Coal	2	24	5	6
Cobalt	2	14	5	4
Copper	2	12	5	5
IImenite	2	19	3	13
Silver	2	16	5	5
Diamond	3	18	2	24
Lithium	3	18	unknown	unknown
Antimony	4	9	4	4
Black Coal	4	10	4	7
Manganese Ore	4	13	4	9
Tin	4	10	7	2

[2] Data collected from the website of Geoscience Australia; accessed on 11 November, 2017 (http://www.ga.gov.au/scientific-topics/minerals/table-4-world-rankings)

Over the past 200 years, there have been five major mining booms in Australia. These include: (1) the gold rush in the 1850s (the first major boom in Australia), (2) the mineral boom in the late nineteeth-century, (3) the mineral and energy boom in the early 1970s, (4) the energy boom in the early 1980s and (5) the mineral and mining boom that began around 2005 (Battellino, 2010). Mining has been a driving force not only for much of the exploration of Australia's remote inland and for its industrial development, but also for meeting the demand for minerals to fuel the industrial growth of much of the rest of the world. Historically, Australia's exports have contributed significantly to its prosperity (McLean, 2012).

The value of Australia's mining exports has grown more than three times over the past decade, while investment spending by the mining sector has increased from 2% of GDP to 8% of GDP. This recent 'mining boom' represents one of the largest positive shocks to hit the Australian economy in generations (Downes et al., 2014).

According to 'Australia's Identified Mineral Resources 2016' report,[3] Australian mineral exports (excluding petroleum products) amounted to approximately $141 billion. This represents almost 60% of all export merchandise and 50% of all exported goods and services. In 2015, GDP was approximately $1,643 billion, with mineral exports contributing almost 9%. However, as a percentage of GDP, mineral exports have trended downwards from the 2011 level of 11%.[4] The value of total mineral exports is now at its lowest point in five years. This reflects generally weak commodity prices, but is particularly affected by the steep fall in the iron ore price that has only been partially offset by increased iron ore production.

[3] Published by the Geoscience Department of Australian Government.
[4] Which has been identified as the post-mining collapse period in this thesis.

2.2. Recent Market Conditions

Market conditions for the Australian mining industry have been challenging over the past few years, due to falling commodity prices and increasing competition from new supply capacity overseas. Although there was a sharp fall in commodity prices at the time of GFC, this was temporary (see Figure 3). According to Robson (2015), when prices and volumes started to fall as a result of the GFC, China implemented a four trillion RMB of economic stimulus programme in late 2008. However, the fall in commodity prices seemed to continue after 2011. The commodity price cycle has clearly been in a downturn since 2011, as the factors that supported the rapid increase in prices over the previous decade subside.

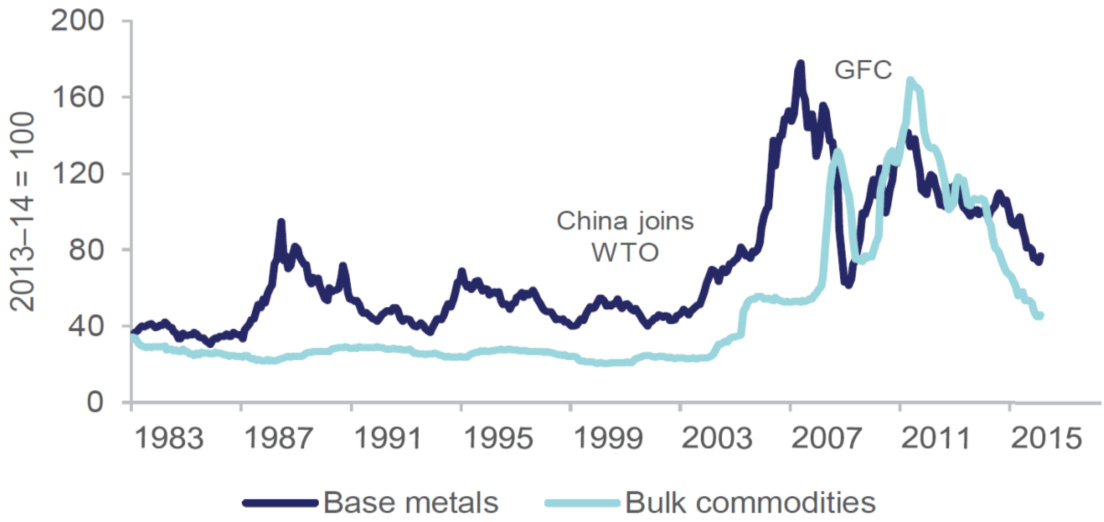

Figure 3. Commodity price movements in terms of base metals[5] and bulk commodities[6]. Source: Resources and Energy Quarterly Report – March 2016.

From Figure 4, it is evident that mineral resources account for most of Australia's exports. Figure 4 also indicates that the proportion of mineral resources export with respect to total export dropped from 60% in 2010–2011 to 50% in 2015–2016. This is close to the pre-collapse period level of 49% in 2006–2007.

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[5] Base metals are common and relatively inexpensive metals, such as, lead, nickel, copper, tin, zinc, etc.
[6] Bulk commodities are dry materials in loose bulk form, such as, iron ores, coal, sand, gravel and stone, etc.

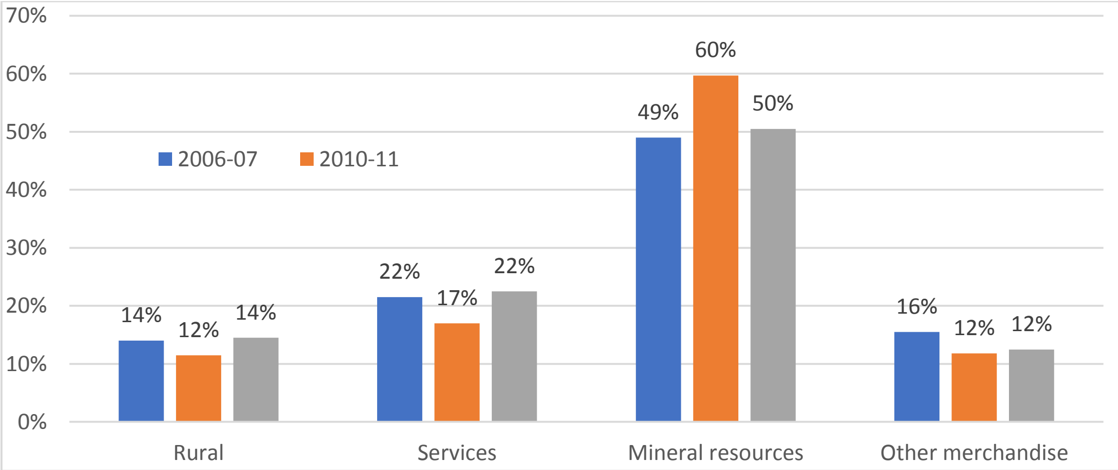

Figure 4. Contribution to exports by sector (proportion of goods and services). Source: Australian Bureau of Statistics (ABS).

According to ‘Australia’s Identified Mineral Resources 2016’ report, the economic growth in China, the key driver of growth in commodity demand over the past decade, is slowing as it transitions from investment-led growth to a model of consumption-led growth. Over the past few years, world production of resources and energy commodities has outpaced consumption growth. The subsequent decline in prices has reduced the viability of many operations and has increased the financial pressure on companies. Hence, many operations have scaled back production or have been placed on care and maintenance.

Although China is the major export destination for resources, Japan appears to be the dominant importer of Australian energy products (see Figure 5). Among commodities, iron ore is the most dominant exporting item, followed by coal items, gas, gold and so forth. Thus, it is understandable that the prices of the dominant commodities affect this sector the most. An indication of how prices of some of these items have been trending can be seen in Figure 6.

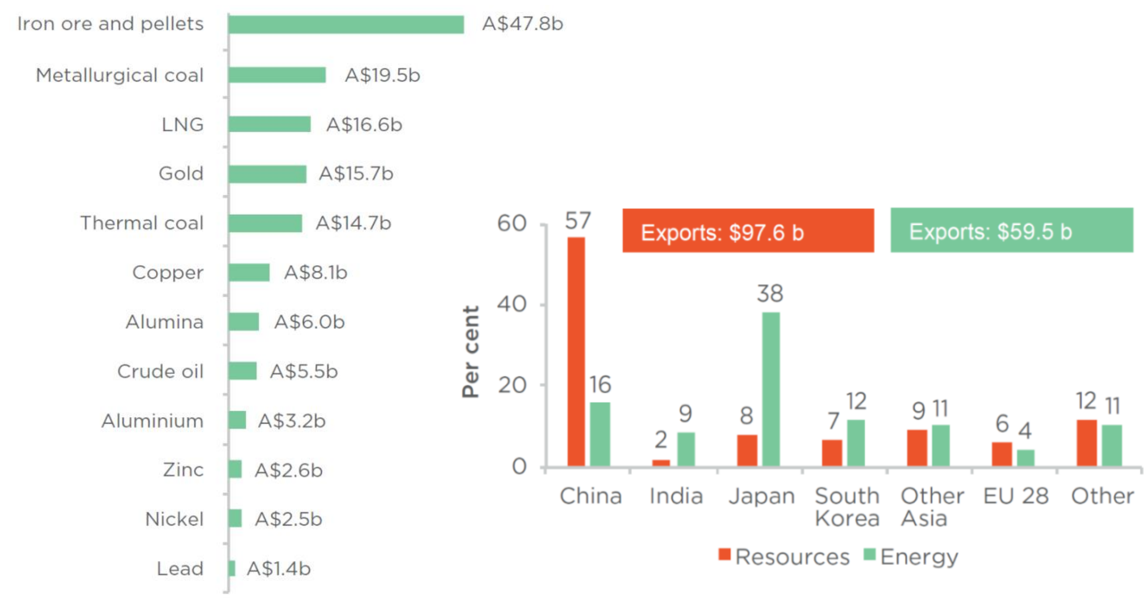

Figure 5. Australia's major resources and energy commodity exports and major export markets (2015–2016).

Source: Department of Industry, Innovation and Science.

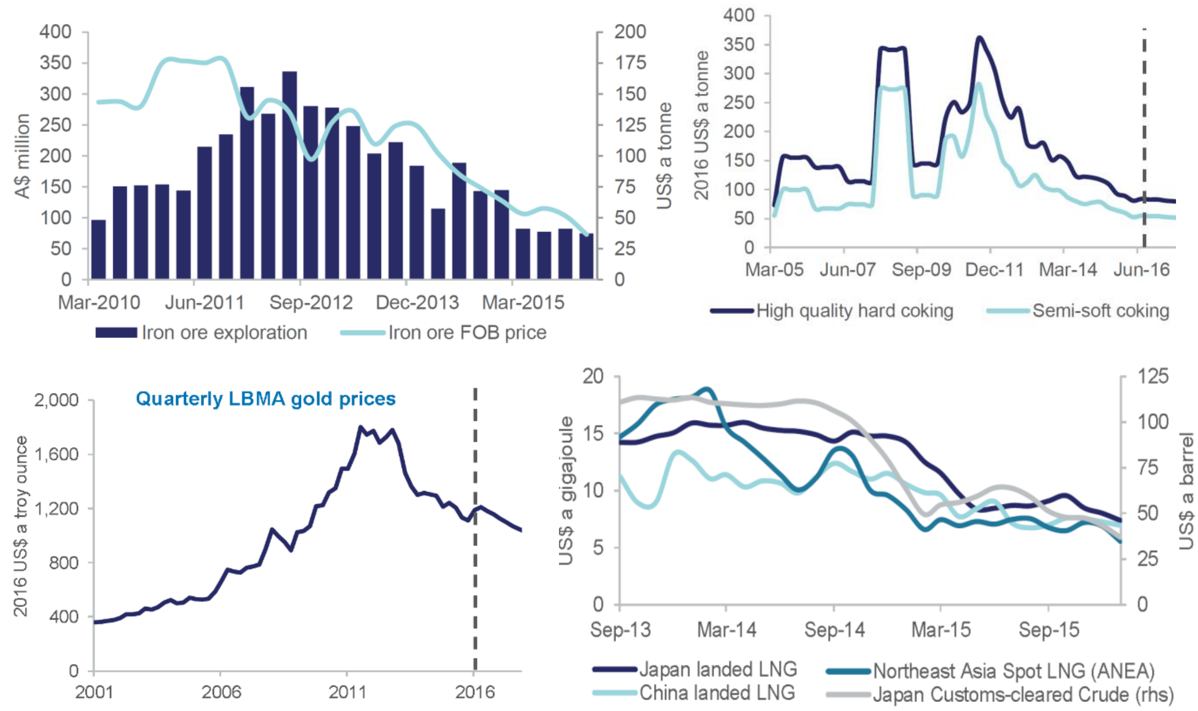

Figure 6. Price trend in major mining commodities.

Sources: ABS, Bloomberg Metal Bulletin, Department of Industry, Innovation and Science, LBMA[7], Argus Media, and Petroleum Association of Japan.

[7] London Bullion Market Association (LBMA)

2.3. Way forward

While significant economic changes have been seen during mining boom periods, the collapse that follows boom periods brings complex challenges. However, as the Australian economy has experienced so many booms and busts over the years, it is expected to have developed resilience to better cope with such fluctuations in its key economic areas.

Chapter 3. Literature Review and Hypotheses Development

3.1. Fire Sale: The Initial Motivation

The initial motivation behind the current study has been a phenomenon called ‘fire sale’. The term ‘fire sale’ was used frequently after the GFC and it has been in use since the nineteenth-century (Shleifer & Vishny 2011). However, in earlier times, the term indicated companies selling goods that were damaged by smoke due to a fire incident. Recent usage of the term highlights a different meaning. Shleifer and Vishny (1992) explain that the term in contemporary financial research refers to a situation in which companies are forced to sell assets at heavily discounted prices. The companies are essentially forced to sell their assets as they have no other way to pay their debt obligations. According to Shleifer and Vishny (1992, 2011), for any event of selling assets to be considered a fire sales event there are two related conditions: (1) assets are sold at a high discount and (2) the buyers of these assets are industry outsiders.

The first condition appears straightforward, as the assets in a fire sale situation are sold at a price that is significantly lower than the value in the best use of the asset. This results in severe losses for the selling companies. However, the second condition may require elaboration as to why the buyers of the assets are from outside the industry, despite the assets being available at very lucrative prices. The high discount in prices occurs because the rest of the industry is also in a similarly bad financial situation and is unable to borrow more to purchase the assets for themselves. Instead of participating in the purchase activity, they are also engaged in selling activities to pay off their debts to save their businesses. In such a situation, industry outsiders participate in the bidding activities to take advantage of the heavily reduced prices. As the industry outsiders are non-specialists who do not have relevant expertise, they are interested in buying the assets mainly because of the very high discount. They may wish to use the assets for a particular job or to hold on to the assets until a better time comes with the hope of making a very high profit.

Shleifer and Vishny (2011) call this situation a self-reinforcing process. When a fire sale situation causes a high reduction in prices of some assets, similar assets held by industry peers sharply lose value. This price drop pushes the firms into financial distress and they are forced to sell their assets as well, especially when they need to pay their debt obligations. This self-reinforcing phenomenon pushes prices further down and this leads to a domino effect of asset price decline that makes the market more fragile during a crisis. The assets are sold at drastically low prices and this causes severe losses to the sellers. For this to occur, there should be an industry-wide recession as we expect to see in the recent mining collapse of Australia.

There have been news reports about the conditions of mining companies and the overall industry after the mining collapse. Table 2 has been compiled from such a report. It is evident that the mining companies faced the dire situation of having to sell high-value assets at heavily discounted prices. The buyers are industry outsiders (including a wheat farmer and an equipment trader), indicating the possible existence of a fire sale experience for the mining companies.

Table 2

Example Auction Prices of Some Mining Company Assets[8]

Auctioned Items	Original Price	Auctioned Price
Caterpillar 992C wheel loader	$2,900,000	$15,000
Caterpillar D11N crawler tractor	$2,700,000	$46,000
Caterpillar 775D rear dump truck	$900,000	$47,500
Hitachi EX1200 hydraulic excavator	$1,400,000	$50,000
Large workshop with water tank	$200,000	$2,000

However, to conduct a credible study to empirically support such a claim, it is imperative that we have a sizable dataset containing enough historical asset sale data-

[8] From ABC News report accessed online on April 10, 2017 (http://www.abc.net.au/news/2015-10-28/heavy-machinery-prices-slashed-at-auction-mining-downturn-bites/6892966)

points. Several attempts have been made by the author to collect such asset sale price data by contacting the major auction houses that usually sell firm assets by public auction, as well as some of the major mining associations. Unfortunately, none of these could provide the firm-level historical data needed for such a study. Therefore, as it is evident from the current study, the initial focus of the study has shifted towards examining the effects of the mining collapse on firm-level performance measures.

3.2. Firm Performance

Despite numerous studies, there is no unanimous standard of measurement to determine firm performance[9]. Although Cyert and March (1963) explicitly deal with the question of how managers evaluate the performance of their firms through their groundbreaking behavioural theory of the firm (BTOF), scholars seem to largely ignore this question and implicitly assume that managers either use capital market-based or accounting book value-based performance measures (Bromiley & Harris, 2014). The BTOF indicates that managers use comparisons between expected firm performance and aspiration levels that depend on prior aspirations, prior performance and the comparable firms' performance levels (Miller & Chen, 2004; Miller & Leiblein, 1996).

Chaudhuri et al. (2016) also observe that the meaning of the term 'firm performance' is not always made clear, although it has been used extensively in literature. Sometimes it is used to measure the overall financial health of a firm, or to compare similar firms in a particular industry or to make comparisons between sectors or industries. According to Chaudhuri et al., a firm performance measure should reflect the various aspects of the firm such as ROA, ROE, firm value, asset utilisation efficiency. However, they conclude that there is no single comprehensive measure that

[9] Two other synonymous terms, 'organizational performance' and 'corporate performance', have also been found in literature. However, we prefer to use the term 'firm performance' instead as this seems to be more common. As an indication, Google Scholar has produced 771,000 results for the term 'firm performance' compared to 561,000 and 238,000 results for 'organisational performance' and 'corporate performance' on the 9th of December, 2017.

could capture more than one such performance indicator to provide a 'true' indication of firm performance.

Bromiley and Harris (2014) report that some scholars use just one performance measure and ignore other measures that could potentially be superior from other perspectives. They note that ROA, a common accounting-based firm performance measure does not provide any indication of the market performance of a firm. Hence, we are restricted to biases or weaknesses related to most accounting measures by being dependent on a firm's accounting choices (e.g., depreciation methods, inventory valuation methods, methods on capitalisation of intangible assets and tax strategies). Further, they state that each measure of firm performance may contain a different theoretical nuance, even if minor. This is especially true when different scholars use the same term for firm performance but the construct or the measurement could be slightly different.

For example, ROA is a common firm performance measure from a book value or accounting perspective. Interestingly, the same term appears to be measured in a variety of different ways by different scholars. ROA has been found to be defined as net profit after tax divided by total assets (Houston, Jiang, Lin, & Ma, 2014; Bromiley & Harris, 2014), as net income divided by total assets subtracting intangible assets (Chaudhuri, Kumbhakar, & Sundaram, 2016), as earnings before interest and taxes, depreciation and amortisations divided by total assets (Aktas, Croci, & Petmezas, 2015; Custódio & Metzger, 2014), as earnings before interest and taxes (EBIT) before extraordinary earnings divided by total assets (Liu, Miletkov, Wei, & Yang, 2015; Francis, Hasan, & Wu, 2015), as EBIT divided by average total assets of current period and previous period (Shailer & Wang, 2015) and as net income divided by average total assets (Ma, Naughton, & Tian, 2010).

In analysing the validity of different measures to gauge firm performance accurately, Benston (1985) argues that the differences between market value measures and accounting measures are highly likely to be significant and very difficult to determine (even impossible, in some cases). However, due to various reasons depending on the variable of interest they could be related to each other in some way. According to Bromiley and Harris (2014), multiple measures should ideally be used, especially accounting-based measures and market-based measures. For example, in addition to ROA we could examine stockholder returns (defined as the sum of the stock price change and dividends, divided by the stock price of previous period) or Tobin's Q ratio (the market value of the company with respect to its replacement cost).

Chaudhuri et al. (2016) observe that ROA and ROE are accounting-based measures of firm performance and profitability, whereas measures such as Tobin's Q and market-to-book value ratio indicate stock market-based measures. While accounting-based measures indicate past financial performance, market-based measures indicate future performance. In addition, if ROA has been chosen as a preferred measure, it would only indicate how effectively a firm utilised its assets to generate income. However, this is not the only measurement of a firm's wellbeing. Other than having a high asset utilisation indicator, a firm also has to judiciously invest its equity capital to provide higher earnings to its investors. In that case, ROE could be a useful measure. However, using ROE alone could be problematic, as managers may resort to financial strategies such as high financial leverage and stock repurchase to artificially maintain a healthy ROE and hide deteriorating firm performance.

Further, as both ROA and ROE are measured using the financial statements, they do not reflect market-orientated factors. Announcements related to earnings or dividends could influence the stock market performance of a firm. This is reflected in market-based measures such as Tobin's Q ratio. For example, a low Tobin's Q ratio means that the cost to replace a firm's assets is greater than the value of its stock. This implies that the stock is undervalued (Chaudhuri et al., 2016)

According to Hoskisson et al. (1999), scholars in the early years mainly used accounting-based measures. With the rise of shareholder activism in the early 1990s, shareholder value maximisation became a prominent objective for the firms. From that point onwards, market-based measures such as Tobin's Q ratio and market-to-book value ratio became popular. According to Barney (2007), Tobin's Q ratio has advantages over accounting-based measures of firm performance as the calculation of the ratio does not depend on accounting earnings that can easily be changed through creative accounting techniques and managers can influence earning figures and investment decisions. Thus, as a market-based measure of firm performance Tobin's Q ratio is also future-orientated and may reflect the present value of future cashflows based on present and future information (Shah et al., 2012; Ganguli & Agrawal, 2009). Further, compared with accounting-based measures Tobin's Q ratio has been found to be a better firm performance measure, especially in terms of reflecting value of intangible assets (Morck, Shleifer, & Vishny, 1988).

Although both accounting-based measures and market-based measures are widely accepted, there is debate in the existing literature regarding their relationship (Richard et al., 2009; Combs et al., 2005; Rowe & Morrow, 1999). The accounting-based measures and the market-based measures can be unrelated due to the conflict between achieving short-term and long-term economic goals for a firm (Venkatraman & Ramanujam, 1986). Even if there is a relationship, it may not be high enough that the measures could be used interchangeably. This debate indicates that using one type of indicator may not be suitable to estimate firm performance.

Several studies appear to draw a definite distinguishing feature between accounting-based measures and market-based measures. Many scholars have opined that market-based measures (such as Tobin's Q ratio) are forward-looking measures that reflect the market valuation of a firm's assets, whereas accounting-based measures are backward-looking measures that mainly consider profitability or productivity (Chauhan et al., 2016; Wang & Sengupta, 2016; Salas-Fumás et al., 2016; Li et al., 2015; Isakov & Weisskopf, 2014).

Although there are studies that cover accounting-based measures and others that cover market-based measures, few studies cover both types of measures together. According to Wang (2014), some empirical studies use accounting-based measures (such as ROA or ROE) to measure firm performance, whereas others use market-based measures (such as Tobin's Q ratio). Out of 28 studies relating to firm performance measures (along with board independence), 22 studies used either accounting-based measures or market-based measures, while only six studies used both measures.

In the light of above discussion, it appears that both accounting performance measures and market performance measures have advantages and disadvantages. Therefore, to provide a good balance in this study, firm performance measures have been carefully chosen from both perspectives. Further, we have tried to pick the ones that are most commonly used in prior literature. In this thesis, two measures are examined from an accounting, or book value, perspective: ROA and ROE and two measures are examined from a market value perspective: Tobin's Q ratio and the annual total stock return.

3.3. The Effect of Mining Collapse on Firm Performance

According to Cerrato et al. (2016), the GFC caused a dramatic change in the external environment for many firms. The problems in the financial market resulted in a decline in the availability of capital for firms, making it harder for them to obtain enough funds for working capital financing and payment of debt service obligations. Further, the crisis had a significant effect on earnings, government finances and labour markets. Consequently, consumer demand for goods fell, resulting in a reduction in business-to-business demand for goods and services. This drove unemployment rates higher and further accelerated these effects. The decrease in demand for goods and services would likely cause lower-than-expected sales revenues for the firms, Conversely, firms were less able to reduce labour and other costs as rapidly.

Such factors working together make it impossible for managers to prevent declining firm performance and potential losses in times of crisis (Zona, 2012). Additionally, prediction becomes highly unreliable in such an environment, creating higher uncertainty. The decline in firm performance accompanied by an economic crisis is highly likely to cause even greater magnitudes of potential losses leading to greater underperformance relative to managers' expectations (Iyer & Miller, 2008; Chen & Miller, 2007).

Using the market capital of different sectors in Australia from 2001 to 2016, an attempt has been made to depict the overall scenario of both mining and non-mining firms including the financial sector (see Figure 7). Following the mining collapse of 2011, the market capital of the mining sector lost about half its value—from 43.45% in 2011 to 21.71% in 2015. Conversely, the financial sector recovered well from the GFC, from 20.73% in 2008 to as high as 38.7% in 2015. Similarly, all other sectors combined (non-finance and non-mining sectors) appear to have steadily recovered from just above 30% in 2009 (after falling from 41.42% in 2006) to nearly 40% in 2013 and remaining at that level for last four years.

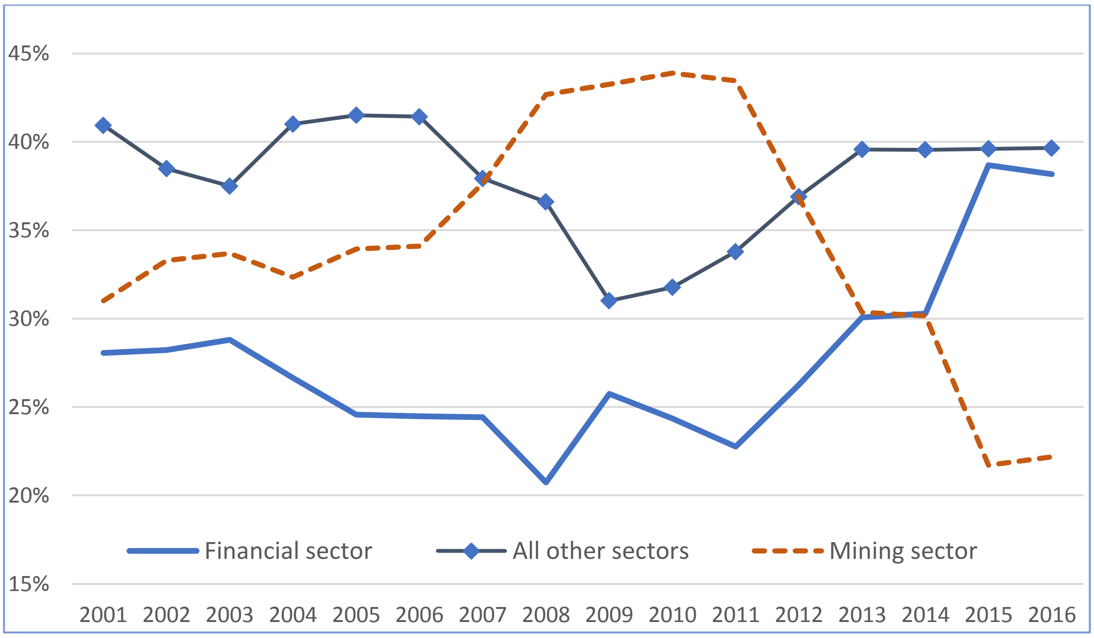

Figure 7. Australian Securities Exchange (ASX) market capital of major sectors as percentages of total.

Above figure reflects all ASX-listed and delisted companies from years 2001 to 2016**.** Data have been collected from Morningstar's DatAnalysis Premium database.

Based on these discussions, we form the following pair of hypotheses of this study related to firm performance.

H1a: The recent mining collapse has affected the firm performance (accounting perspective) of the mining companies more negatively, compared with the firm performance of the non-mining companies.

H1b: The recent mining collapse has affected the firm performance (market value perspective) of the mining companies more negatively, compared with the firm performance of the non-mining companies.

3.4. The Effect of Mining Collapse on Cost of Debt and Investments

Debt financing can be crucial for the growth and development of a firm. A lower cost of debt may save a firm money due to lower interest payments and the reduced cost of raising capital should positively affect firm performance. However, a higher level of debt may indicate that the borrower can finance with a lower cost of debt. Conversely, a higher level of leverage above a certain limit raises the default risk as well as the cost of debt. Therefore, the effect of leverage on the cost of debt is an empirical question (Lim, Wang, & Zeng, 2018). This is the reason for using the level of financial leverage as a control variable in this study.

Some scholars observe that the cost of debt financing is principally determined by the borrower's probability of failure to meet the required debt obligations (Bhojraj & Sengupta, 2003; Fisher, 1959). The higher the likelihood of default, the greater the expected cost of debt for the creditor (Valta, 2012; Smith & Warner, 1979).

Similarly, Myers (2003, pp. 216–217) notes, 'There is no universal theory of capital structure and no reason to expect one. There are useful conditional theories … Each factor could be dominant for some firms or in some circumstances, yet unimportant elsewhere'. This means that different theories may apply to different firms in different situations.

To make matters more complex, there is no universally accepted definition or measurement tool to measure leverage of firms. Different definitions of leverage have been used in different literature based on the author's own convenience or suitability. Some scholars prefer to use market value for leverage, while others prefer book leverage. The main difference is that market value considers future growth opportunities in value whereas book value considers assets in place in terms of cost. According to Myers (1977), most managers prefer book leverage rather than the market value of leverage. The primary reason is that the greater fluctuations in the financial markets make the use of market leverage values more difficult and unreliable when making decisions. In support of this, Graham and Harvey (2001) note that many managers do not rebalance or readjust the capital structure of their firms based on the movements of equity markets to avoid the high cost of adjustments on a continuous basis.

To provide some assurance, an empirical study by Huang and Ritter (2009) estimates the speed of adjustment of capital structure in corporations. It finds that there are not many differences in the speed of adjustment using either market value or book value for leverage or debt ratios. Taking this view into consideration, this study considers book values when forming cost of debt measurement, as well as when constructing the measure of financial leverage ratio as a control variable.

According to Asker et al. (2015), firms may acquire additional assets by purchasing existing assets of another firm or by either building or creating new capacity. These types of activities are usually reflected in mergers and acquisitions or the capital expenditure amount, respectively. Although there have been many studies related to firm investments that focus on capital expenditures, we could expect systematic differences between these. As our database does not provide such data, we cannot directly consider this using our sample. However, to address this potential shortcoming, in addition to measuring firm investments by using capital expenditure data, this study also examines an alternative measure of firm investments by using yearly changes in property, plant and equipment figures.

When we consider firm investments, a common consideration is agency problem and how this relates to investment decisions made by the managers of the firms. Agency problems could result in overinvestment or underinvestment situations for the firms, depending on managers' perspectives. According to Jensen (1986, 1993), some managers prefer negative net present value projects and take wasteful investments projects because they want to derive private benefits by controlling more assets. This is known as the overinvestment phenomenon. Conversely, some managers may let go of good and positive net present value projects as they fear such projects may incur private costs by requiring them to work more. This leads to an underinvestment situation for firms. These two types of agency problems provide two opposing characterisations of firm behaviour.

From the point of view of this study, this needs to be considered carefully. Although we expect to observe a negative effect on firm investments due to the mining collapse, this does not necessarily indicate underinvestment by the mining companies. Hypothetically, if there had been an overinvestment situation for the mining companies in the pre-collapse period, the collapse could have restricted the situation to an appropriate level of investment. Similarly, if the mining companies already had an appropriate level of investment, the collapse could have caused them to have underinvestment. Whichever is the case, for the mining companies this may still remain an empirical question.

Firms with more tangible assets may be able to provide more collateral to reduce the risk faced by the lenders. Benmelech and Bergman (2011) demonstrate that bankrupt firms may increase the cost of debt financing for their peers who are not bankrupt. This is done through the reduction of the collateral values of the industry competitors. Benmelech and Bergman studied the collateral channel of the US airline industry and found that when a firm goes bankrupt, the creditors reduce the value of collateral for other industry peers, especially if the collateral asset is relatively less liquid and the industry is not doing well. As collateral is important when raising money through debt financing, the decrease in collateral asset value increases the cost of debt financing throughout the entire sector.

The literature provides two interconnected reasons behind such a phenomenon. The first reason is related to the increase in supply of collateralised assets when a firm goes bankrupt or is on the verge of going bankrupt and needs to liquidate those assets. This reasoning is supported by a number of studies (Pulvino 1998, 1999; Acharya et al., 2007; Campbell et al., 2011). According to these studies, when companies face financial distress and there is an oversupply of assets this creates a downward pressure on the prices for such assets.

The second reason is the decrease in demand for such assets. When companies face financial distress, they are less likely to acquire such assets and this causes a drop in demand. This observation is supported by studies by Shleifer and Vishny (1992, 2011) and Kiyotaki and Moore (1997). These studies show that financial distress and bankruptcy diminish the likelihood to acquire industry assets, especially when fire sale conditions exist. This causes less demand for the assets that, in turn, creates a downward pressure on the values of collateralised assets for the industry. As a result of these dual effects of increased supply and decreased demand for collateralised assets, collateralised assets lose their value across the entire industry. Empirical studies (i.e., Lang & Stulz, 1992) also show that even the announcement of bankruptcy by a firm can adversely affect the share price of its peers in the industry.

By studying the collapse of land prices in Japan in the early 1990s, Gan (2007) investigated how a shock to the value of collateralised assets may greatly influence the debt capacity and investments of companies. Her findings reveal that losses in collateral value are closely associated to lower debt capacities. Controlling for the possible endogeneity that may have been caused by the banking relationship, she used matched firm–bank data to find that companies that experienced higher collateral losses tended to have problems sustaining a relationship with their banks and obtained lower bank credit facilities.

Norden and Kampen (2013) observe that ‘property, plant and equipment’, a common fixed asset item on corporate balance sheets, plays an important role in deciding collateral value compared with current assets such as inventories and receivables. In line with this finding, this study examines the effect of the mining collapse on the property, plant and equipment balance sheet item of the mining companies and expects this item to have a declining effect.

Firm performance can be seen as a function of the ability of firm managers to run their firms profitably and efficiently using the available investment opportunities and cost of financing (Lim, Wang, & Zeng, 2018). When the cost of financing is low, the savings in interest and the lower cost of raising capital should positively influence firm performance. We expect to observe falling firm performance for the mining companies due to the mining collapse, thus, we also expect to find an increase in the cost of debt as this is a related channel.

According to Kahle and Stulz (2013), there is a significant decline in corporate borrowing and capital expenditures due to financial crisis. They relate these two phenomena by arguing that a shock to bank lending due to a crisis also causes a decrease in capital expenditures. This bank lending supply shock theory provides a straightforward expectation for firm investments and policies related to financing. It implies that when a crisis hits, it will be more difficult for firms to borrow from banks. Even if the laws of economics indicate that firms will seek alternative sources of credit, literature demonstrates that firms that face difficulty obtaining bank credit would find it equally (or even more) difficult to replace that source with alternative sources of credit. This eventually would lead firms to reduce firm investments (Slovin et al., 1993). Similarly, a survey conducted by Campello et al. (2010) of more than 1,000 chief financial officers from firms across the world on the effects of the GFC, found the majority had changed their original investment plans. For financially constrained firms these changes were pronounced.

The above facts have given rise to the following pair of hypotheses:

H2a: The cost of debt of Australian mining companies increased more after the mining collapse in 2011, compared with that of the non-mining companies.

H2b: Investments of the Australian mining companies decreased more after the mining collapse in 2011, compared with those of the non-mining companies.

Chapter 4. Data, Variable Measures and Methodology

4.1. Data Sample

The data sample used in this thesis consists of all ASX companies from 2006 to 2015 (both listed and delisted) belonging to all sectors except the financial sector (due to the differing nature of business). The data sample of 2,402 companies includes:

- 851 (35%) metal mining sector companies (excluding 54 companies from overall metal mining that are not directly involved in mining but indirectly related to support services, such as containers and packaging, paper and forest products, chemicals and construction materials);
- 305 (13%) energy sector companies; and
- 1,246 (52%) other non-financial sector companies including industrial (253), consumer discretionary (264), consumer staples (81), health care (210), information technology (263), telecommunications services (43), utilities (45) and real estate (87) sectors.

Different financial statement items for these companies have been collected from Morningstar's DatAnalysis Premium database that specialises in the listed companies of the ASX and NZX.

Firm-level annual total stock return data, market and sector index values have been collected directly from Bloomberg. However, an alternative measure for the firm-level annual total stock return (for which we have depended on our main data source provided by Morningstar's DatAnalysis Premium database), has been used to check the robustness of the findings.

GDP growth rates for developed countries have been collected from World Bank national accounts data, and OECD national accounts data files. In addition, economy-level data such as Australian GDP growth rate, resources and energy commodity prices, export data and mining- and energy sector-related data have been collected from the Office of the Chief Economist under the Department of Industry, Innovation, and Science and the Australian Bureau of Statistics (ABS). Most regression analyses have used a pertinent segment of the dataset depending on the relevance of interest.

4.2. Data Summary

This section presents different aspects of the sample dataset used in the main analysis. Table 3 shows the summary statistics of the dependent variables and some firm-level control variables covering the period 2006 to 2015.

Table 3

Summary Statistics[10]

		Observations	Mean	Std.	p25	p50	p75
ROA	Overall[11]	15,984	-0.2095	0.5125	-0.2633	-0.0551	0.0489
	Non-Mining[11]	7,742	-0.1262	0.4634	-0.1507	0.0286	0.0779
	Mining	8,242	-0.2877	0.5433	-0.3341	-0.1159	-0.0274
ROE	Overall	15,984	-0.3211	0.9693	-0.3434	-0.0733	0.0685
	Non-Mining	7,742	-0.2290	0.9825	-0.2414	0.0303	0.1310
	Mining	8,242	-0.4076	0.9488	-0.4197	-0.1386	-0.0330
Tobin's Q	Overall	15,848	1.9601	2.2579	0.8112	1.2472	2.1993
	Non-Mining	7,696	1.9199	2.1462	0.8705	1.2311	2.0824
	Mining	8,152	1.9981	2.3581	0.7428	1.2642	2.3096
Annual total stock return	Overall	13,661	0.1762	1.5124	-0.4667	-0.1081	0.3517
	Non-Mining	6,581	0.1816	1.2465	-0.3462	0.0053	0.3725
	Mining	7,080	0.1713	1.7232	-0.5455	-0.2222	0.3226
Cost of debt	Overall	7,675	0.2817	1.6240	0.0621	0.0868	0.1377
	Non-Mining	4,710	0.2105	1.1441	0.0618	0.0815	0.1154
	Mining	2,965	0.3949	2.1744	0.0632	0.1012	0.1877
Firm investments	Overall	15,007	0.1332	0.2249	0.0100	0.0487	0.1579
	Non-Mining	7,315	0.0692	0.1419	0.0069	0.0270	0.0715
	Mining	7,692	0.1940	0.2682	0.0192	0.1052	0.2526
Assets (in million A$)	Overall	17,043	735.86	5,174	6.1416	21.561	119.06
	Non-Mining	8,336	911.39	4,229	7.6991	41.876	263.61
	Mining	8,707	567.80	5,935	5.2870	14.127	50.782
Debt ratio	Overall	8,601	0.1980	0.1845	0.0448	0.1697	0.3009
	Non-Mining	5,469	0.2254	0.1882	0.0848	0.2091	0.3273
	Mining	3,132	0.1501	0.1675	0.0163	0.0938	0.2279
Sales growth	Overall	8,393	0.1642	1.1619	-0.2736	0.0312	0.2705
	Non-Mining	5,397	0.1969	0.9781	-0.0987	0.0559	0.2514
	Mining	2,996	0.1054	1.4330	-0.9550	-0.1273	0.3229

According to these summary statistics, the mean values of ROA and ROE for both mining and non-mining sectors are negative; however, the median values for the

[10] For exact definition/measurement of the variables, please refer to the next section, 'Important variables and their measurements'.
[11] Excluding the financial companies as indicated earlier.

non-mining sector appear positive. Tobin's Q ratio for the mining companies appears to be about 200%, followed closely by the non-mining sector at 192%. The median values for both mining and non-mining sectors are close to 125%. Although the mean annual total stock return for mining and non-mining sectors are 17% and 18%, respectively, the median value for the mining sector appears much lower at –22% and barely positive for the non-mining sector. This is reflected in the higher standard deviation value for the mining sector that indicates a higher level of volatility in the stock prices for companies belonging to this sector.

The mean (as well as the standard deviation) of the cost of debt for the mining sector appears to be almost double that of the non-mining sector. This may reflect the higher risk involved in the mining sector as indicated by the higher standard deviation value in the case of stock return. Firm-level investments for the mining sector appear to be triple that of the non-mining sector in terms of both mean and median values. This indicates a high-level capital-intensive business structure for the mining companies.

The average firm size of the mining companies in terms of book value of total assets appears to be about half that of the non-mining companies (or less, when considering median value). However, the very high standard deviation values suggest the variation in firm size is also very high. The level of financial leverage in terms of total debt to total assets ratio seems to be lower for the mining companies compared with that of the non-mining companies. The average year-to-year growth in sales seems to be about half for the mining companies compared with the non-mining sectors. In terms of median value, it is –12.73% for the mining firms. Overall, it seems quite clear that a great deal of difference exists between the mining companies and the non-mining companies in terms of firm performance (both from accounting and market value perspectives), cost of debt, investments, leverage, and firm size.

Figure 8 provides a visual understanding of firm performance from an accounting perspective. It shows comparative trends in ROA and ROE between the mining sector and the non-mining sectors. As Table 3 demonstrates, there are considerable differences between the median and the mean values for some firm characteristics. Thus, we now examine the trends graphically by using both the median and the mean values.

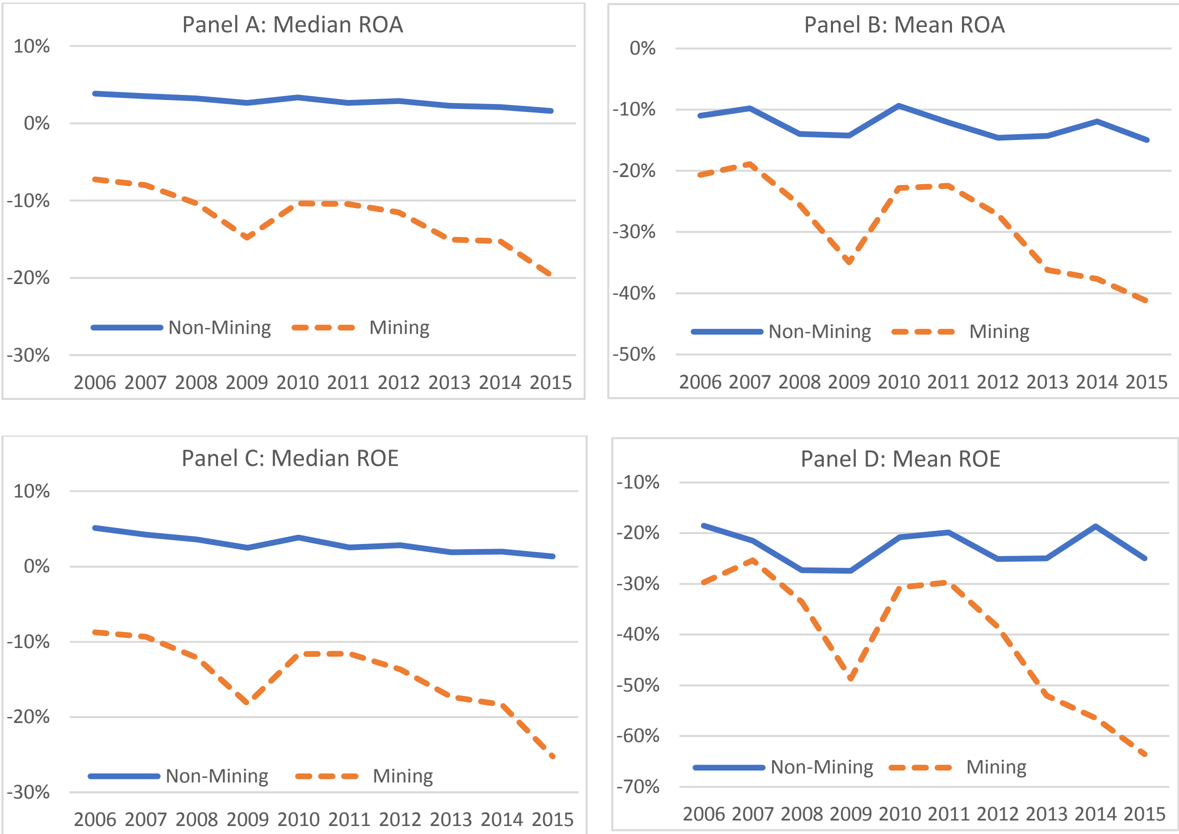

Figure 8. Firm performance (accounting perspective) comparison between the mining companies and the non-mining non-financial companies.

Data have been collected from Morningstar's DatAnalysis Premium database.

Although we observe a drop in firm performance (in both ROA and ROE) for the mining sector in 2009, it then rose quickly, only to fall again after 2011. It has not been able to recover since that period. Conversely, the non-mining sector seems to be relatively more stable throughout the entire period.

Comparative trends in firm performance (from a market value perspective) in terms of Tobin's Q ratio and annual total stock return for the mining sector and the non-mining sectors are presented in Figure 9. Interestingly, in all cases, firm performance for the mining sector seemed to be above that of the non-mining sectors in 2006, but eventually fell below the non-mining sector, especially after 2011. Trends in total annual stock return appear to have more fluctuations compared with trends in Tobin's Q ratio. As these trends reflect the overall perceptions of the market participants in the capital markets, it appears that the market could predict bad times ahead for the mining sector well before 2011.

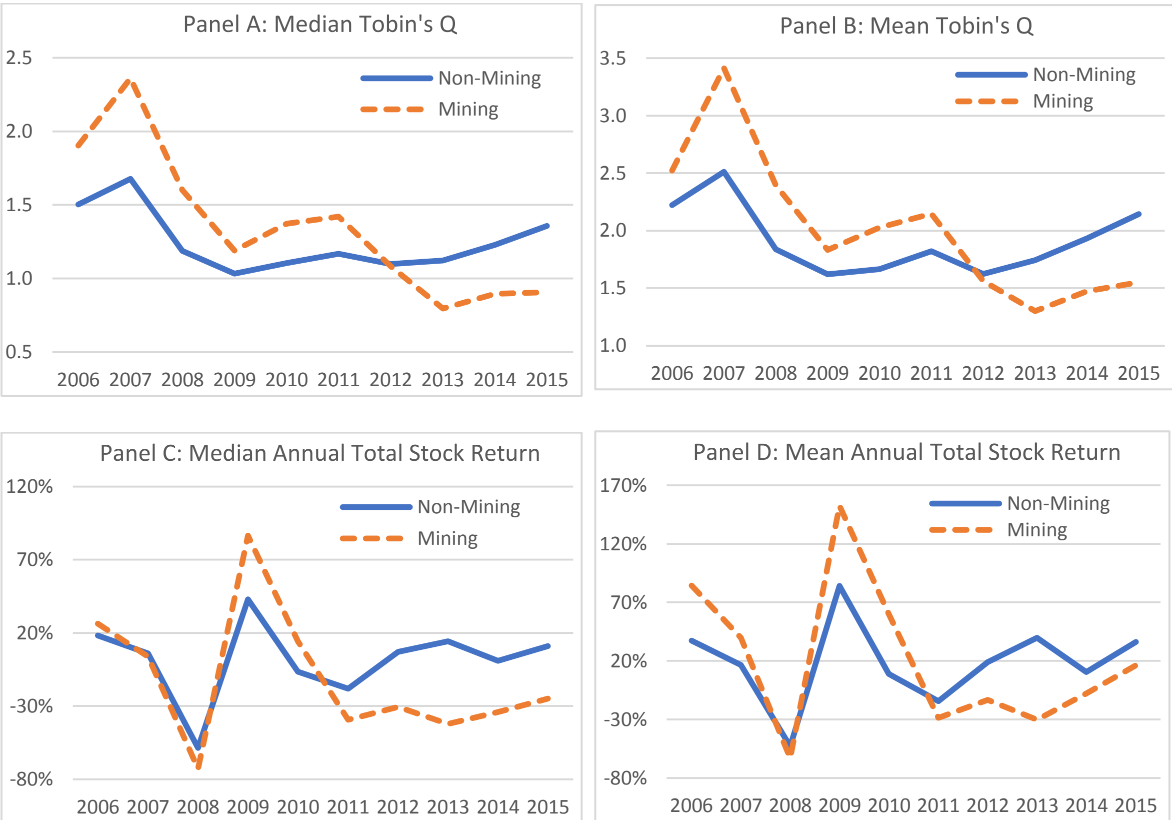

Figure 9. Firm performance (market perspective) comparison between the mining companies and the non-mining non-financial companies.

Data have been collected from Morningstar's DatAnalysis Premium database and Bloomberg.

Figure 10 shows the trends in the cost of debt and firm investments for the mining sector and the non-mining sectors. Although there are some discrepancies for the non-mining sector between panel A and panel B, the overall trends for cost of debt demonstrate a higher level for the mining sector, especially after 2011. Conforming with Table 3, we can observe that the mining sector began with a very high level of investments, but this gradually fell significantly converging towards the non-mining sector's firm investment level. However, overall firm investments for the non-mining companies seem to remain stable throughout the entire period.

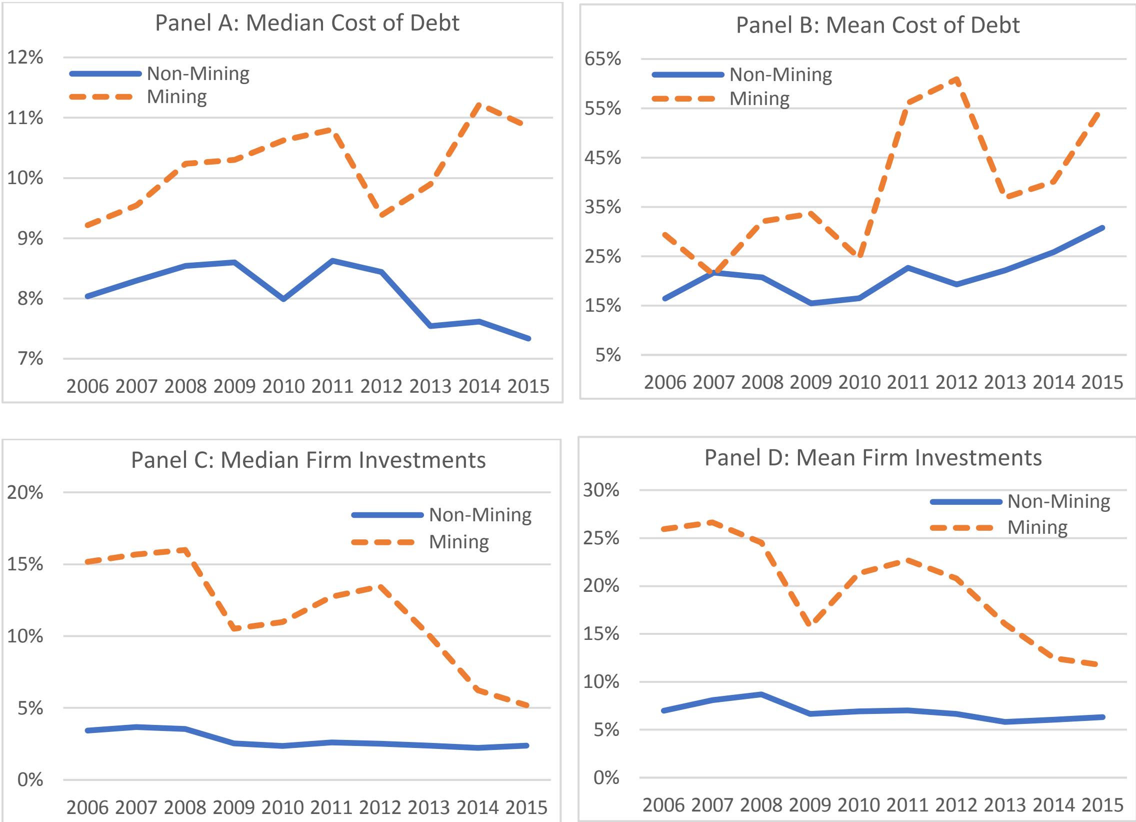

Figure 10. Cost of debt and firm investments comparison between the mining companies and the non-mining non-financial companies.

Data have been collected from Morningstar's DatAnalysis Premium database.

4.3. Important Variables and Measurements

4.3.1. The dependent variables

To test the first pair of hypotheses related to the effect of the mining collapse on firm performance (H1a and H1b), two book performance related variables, ROA and ROE, and two market performance related variables, Tobin's Q ratio and annual total stock return, have been used. With the exception of the Tobin's Q ratio, the ROA, ROE and stock returns have been directly collected from the data sources.

ROA is a key measure of a company's profitability from a book or an accounting perspective. Morningstar's DatAnalysis Premium database, from which we have sourced this data, defines ROA as equal to a fiscal year's earnings divided by its total assets (as in Houston, Jiang, Lin, & Ma, 2014; Bromiley & Harris, 2014; Lugo, 2017; Chui, Kwok, & Zhou, 2016; Liu, Cullinan, Zhang, & Wang, 2016; Hameed, Morck, Shen, & Yeung, 2015).

ROE is an evaluation of profit earned in relation to equity resources invested by the equity holders. Similar to ROA, ROE has been sourced from Morningstar's DatAnalysis that measures it by dividing net income before abnormals by shareholders' equity (as in Hettler & Forst, 2017; Saeidi et al., 2015; Wan & Yiu, 2009; Ferreira & Matos, 2008).

Firm-level annual total stock return has been sourced from Bloomberg. This measure has been used as an indicator of firm performance from a market value perspective in literature (e.g., Lins, Servaes, & Tamayo, 2017; Allen, Larson, & Sloan, 2013; Aldamen, Duncan, Kelly, McNamara, & Nagel, 2012). For an additional check, an alternative measure has been used for the annual total stock return which is the sum of capital gains yield (found from the annual stock price change, also referred to as the dividend growth rate assuming constant growth in dividends) and dividend yield. This measurement is commonly found in typical financial textbooks and is referred to as Gordon's dividend growth model (Gordon, 1959; Fama & French, 1988). The study has found similar results (see Table A.2).

In this thesis, as a measurement of firm performance, the firm-level Tobin's Q ratio has been calculated by dividing the sum of market capital and book value of total liabilities by the book value of the total assets of the firm (as in Yang, Han, Li, Yin, & Tian, 2017; Wang & Sengupta, 2016; Chaudhuri, Kumbhakar, & Sundaram, 2016;

Salas-Fumás, Rosell-Martínez, & Delgado-Gómez, 2016; Wang, Chen, Yu, & Hsiao, 2015; Black, Kim, Jang, & Park, 2015).

To test the second set of hypotheses relating to the effects of the mining collapse on firm-level cost of debt and investments (H2a and H2b), the dependent variables of cost of debt and two related forms of firm investments have been used.

Although some studies seem to use credit or yield spread over corporate bonds or treasury bonds (Chen & King, 2014; Schneider, 2011; Borisova & Megginson, 2011) to measure cost of debt, this measure has been decided against, as it would significantly reduce the sample size due to bond issuance being less common in this sample of Australian firms. Some scholars demonstrate that the marginal interest rate that is charged against loans taken by the borrowers provides a good proxy for the cost of debt (e.g., Wu & Chua, 2012). However, this type of information is not easily available. According to Chui et al. (2016), as interest expenses are paid for borrowed money in various years, this measure captures a cumulative effect on the borrowing culture for the firm. Further, this ratio reflects interest payments for both private and public creditors. Therefore, this ratio can better capture the cost of debt for a firm. Following prior literature, the firm-level cost of debt has been calculated as interest expense divided by the average total debt of the current year and the previous year (as in Chui, Kwok, & Zhou, 2016; Jung, Herbohn, & Clarkson, 2016; Shailer & Wang, 2015; Chen, Ding, & Wu, 2014; Bliss & Gul, 2012; Kim et al., 2011; Gray, Koh, & Tong, 2009).

For an additional robustness check, a comparatively less common definition for the cost of debt has been used. It has been measured as interest expense divided by the total debt of that year (as in Zou & Adams, 2008; Frank, & Shen, 2016). The results of the test have been found to be similar (see Table A.3).

According to Trueman (1986), the capital expenditure level may serve to signal information about a firm’s future growth prospects that eventually are reflected in firm value. Thus, the level of capital expenditure has been used as an indicator of firm investments and is one of the dependent variables. Firm investments have been calculated dividing capital expenditure by beginning of the year total assets (as in Gulen & Ion, 2016; Liu, Miletkov, Wei, & Yang, 2015; Chen & King, 2014; Kahle & Stulz, 2013; Denis & Sibilkov, 2010). To add robustness to this analysis, another related aspect of firm investment has been examined by measuring it as change in property, plant and equipment (sometimes also referred to as fixed assets) divided by the beginning period's total assets (as in Asker, Farre-Mensa, & Ljungqvist, 2015; Filip & Raffournier, 2014). Both of these firm investment measures are conceptually close; therefore, similar results are expected.

4.3.2. The DID-related variables

As a standard procedure, some dummy variables have been used to help apply the DID methodology. These are:

(1) 'mining'—a dummy variable used to distinguish between mining sector companies (the treatment group) and other companies belonging to all other sectors except the financial sector (the control group), by assigning a value of 1 to the mining companies and 0 to the non-mining companies;

(2) 'collapse'—a dummy variable used to distinguish between the period before the mining collapse and the period after the collapse by assigning a value of 1 to the period 2011 and all subsequent years to 2015 and 0 for earlier periods, that is, 2006 to 2010; and

(3) the interaction between 'mining' and 'collapse' dummy variables to obtain the DID coefficient of interest (the main appeal of this methodology).

In addition, an alternative approach of the DID methodology has been applied, using a continuous variable (as in Acemoglu et al., 2004, equation [8], p. 521) instead of the common dummy variable. For this continuous treatment of DID, the R&E Index prepared by the Department of Industry, Innovation and Science has been used. This index has been created using the Fisher Price Index methodology by weighting the export unit value for each commodity by its share of total export value. Data for this has been sourced from the ABS. Although the results are not shown in the main paper, other possible continuous variables[12] are used to test the consistency and robustness of the results. These include individual resources and energy (major mining commodity varieties) export unit value indices, the iron ore agglomerated export price from Australia to China and mining as a percentage of annual GDP (current prices). Moreover, as these continuous treatment variables represent an economic mechanism that relates to the mining collapse, the results are expected to further strengthen our position in order to prove our hypotheses.

4.3.3. The control variables

According to Lim et al. (2018), firm size is an important determinant of firm performance. This is because larger firms are more likely to have specialised financial and managerial resources and enjoy higher economies of scale in production. In addition, compared with smaller firms, larger firms can better monitor managers, have a greater ability to formalise procedures and can improve shareholder value (Chaudhuri et al., 2016). However, larger firms seem to have higher barriers among functional departments and more layers of management. Wang and Sengupta (2016) note that although larger firms tend to have more economies of scale advantages, they incur more risks. Therefore, the relation between performance and firm size is not clear.

[12] A sample of such results using ROA as the dependent variable has been included in the Appendix (Table A1).

Following prior literature (such as Lim, Wang, & Zeng, 2018; Lugo, 2017; Lin & Fu, 2017; Singh, Tabassum, Darwish, & Batsakis, 2017; Borisov, Goldman, & Gupta, 2016; Foucault & Fresard, 2014; Deng, Kang, & Low, 2013), this study uses firm size as the control variable and measures it as natural logarithm of the book value of total assets.

Lim et al. (2018) indicate that capital structure is a widely accepted determinant of firm performance. A higher level of debt creates more pressure on managers to perform well and thus, decreases moral hazard-related decisions by managers (Jensen, 1986). Higher leverage also means a higher agency cost due to the possible conflict of interest between shareholders and creditors. Hence, the overall effect of financial leverage on firm performance remains unknown. Therefore, a measurement for capital structure has been included in this study as a control variable. Capital structure is measured using the ratio of total debt to total assets (as in Lim, Wang, & Zeng, 2018; Li, Meng, Wang, & Zhou, 2008; Singh, Tabassum, Darwish, & Batsakis, 2017; Cerrato, Alessandri, & Depperu, 2016; Hamadi & Heinen, 2015; Aktas, Croci, & Petmezas, 2015). This is commonly known as the debt ratio.

Sales growth is measured as the year-on-year growth in sales revenue (as in Lim, Wang, & Zeng, 2018; Lins, Servaes, & Tamayo, 2017; Lugo, 2017; Chauhan, Lakshmi, & Dey, 2016). Firms that grow faster tend to have higher profitability and increased valuation; therefore, a positive relation is expected to be found between firm performance and sales growth. However, the database provides a measure termed ‘operating revenue’ instead of ‘sales’ and defines the term as revenue that is earned in the normal course of business. This has been used in place of sales revenue.

Following prior literature, in addition to the firm-level control variables a commonly used macroeconomic variable—the annual growth rate of GDP for Australia—has been incorporated in this study to control for the common economy-wide variations for all firms in the sample (as in Leary, 2009; Wan & Yiu, 2009; Hettler & Forst, 2017; Bris, Koskinen, & Nilsson, 2006).

Some values are observed that are unusually different from what we would expect to see for a normal firm or even a somewhat distressed firm. This may be due to the inclusion of delisted firms in the sample alongside listed firms. Thus, the common method of winsorising the sample at 1% (as in Andrade, Bernile, & Hood, 2014; Servaes & Tamayo, 2013) appears inadequate. To help protect from the distortion effects of outliers, restrictions have been placed on some variables (e.g., total assets >0, –4.5<ROA<4.5, –10<ROE<10, 0<Tobin's Q<25, 0<cost of debt<50, –0.01<debt to equity ratio<100, –1<capital expenditure to beginning of year total assets<2, –2<change in property, plant and equipment (PPE) to total assets<2 and –10<sales growth<10). Such restrictions have been applied in many prior studies (Gochoco-Bautista, Sotocinal, & Wang, 2014; Gilchrist & Himmelberg, 1999; Ratti, Lee, & Seol, 2008; Love, 2003).

4.4. Methodology and the Regression Model

As indicated earlier, the collapse in the mining sector is an exogenous industry shock to Australia's economy and not caused by the mining companies themselves. As such, it is beyond the control of any individual firm and; therefore, it provides a natural experiment setting. Thus, the DID methodology has been used to test the hypotheses of this study. This type of DID estimation has become an increasingly popular method to estimate causal relationships (Bertrand, Duflo, & Mullainathan, 2004).

Choosing the correct methodology is a significant concern in any empirical research, especially to address endogeneity-related issues. According to Brown et al. (2011), endogeneity is present in much of empirical research. However, Lins et al. (2017) state that the great demand in application of DID estimation comes from its simplicity as well as its potential to circumvent many of the endogeneity problems that arise when making comparisons between the heterogeneous elements that are evident between mining and non-mining companies. Therefore, this methodology is an appropriate choice for this study.[13] Further, DID methodology seems to be useful in alleviating the omitted variable concerns (Houston et al., 2014).

As indicated by Imbens and Wooldrige (2009), DID methods and estimates received widespread popularity in empirical studies following Ashenfelter's seminal paper (1978) and and an equally important study by Ashenfelter and Card (1985). Many influential applications and empirical studies have since been conducted using this methodology (e.g., Card & Krueger, 1993; Meyer, 1995; Meyer, Viscusi, & Durbin, 1995; Acemoglu, Autor, & Lyle, 2004; Leary, 2009; Liu et al., 2015; Lins, Servaes, & Tamayo, 2017).

DID estimation consists of identifying a specific intervention or treatment—in this case, the mining collapse of 2011. The next step is to compare the difference in outcomes before and after the intervention for two groups, in which the first group is affected by the intervention (treatment group) and the second group is not affected by the same intervention (control group). The first group is affected by the intervention in the second period, but not in the first period, whereas the second group is not affected by the intervention in either period. Thus, the same characteristic is observed within each group in each period. The average observed change in the second group is then subtracted from the average observed change in the first group. This removes possible biases from the second period comparisons between the first group and the second group that could exist due to the pre-existing heterogeneity among the groups or any prior trends (Wooldridge, 2007).

In this study, the treatment group (the mining companies) receives the treatment (the mining collapse). Conversely, the control group (the non-mining companies) does not receive the treatment. By using DID, the treatment effect (i.e., the effect of the

[13] Please refer to Meyer (1995) for an overview on DID.

mining collapse) can be identified on the treatment group or mining companies, compared with the control group or the non-mining companies. To strengthen the application of DID in this study, in addition to a more common discrete dummy variable, several continuous variables are used to demonstrate a similar DID effect (i.e., a continuous treatment variable using DID) in terms of results (as shown by Acemoglu, Autor, & Lyle, 2004). In addition, one period lag is used in the continuous variable. This lead-lag approach potentially reduces reverse causality issues that usually arise from contemporaneous relation (Lim, Wang, & Zeng, 2018).

Similar specifications have been used following a theoretical paper by Meyer (1995) and an empirical study by Leary (2009). According to Meyer, DID methodology is found to be very useful in a 'natural experiment' study such as this one, in which the outcome measures (i.e., firm performance, cost of debt and firm investments) are observed in treatment groups and comparison groups. Based on the standard DID specification used in theoretical papers and empirical studies mentioned, the following regression model has been formed to test the hypotheses of this thesis:

$$y_{it}^{j} = \beta_0 + \beta_1 mining^{j} + \beta_2 collapse_t + \beta_3 mining^{j} * collapse_t + \beta_4 X_{it}^{j'} + \beta_5 Z_t' + \epsilon_{it}^{j} \quad (1)$$

The dependent variable y_{it}^{j} represents a firm performance measure (or some other measures such as cost of debt and firm investments) that has been indexed by *j* for the mining or the non-mining group, *i* for an individual firm and *t* for the collapse period. The dummy variable $mining^{j}$ has been indexed by *j* to distinguish an individual firm between the mining sector company (i.e., the treatment group with an assigned value of 1) and the non-mining sector company (i.e., the control group with an assigned value of 0). Similarly, the dummy variable $collapse_t$ has been indexed by *t* to distinguish an individual firm characteristic between the period before the mining collapse (for years 2006 to 2010, with an assigned value of 0) and the period after the mining collapse (for years 2011 to 2015, with an assigned value of 1). Thus, all of the dependent variables have been identified at firm-level for firm *i*, 'mining' group *j*, and period *t*, in which *i* represents any individual firm (regardless of whether it is a mining firm or a non-mining firm) and *j* identifies the type of firm (i.e., whether it belongs to the mining group or the non-mining group).

Most importantly, $mining^j * collapse_t$ is the combined dummy variable that represents the experimental group after it receives the treatment (i.e., after the mining collapse). The coefficient of great interest is β_3 as this is supposedly the true causal effect of the treatment on the dependent variable for the given model. One of the key features of the model is that β_3 would be zero in the absence of the treatment, that is, $E\left[\epsilon_{it}^{j} | mining^j * collapse_t\right] = 0$. In the specification of regression equation (1), β_1, β_2 and β_3 capture the time-invariant differences and the changes over time in overall means. Conversely, $X_{it}^{j'}$ and Z_t' are vectors of firm-specific variables (e.g., firm size, debt ratio and annual sales growth) and time period-specific economy-wide control variables (e.g., growth in annual GDP for Australia).

Chapter 5. Empirical Results and Discussion

5.1. Firm Performance: Accounting Perspective

To test the first hypothesis related to the effects of the mining collapse on firm performance (from an accounting perspective), the regression equation (1) has been evaluated using ROA and ROE as the dependent variables. The results are shown in Table 4 and Table 5, respectively.

Table 4

Effect of Mining Collapse on Return on Assets (ROA)

	Dependent variable: ROA					
	(a)	(b)	(c)	(d)	(e)	(f)
Constant	-0.117***	-2.123***	-1.799***	0.032	-1.910***	-1.748***
	(0.008)	(0.035)	(0.040)	(0.139)	(0.133)	(0.137)
Mining	-0.130***	-0.020*	-0.078***	0.524***	0.733***	0.602***
	(0.011)	(0.011)	(0.012)	(0.197)	(0.176)	(0.213)
Collapse	-0.019*	-0.025**	-0.012			
	(0.011)	(0.010)	(0.011)			
Mining * Collapse	-0.059***	-0.065***	-0.048***			
	(0.016)	(0.014)	(0.018)			
R&E Index				-0.029	-0.038	-0.008
				(0.025)	(0.023)	(0.024)
Mining * R&E Index				-0.125***	-0.143***	-0.129***
				(0.036)	(0.032)	(0.039)
Firm size		0.110***	0.096***		0.110***	0.095***
		(0.002)	(0.002)		(0.002)	(0.002)
Debt ratio		-0.115***	-0.106***		-0.117***	-0.106***
		(0.024)	(0.028)		(0.024)	(0.028)
GDP growth			0.016***			0.016***
			(0.004)			(0.004)
Sales growth		2.120***	-0.057		1.466***	-0.396
		(0.533)	(0.622)		(0.553)	(0.644)
Observations	15,984	15,984	8,393	15,984	15,984	8,393
R-squared	0.0279	0.2309	0.2475	0.0271	0.2297	0.2475

Table 4 presents estimates of equation (1) using ROA (which has been directly sourced from the database and defined as a fiscal year's earnings divided by total assets) as the dependent variable based on DatAnalysis data from 2006 through 2015. 'Mining' dummy is used to distinguish between mining companies (the treatment group with an assigned value of 1) and all other non-mining companies excluding financial firms (the control group with an assigned value of 0). 'Collapse' dummy is assigned a value of 0 for years from 2006 through 2010 (the pre-collapse period) and a value of 1 for years from 2011 through 2015 (the post-collapse period). R&E Index is the resources and energy annual export unit value index which has been lagged by one period and the values are in natural logarithm format. Column (a) shows the basic DID effect whereas columns (b) and (c) show us DID effect when considering firm-level and economy-level control variables. Similarly, column (d) shows us results of alternative DID using a continuous variable in basic form while columns (e) and (f) with control variables. Standard errors are shown in parentheses (*, **, and *** denote significance at 10%, 5%, and 1% levels, respectively).

When examining the DID coefficients in Table 4, after the mining collapse in 2011 the accounting performance indicated by ROA on average appears to have decreased by 4.8% to 6.5% for the mining companies compared with that of the non-mining companies (excluding the financial companies). The results have been found to be statistically significant at 1% level. In addition to statistical significance, the results also show economic significance. In the summary statistics of Table 3, we can observe that the mean ROA for the mining companies is 16.15% less than that of the non-mining companies. Therefore, the average decrease in ROA (as indicated by the DID coefficients) appears to be about 35% of that difference and is quite significant.

Negative significant coefficients for the ‘mining’ dummy (for columns (a) to (c)) indicate that the mining companies experienced negative ROA overall. For the ‘collapse’ dummy, the results indicate that both mining companies and non-mining companies together on average experienced negative ROA after the mining collapse. These findings are also somewhat evident in the charts in Figure 8.

Moreover, the R&E Index has been used in form of continuous treatment of DID approach, the results of which are shown in columns (d) to (f). Although the magnitude of the coefficients is not relevant, the negative sign along with high statistical significance confirms the robustness of the discrete DID results. Additionally, as this continuous treatment variable represents an economic mechanism that relates to the mining collapse, the results further strengthen our position to confirm our hypothesis to be true.

The firm-level control variable firm size (measured as a natural log of total assets) has been found to be positively associated with ROA. This conforms with prior literature (Isakov & Weisskopf, 2014; Liu, Miletkov, Wei, & Yang, 2015; Lin & Fu, 2017) and suggests that ROA is likely to increase (or decrease) with increasing (or decreasing) firm size for our sample.

Financial leverage (measured as total debt to total assets ratio) has been found to be negatively associated with ROA (Chauhan, Lakshmi, & Dey, 2016; Ma, Naughton, & Tian, 2010; Ferreira & Matos, 2008) indicating that a higher level of debt reduces

ROA. This is perhaps due to the negative effect of higher interest payments on profitability.

Sales growth seems to be positively associated with ROA (Aktas, Croci, & Petmezas, 2015). When calculating year-on-year sales growth, a considerable number of observations are lost, due to an unbalanced panel dataset resulting from the inclusion of delisted firms alongside listed firms. Therefore, this is reported separately in columns (c) and (f) in Table 5 and all other subsequent tables. The economy-wide control variable GDP growth seems to have a significant positive association with ROA.

Table 5 reports the results of the regression equation (1) to find the effects of the mining collapse on ROE, the other accounting firm performance measurement item. After the mining collapse in 2011, ROE appears to have decreased by 10% to 14% on average for the mining companies compared with the non-mining companies. This is indicated by the highly statistically significant discrete DID coefficients. Similarly, the continuous treatment DID also supports the negative effect of the mining collapse on ROE having significant negative coefficients.

In addition to statistical significance, economic significance also seems to be quite high. According to the summary statistics presented in Table 3, the mean ROE of the mining firms is 17.86% lower compared with that of the non-mining firms. Therefore, an average decrease of 10% to 14% in ROE (indicated by the DID coefficients) after the mining collapse for the mining companies seems to be much greater than 50% of that difference.

Table 5

Effect of Mining Collapse on Return on Equity (ROE)

	Dependent variable: ROE					
	(a)	(b)	(c)	(d)	(e)	(f)
Constant	-0.231***	-3.610***	-3.523***	-0.020	-3.032***	-3.236***
	(0.015)	(0.069)	(0.089)	(0.265)	(0.262)	(0.301)
Mining	-0.106***	-0.026	-0.130***	0.937**	0.954***	1.052**
	(0.022)	(0.021)	(0.028)	(0.376)	(0.345)	(0.469)
Collapse	0.004	-0.034*	-0.015			
	(0.022)	(0.020)	(0.023)			
Mining * Collapse	-0.140***	-0.115***	-0.101***			
	(0.031)	(0.028)	(0.039)			
R&E Index				-0.038	-0.103**	-0.049
				(0.048)	(0.045)	(0.052)
Mining * R&E Index				-0.203***	-0.189***	-0.225***
				(0.069)	(0.063)	(0.086)
Firm size		0.195***	0.194***		0.195***	0.194***
		(0.004)	(0.005)		(0.004)	(0.005)
Debt ratio		-1.167***	-1.235***		-1.173***	-1.239***
		(0.048)	(0.063)		(0.048)	(0.063)
GDP growth			0.023***			0.023***
			(0.008)			(0.008)
Sales growth		3.267***	0.702		1.994*	-0.209
		(1.047)	(1.373)		(1.086)	(1.421)
Observations	15,984	15,984	8,393	15,984	15,984	8,393
R-squared	0.0110	0.1691	0.1881	0.0100	0.1683	0.1882

Table 5 presents estimates of equation (1) using ROE (which has been directly sourced from the database and defined as net profit before abnormals divided by difference between shareholders equity and outside equity interests) as the dependent variable based on DatAnalysis data from 2006 through 2015. ‘Mining’ dummy is used to distinguish between mining companies (the treatment group with an assigned value of 1) and all other non-mining companies excluding financial firms (the control group with an assigned value of 0). ‘Collapse’ dummy is assigned a value of 0 for years from 2006 through 2010 (the pre-collapse period) and a value of 1 for years from 2011 through 2015 (the post-collapse period). R&E Index is the resources and energy annual export unit value index which has been lagged by one period and the values are in natural logarithm format. Column (a) shows the basic DID effect whereas columns (b) and (c) show us DID effect when considering firm-level and economy-level control variables. Similarly, column (d) shows us results of alternative DID using a continuous variable in basic form while columns (e) and (f) with control variables. Standard errors are shown in parentheses (*, **, and *** denote significance at 10%, 5%, and 1% levels, respectively).

Similar to ROA, the firm-level control variable firm size is also found to have a high statistically significant positive association with ROE (as in Hettler & Forst, 2017; Tariq & Abbas, 2013). Sales growth appears to have a significant positive association with ROE (as in Liu, Miletkov, Wei, & Yang, 2015; Wan & Yiu, 2009), whereas for financial leverage the association with ROE is negative significant (as in Hettler & Forst, 2017). Economy-wide variable GDP growth appears to have a significant positive relation with ROE (as in Gul, Irshad, & Zaman, 2011; Ali, Akhtar, & Ahmed, 2011). Overall, the results strongly indicate a negative effect of the mining collapse on firm performance.

5.2. Firm Performance: Market Perspective

Table 6 presents the results after evaluating the regression equation (1) to test the second hypothesis (H1b) to assess the effect of the mining collapse on firm performance from a market value perspective, using Tobin's Q ratio as the dependent variable.

Table 6

Effect of Mining Collapse on Tobin's Q Ratio

	Dependent variable: Tobin's Q					
	(a)	(b)	(c)	(d)	(e)	(f)
Constant	1.977***	5.342***	4.420***	6.095***	8.676***	7.422***
	(0.036)	(0.171)	(0.202)	(0.615)	(0.644)	(0.684)
Mining	0.442***	0.143***	0.175***	6.642***	6.124***	6.340***
	(0.051)	(0.051)	(0.063)	(0.876)	(0.852)	(1.064)
Collapse	-0.115**	-0.070	-0.056			
	(0.051)	(0.050)	(0.053)			
Mining * Collapse	-0.691***	-0.682***	-0.753***			
	(0.071)	(0.069)	(0.088)			
R&E Index				-0.764***	-0.581***	-0.519***
				(0.112)	(0.112)	(0.118)
Mining * R&E Index				-1.194***	-1.154***	-1.193***
				(0.160)	(0.155)	(0.194)
Firm size		-0.226***	-0.166***		-0.224***	-0.165***
		(0.009)	(0.010)		(0.009)	(0.010)
Debt ratio		-0.478***	-1.274***		-0.534***	-1.326***
		(0.118)	(0.142)		(0.118)	(0.142)
GDP growth			0.010			0.008
			(0.018)			(0.018)
Sales growth		27.058***	27.053***		18.843***	19.990***
		(2.583)	(3.112)		(2.675)	(3.221)
Observations	15,848	15,848	8,379	15,848	15,848	8,379
R-squared	0.0170	0.0768	0.0876	0.0214	0.0776	0.0877

Table 6 presents estimates of equation (1) using Tobin's Q (measured as the sum of market capital of equity and book value of total liabilities divided by book value of total assets) as the dependent variable based on DatAnalysis data from 2006 through 2015. 'Mining' dummy is used to distinguish between mining companies (the treatment group with an assigned value of 1) and all other non-mining companies excluding financial firms (the control group with an assigned value of 0). 'Collapse' dummy is assigned a value of 0 for years from 2006 through 2010 (the pre-collapse period) and a value of 1 for years from 2011 through 2015 (the post-collapse period). R&E Index is the resources and energy annual export unit value index which has been lagged by one period and the values are in natural logarithm format. Column (a) shows the basic DID effect whereas columns (b) and (c) show us DID effect when considering firm-level and economy-level control variables. Similarly, column (d) shows us results of alternative DID using a continuous variable in basic form while columns (e) and (f) with control variables. Standard errors are shown in parentheses (*, **, and *** denote significance at 10%, 5%, and 1% levels, respectively).

The results indicate that, after the mining collapse, the market value performance measured by Tobin's Q ratio on average has decreased by 66% to over 75% for the mining companies compared with those of the non-mining companies (excluding financial firms). A similar effect has been shown by the continuous treatment of DID through using the R&E Index.

Firm size has been found to have a significant negative association with this ratio (as in Li, Lu, Mittoo, & Zhang, 2015; Jameson, Prevost, & Puthenpurackal, 2014; Pham, Suchard, & Zein, 2011).

There is a negative significant association between financial leverage and Tobin's Q ratio. This conforms to prior literature (as in Francis, Hasan, & Wu, 2015; Custódio & Metzger, 2014).

Annual sales growth seems to be positively associated with Tobin's Q ratio; however, the results have failed to show any statistical significance (as in Chauhan, Lakshmi, & Dey, 2016), unlike prior literatures that have found statistical significance for this relationship (Jameson, Prevost, & Puthenpurackal, 2014; Hettler & Forst, 2017).

Similar to the study by Hettler and Forst (2017), this study has found a positive significant relation between GDP growth and Tobin's Q ratio.

To examine the effects of the mining collapse on firm performance from a market value perspective, the regression equation (1) is evaluated using annual total stock return, another popular firm performance measurement, as the dependent variable. As shown in Table 7, the DID coefficient results suggest that, following the mining collapse of 2011, annual total stock return on average has decreased by 62% to about 67% for the mining companies compared with those of the non-mining non-financial firms.

The sign of the coefficients using the continuous treatment variable (i.e., the R&E Index) for DID has also been negative with very high statistical significance and adds robustness to the results.

Table 7

Effect of Mining Collapse on Annual Total Stock Return

	Dependent variable: annual total stock return					
	(a)	(b)	(c)	(d)	(e)	(f)
Constant	0.180***	1.756***	1.063***	0.167	3.840***	2.410***
	(0.026)	(0.128)	(0.135)	(0.453)	(0.480)	(0.451)
Mining	0.350***	0.291***	0.236***	5.154***	4.870***	5.629***
	(0.037)	(0.038)	(0.041)	(0.645)	(0.635)	(0.708)
Collapse	0.003	-0.053	-0.015			
	(0.037)	(0.036)	(0.035)			
Mining * Collapse	-0.669***	-0.639***	-0.624***			
	(0.051)	(0.051)	(0.058)			
R&E Index				0.003	-0.362***	-0.223***
				(0.083)	(0.083)	(0.078)
Mining * R&E Index				-0.941***	-0.896***	-1.041***
				(0.118)	(0.116)	(0.129)
Firm size		-0.028***	-0.002		-0.027***	-0.003
		(0.007)	(0.007)		(0.007)	(0.007)
Debt ratio		-0.072	-0.191**		-0.110	-0.224**
		(0.087)	(0.094)		(0.087)	(0.094)
GDP growth			-0.006			-0.005
			(0.012)			(0.012)
Sales growth		-37.406***	-28.514***		-42.433***	-32.713***
		(1.893)	(2.039)		(1.969)	(2.113)
Observations	13,661	13,661	7,316	13,661	13,661	7,316
R-squared	0.0250	0.0538	0.0512	0.0091	0.0436	0.0458

Table 7 presents estimates of equation (1) using annual total stock return (sourced from Bloomberg) as the dependent variable based on DatAnalysis data from 2006 through 2015. 'Mining' dummy is used to distinguish between mining companies (the treatment group with an assigned value of 1) and all other non-mining companies excluding financial firms (the control group with an assigned value of 0). 'Collapse' dummy is assigned a value of 0 for years from 2006 through 2010 (the pre-collapse period) and a value of 1 for years from 2011 through 2015 (the post-collapse period). R&E Index is the resources and energy annual export unit value index which has been lagged by one period and the values are in natural logarithm format. Column (a) shows the basic DID effect whereas columns (b) and (c) show us DID effect when considering firm-level and economy-level control variables. Similarly, column (d) shows us results of alternative DID using a continuous variable in basic form while columns (e) and (f) with control variables. Standard errors are shown in parentheses (*, **, and *** denote significance at 10%, 5%, and 1% levels, respectively).

Similar to the earlier findings with Tobin's Q, the results in Table 7 indicate a highly significant negative association of firm size with stock returns (as in Aktas, Croci & Petmezas, 2015). Financial leverage has been found to have a negative association with stock returns (as in Aldamen, Duncan, Kelly, McNamara, & Nagel, 2012; Aktas, Croci, & Petmezas, 2015). Similar to the findings of Aktas, Croci and Petmezas (2015), annual sales growth has been found to be negatively associated with stock return; however, the results have not been statistically significant.

GDP growth appears to be significantly negatively associated with stock returns, similar to the findings in relation with Tobin's Q ratio.

As reported earlier, an alternative measure has been used for the annual total stock return: the sum of capital gains yield and dividend yield. This has produced similar results (see Table A.2).

5.3. Cost of Debt and Investments

To test the first hypothesis of the second set (i.e., H2a), the regression equation (1) is evaluated using the cost of debt as the dependent variable (see Table 8). The cost of debt is one of the firm performance related channels this study aims to explore.

Table 8

Effect of Mining Collapse on Cost of Debt

	Dependent variable: cost of debt					
	(a)	(b)	(c)	(d)	(e)	(f)
Constant	0.182***	0.541***	0.699***	-0.097	0.364	0.475
	(0.032)	(0.178)	(0.170)	(0.566)	(0.617)	(0.551)
Mining	0.100*	0.001	0.015	-0.904	-1.279	-1.472
	(0.054)	(0.055)	(0.056)	(0.931)	(0.926)	(0.940)
Collapse	0.060	0.033	0.044			
	(0.047)	(0.047)	(0.042)			
Mining * Collapse	0.153**	0.199***	0.174**			
	(0.076)	(0.076)	(0.078)			
R&E Index				0.056	0.033	0.040
				(0.104)	(0.106)	(0.094)
Mining * R&E Index				0.198	0.253	0.288*
				(0.170)	(0.169)	(0.172)
Firm size		-0.008	-0.020**		-0.008	-0.019**
		(0.009)	(0.008)		(0.009)	(0.008)
Debt ratio		-1.051***	-0.923***		-1.045***	-0.926***
		(0.114)	(0.112)		(0.114)	(0.111)
GDP growth			0.023			0.023
			(0.017)			(0.017)
Sales growth		1.187	1.391		1.613	1.927
		(2.750)	(2.619)		(2.857)	(2.717)
Observations	7,675	7,675	5,980	7,675	7,675	5,980
R-squared	0.0049	0.0176	0.0202	0.0036	0.0162	0.0191

Table 8 presents estimates of equation (1) using cost of debt (measured as interest expense divided by average total debt) as the dependent variable based on DatAnalysis data from 2006 through 2015. 'Mining' dummy is used to distinguish between mining companies (the treatment group with an assigned value of 1) and all other non-mining companies excluding financial firms (the control group with an assigned value of 0). 'Collapse' dummy is assigned a value of 0 for years from 2006 through 2010 (the pre-collapse period) and a value of 1 for years from 2011 through 2015 (the post-collapse period). R&E Index is the resources and energy annual export unit value index which has been lagged by one period and the values are in natural logarithm format. Column (a) shows the basic DID effect whereas columns (b) and (c) show us DID effect when considering firm-level and economy-level control variables. Similarly, column (d) shows us results of alternative DID using a continuous variable in basic form while columns (e) and (f) with control variables. Standard errors are shown in parentheses (*, **, and *** denote significance at 10%, 5%, and 1% levels, respectively).

The results from the DID coefficients suggest that after the mining collapse the cost of debt for the mining companies has increased on average 15% to about 20%, indicating an increased difficulty for mining firms in borrowing money. Unfortunately, although having the same sign, the coefficients of the continuous treatment variable in this instance do not seem to have high statistical significance.

As a firm-level control variable, firm size appears to have a negative association with the cost of debt (as in Lim, Wang, & Zeng, 2018; Gray, Koh, & Tong, 2009). Financial leverage seems to be have a highly significant negative association with the cost of debt (as in Lim, Wang, & Zeng, 2018; Li, 2015). This implies that higher debt levels added an additional financing cost for the firms.

Both firm-level control variable annual sales growth and macroeconomic control variable GDP growth appear to have positive associations with the cost of debt; however, without any statistical significance.

Following several studies (such as Zou & Adams, 2008; Baños-Caballero, García-Teruel, & Martínez-Solano, 2014), this study has measured the cost of debt alternatively as a ratio of total interest expense to total debt (instead of average total debt). Similar results have been found (see Table A.3).

As mentioned earlier, the effect of the mining collapse on firm investments is the second firm performance related channel that this study explores. Therefore, the regression equation (1) is evaluated using a firm investment measure (i.e., capital expenditure scaled by the beginning of year total assets) as the dependent variable to test the fourth hypothesis (H2b). According to the results (see Table 9), due to the mining collapse, firm investments for the mining companies have been found to decrease by 3.3% to nearly 5% on average compared with the non-mining companies as shown by the DID coefficients. Continuous DID coefficients also demonstrate the same effect with high statistical significance.

The firm-level control variable firm size has a significant positive association with firm investments (as in Custódio & Metzger, 2014; Chen, Sun, Tang, & Wu, 2011). Debt ratio is also found to be positively associated with firm investments (as in

Ahn, Denis, & Denis, 2006; Long & Malitz, 1985), indicating financial leverage helps investments.

Annual sales growth seems to have a significant positive association with firm investments (as in Gulen & Ion, 2016; Ferreira & Matos, 2008). This supports the notion that increased firm investments might enhance sales for firms.

Table 9

Effect of Mining Collapse on Firm Investments

	Dependent variable: Firm investments					
	(a)	(b)	(c)	(d)	(e)	(f)
Constant	0.075***	-0.036**	0.020	0.173***	-0.026	0.037
	(0.004)	(0.017)	(0.017)	(0.061)	(0.066)	(0.059)
Mining	0.150***	0.156***	0.142***	0.704***	0.727***	0.623***
	(0.005)	(0.005)	(0.005)	(0.088)	(0.088)	(0.092)
Collapse	-0.011**	-0.007	-0.005			
	(0.005)	(0.005)	(0.005)			
Mining * Collapse	-0.045***	-0.048***	-0.033***			
	(0.007)	(0.007)	(0.008)			
R&E Index				-0.019*	-0.001	-0.002
				(0.011)	(0.011)	(0.010)
Mining * R&E Index				-0.105***	-0.109***	-0.091***
				(0.016)	(0.016)	(0.017)
Firm size		0.002***	-0.001		0.002***	-0.001
		(0.001)	(0.001)		(0.001)	(0.001)
Debt ratio		0.023*	0.039***		0.021*	0.039***
		(0.012)	(0.012)		(0.012)	(0.012)
GDP growth			0.015***			0.015***
			(0.002)			(0.002)
Sales growth		2.316***	1.905***		2.008***	1.681***
		(0.263)	(0.268)		(0.272)	(0.277)
Observations	15,007	15,007	8,472	15,007	15,007	8,472
R-squared	0.0850	0.0908	0.1279	0.0841	0.0885	0.1285

Table 9 presents estimates of equation (1) using firm investments (measured as capital expenditure of a given year divided by total assets at the beginning of that year) as the dependent variable based on DatAnalysis data from 2006 through 2015. ‘Mining’ dummy is used to distinguish between mining companies (the treatment group with an assigned value of 1) and all other non-mining companies excluding financial firms (the control group with an assigned value of 0). ‘Collapse’ dummy is assigned a value of 0 for years from 2006 through 2010 (the pre-collapse period) and a value of 1 for years from 2011 through 2015 (the post-collapse period). R&E Index is the resources and energy annual export unit value index which has been lagged by one period and the values are in natural logarithm format. Column (a) shows the basic DID effect whereas columns (b) and (c) show us DID effect when considering firm-level and economy-level control variables. Similarly, column (d) shows us results of alternative DID using a continuous variable in basic form while columns (e) and (f) with control variables. Standard errors are shown in parentheses (*, **, and *** denote significance at 10%, 5%, and 1% levels, respectively).

The economy-wide control variable GDP growth appears to be positively associated with firm investments (as in Gulen & Ion, 2016; Bris, Koskinen, & Nilsson, 2006).

For an additional check on the effect of the mining collapse on firm investments, an alternative measure is used—the change in PPE (sometimes referred to as fixed assets and commonly used as collateral against borrowing) to total assets. This is done to test the last hypothesis related to firm investments through examining the effects of the mining collapse on the fixed assets for the mining companies.

Table 10

Effect of Mining Collapse on Fixed Assets

Dependent variable: Firm investments in terms of change in fixed assets						
	(a)	(b)	(c)	(d)	(e)	(f)
Constant	0.026***	-0.224***	-0.191***	0.258***	-0.066	-0.050
	(0.003)	(0.014)	(0.017)	(0.053)	(0.057)	(0.060)
Mining	0.036***	0.055***	0.045***	0.231***	0.275***	0.196**
	(0.004)	(0.005)	(0.006)	(0.077)	(0.076)	(0.094)
Collapse	-0.015***	-0.011**	-0.012**			
	(0.004)	(0.004)	(0.005)			
Mining * Collapse	-0.022***	-0.026***	-0.018**			
	(0.006)	(0.006)	(0.008)			
R&E Index				-0.044***	-0.028***	-0.025**
				(0.010)	(0.010)	(0.010)
Mining * R&E Index				-0.038***	-0.043***	-0.029*
				(0.014)	(0.014)	(0.017)
Firm size		0.010***	0.008***		0.011***	0.008***
		(0.001)	(0.001)		(0.001)	(0.001)
Debt ratio		0.051***	0.065***		0.049***	0.065***
		(0.009)	(0.012)		(0.009)	(0.012)
GDP growth			0.026***			0.026***
			(0.002)			(0.002)
Sales growth		1.864***	1.944***		1.558***	1.708***
		(0.227)	(0.275)		(0.234)	(0.284)
Observations	15,022	15,022	8,475	15,022	15,022	8,475
R-squared	0.0097	0.0359	0.0657	0.0096	0.0342	0.0646

Table 10 presents estimates of equation (1) using change in fixed assets (or property, plant, and equipment) divided by total assets at the beginning of the year as the dependent variable based on DatAnalysis data from 2006 through 2015. ‘Mining’ dummy is used to distinguish between mining companies (the treatment group with an assigned value of 1) and all other non-mining companies excluding financial firms (the control group with an assigned value of 0). ‘Collapse’ dummy is assigned a value of 0 for years from 2006 through 2010 (the pre-collapse period) and a value of 1 for years from 2011 through 2015 (the post-collapse period). R&E Index is the resources and energy annual export unit value index which has been lagged by one period and the values are in natural logarithm format. Column (a) shows the basic DID effect whereas columns (b) and (c) show us DID effect when considering firm-level and economy-level control variables. Similarly, column (d) shows us results of alternative DID using a continuous variable in basic form while columns (e) and (f) with control variables. Standard errors are shown in parentheses (*, **, and *** denote significance at 10%, 5%, and 1% levels, respectively).

Not surprisingly, the results of the effects due to the mining collapse on change in PPE to total assets ratio in Table 10 are quite similar to the findings in Table 9. The results indicate that there has been a decrease in the ratio by about 1.8% to 2.6% for the mining companies. This somewhat confirms a similar adverse situation in terms of borrowing for the mining companies compared with other companies. The associations of this ratio with the control variables have also been found to be similar.

However, there is a caveat for firm investments. Although we can observe a negative effect on firm investments due to the mining collapse, this does not necessarily indicate underinvestment by the mining sector. Hypothetically, if there had been an overinvestment situation for the mining companies before the collapse occurred, the collapse could have restricted this to an appropriate level of investment. Similarly, if the mining companies had an appropriate level of investment before the collaps, the collapse could have caused the firms to now have underinvestment. Whichever is the case for the mining companies, it remains an empirical question.

The results shown in the preceding three tables suggest that the mining collapse of 2011 appears to have had similar adverse effects on the cost of debt (by increasing the cost of debt for the firms) and firm investments (by decreasing investment opportunities for the firms) for the mining firms compared with the non-mining firms in firm performance from an accounting perspective and from a market perspective. Therefore, these two channels provide additional support to the conclusion that poor firm performance by the mining companies resulted from the mining collapse.

Overall, due to the mining collapse, mining companies' firm performance (when considering accounting or book value perspectives) has decreased by 4.8% to 6.5% on average in terms of ROA. For the non-mining companies, firm performance has decreased from 10% to 14% on average in terms of ROE. Similarly, when considering the market value perspective, firm performance for the mining companies has decreased by 68% to 75% on average in terms of Tobin's Q ratio, whereas the decrease has been 62% to 67% on average in terms of annual total stock return compared with the non-mining companies after the mining collapse. Conversely, the cost of debt on average has increased by 15% to 20% for the mining companies compared with the non-mining companies due to the mining collapse. Firm investments for the mining companies have decreased by 3.3% to 4.8% on average in terms of capital expenditure to total assets, whereas the decrease seems to be 1.8% to 2.6% on average in terms of change in PPE to total assets compared with the non-mining companies in the post-collapse period. All these results are consistent with the corresponding hypotheses mentioned earlier.

Firm size (in terms of natural log of total assets) is found to have positive significant relations with accounting firm performance measures and firm investments, but negative significant relations with market perspective firm performance measures and cost of debt. Financial leverage (in terms of debt ratio) appears to have positive significant relations with firm investments, but negative significant relations with firm performance (for both book value and market value perspectives) and cost of debt. The sales growth rate appears to have a positive significant association with firm performance and investments. GDP growth rate seems to be positively related with firm performance (except annual total stock return) and firm investments. All of the above associations have been in accordance with prior literature cited earlier.

Additionally, use of resource and energy value index as the continuous treatment variable for DID has provided further strength to our findings as the index represents an economic mechanism that relates to the mining collapse. Thus, the results confirm all our hypotheses to be true.

Chapter 6. Summary and Conclusion

6.1. Summary and Conclusion

Unlike most developed countries, Australia escaped a recession during the GFC. Soon afterwards, Australia experienced a significant boom in its mining sector; however, this did not last long. The next most challenging situation post-GFC that most resources-based businesses in Australia faced has been the market collapse in the mining sector in 2011. This has been caused by a significant drop in mining commodity prices in the international markets, along with lower Chinese import demand.

This study has demonstrated empirical evidences that measure the extent to which the mining companies' performances (from both an accounting perspective and a market value perspective) have been affected by the mining collapse, compared with the non-mining companies. The results show that the performances of the mining companies have been significantly negatively affected due to the collapse compared with the non-mining companies. Accounting performance indicated by ROA has decreased by about 5% to 6.5% on average and ROE has decreased by 10% to 14% on average for the mining companies compared with the non-mining companies (excluding financial companies). Conversely, market value performance measured by Tobin's Q ratio has decreased by 68% to over 75% on average and annual total stock return has decreased by 62% to about 67% on average for the mining companies compared with the non-mining companies (excluding financial companies).

Two related channels have also been explored to support the findings in the performance effects. The results suggest that the mining collapse also had a similar negative effect on the cost of debt and investments by the mining firms. Cost of debt for the mining companies appeared to increase from 15% to about 20% on average after the mining collapse, indicating increased difficulty for these firms in borrowing money.

Although according to the results the higher cost of debt may be related to lower firm performance, it is recognised that a lower cost of debt may not always translate into improved firm performance (Lim, Wang, & Zeng, 2018).

Firm investments (measured as capital expenditure divided by total assets at the beginning of the year) of the mining companies have also suffered due to the mining collapse, decreasing by 3.3% to nearly 5%. The PPE to total assets ratio decreased by about 1.8% to 2.6% for the mining companies. This may indicate a similar adverse situation for borrowing by the mining companies compared with other companies.

As such, it is evident from the results that the poor performance of the mining companies has been largely caused by the mining collapse, among other factors. The collapse has also caused an increased borrowing cost for the firms. At the same time, the mining sector has reduced investments. Thus, the results confirm all our hypotheses to be true.

The results of this thesis may have important policy implications for the Australian government. Subsequently, related government agencies and regulatory bodies may bring necessary changes to their policies to assist the more vulnerable companies.

6.2. Limitations and Future Research Directions

The first limitation of this study could be the differences in the nature of the business between the mining companies and the non-mining companies. As this study uses DID methodology, it would have been preferable if there were fewer differences between the two types of firms and if they were homogenous in overall nature. However, some scholars imply this is an insignificant issue.

Second, the mining collapse is considered as a given factor and the study began from this point. The study would have been stronger and more comprehensive if it had examined matter beyond the collapse, to widen the scope and incorporate the factors that caused the mining collapse. Further, similar studies could examine other mining countries to observe whether there are comparable patterns or dissimilarities in the effects across various countries due to similar mining collapses in their respective economies.

In addition, it is possible that many mining companies experienced acute financial distress after the mining collapse leading to bankruptcy. Studies could be done to explore this issue in greater detail.

References

Acemoglu, D., Autor, D., & Lyle, D. (2004). Women, War, and Wages: The Effect of Female Labor Supply on the Wage Structure at Midcentury. *Journal of Political Economy, 112*(3), 497-551.

Acharya, Bharath, & Srinivasan. (2007). Does industry-wide distress affect defaulted firms? Evidence from creditor recoveries. *Journal of Financial Economics, 85*(3), 787-821.

Ahn, Seoungpil, Denis, David J., & Denis, Diane K. (2006). Leverage and investment in diversified firms. *Journal of Financial Economics, 79*(2), 317-337.

Aktas, Croci, & Petmezas. (2015). Is working capital management value-enhancing? Evidence from firm performance and investments. *Journal of Corporate Finance, 30*, 98-113.

Aldamen, H., Duncan, K., Kelly, S., McNamara, R., & Nagel, S. (2012). Audit committee characteristics and firm performance during the global financial crisis. *Accounting & Finance, 52*(4), 971-1000.

Ali, K., Akhtar, M. F., & Ahmed, H. Z. (2011). Bank-specific and macroeconomic indicators of profitability-empirical evidence from the commercial banks of Pakistan. *International Journal of Business and Social Science, 2*(6), 235-242.

Allen, Larson, & Sloan. (2013). Accrual reversals, earnings and stock returns. *Journal of Accounting and Economics, 56*(1), 113-129.

Andrade, Bernile, & Hood. (2014). SOX, corporate transparency, and the cost of debt. *Journal of Banking and Finance, 38*, 145-165.

Ashenfelter, O. (1978). Estimating the effect of training programs on earnings. *The Review of Economics and Statistics, 60*(1), 47-57.

Ashenfelter, O., & Card, David Edward. (1985). Using the longitudinal structure of earnings to estimate the effect of training programs. *The Review of Economics and Statistics,67*(4), 648-660.

Asker, J., Farre-Mensa, J., & Ljungqvist, A. (2015). Corporate investment and stock market listing: A puzzle?. *The Review of Financial Studies*, *28*(2), 342-390.

Baños-Caballero, García-Teruel, & Martínez-Solano. (2014). Working capital management, corporate performance, and financial constraints. *Journal of Business Research*, *67*(3), 332-338.

Barney, J. B. (2007). *Gaining and Sustaining Competitive Advantage*. New Jersey: Pearson Prentice Hall.

Bashar, O. (2015). The Trickle-down Effect of the Mining Boom in Australia: Fact or Myth? *Economic Record, 91*, 94-108.

Battellino, R. (2010). Mining booms and the Australian economy. *RBA Bulletin, March*, 63-69.

Benmelech, E., & Bergman, N. (2011). Bankruptcy and the Collateral Channel. *Journal of Finance, 66*(2), 337-378.

Benston, G. (1985). The validity of profits-structure studies with particular reference to the FTC's line of business data. *The American Economic Review, 75*(1), 37-67.

Bertrand, M., Duflo, Esther, & Mullainathan, Sendhil. (2004). How much should we trust differences-in-differences estimates? *The Quarterly Journal of Economics*, *119*(1), 249-275.

Bhojraj, S., & Sengupta, P. (2003). Effect of corporate governance on bond ratings and yields: The role of institutional investors and outside directors. *The Journal of Business*, *76*(3), 455-475.

Black, Kim, Jang, & Park. (2015). How corporate governance affect firm value? Evidence on a self-dealing channel from a natural experiment in Korea. *Journal of Banking and Finance, 51,* 131-150.

Bliss, & Gul. (2012). Political connection and cost of debt: Some Malaysian evidence. *Journal of Banking and Finance, 36*(5), 1520-1527.

Borisov, A., Goldman, E., & Gupta, N. (2016). The Corporate Value of (Corrupt) Lobbying. *The Review of Financial Studies, 29*(4), 1039-1071.

Borisova, G., & Megginson, W. L. (2011). Does government ownership affect the cost of debt? Evidence from privatization. *The Review of Financial Studies*, *24*(8), 2693-2737.

Bris, A., Koskinen, Y., & Nilsson, M. (2006). The real effects of the euro: evidence from corporate investments. *Review of Finance*, *10*(1), 1-37.

Bromiley, P., & Harris, J. (2014). A comparison of alternative measures of organizational aspirations. *Strategic Management Journal*, *35*(3), 338-357.

Brown, P., Beekes, W., & Verhoeven, P. (2011). Corporate governance, accounting and finance: A review. *Accounting & finance*, *51*(1), 96-172.

Campbell, J., Giglio, S., & Pathak, P. (2011). Forced Sales and House Prices. *American Economic Review, 101*(5), 2108–2131.

Campello, M., Graham, J. R., & Harvey, C. R. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of financial Economics*, *97*(3), 470-487.

Card, David, & Krueger, Alan B. (1993). Trends in relative black-white earnings revisited. (includes bibliography) (The Economic Status of Black Americans)(Papers and Proceedings of the American Economic Association annual meeting). *American Economic Review, 83*(2), 85.

Cerrato, Alessandri, & Depperu. (2016). Economic Crisis, Acquisitions and Firm Performance. *Long Range Planning, 49*(2), 171-185.

Chauhan, Lakshmi, & Dey. (2016). Corporate governance practices, self-dealings, and firm performance: Evidence from India. *Journal of Contemporary Accounting & Economics, 12*(3), 274-289.

Chaudhuri, Kumbhakar, & Sundaram. (2016). Estimation of firm performance from a MIMIC model. *European Journal of Operational Research, 255*(1), 298-307.

Chen, & King. (2014). Corporate hedging and the cost of debt. *Journal of Corporate Finance, 29*, 221-245.

Chen, D., Ding, S., & Wu, Z. (2014). Effect of foreign ownership on cost of borrowing: Evidence from small and medium-sized enterprises in China. *International Small Business Journal, 32*(6), 693-715.

Chen, Sun, Tang, & Wu. (2011). Government intervention and investment efficiency: Evidence from China. *Journal of Corporate Finance, 17*(2), 259-271.

Chen, W. R., & Miller, K. D. (2007). Situational and institutional determinants of firms' R&D search intensity. *Strategic Management Journal, 28*(4), 369-381.

Chui, A., Kwok, C., & Zhou, G. (2016). National culture and the cost of debt. *Journal of Banking & Finance, 69,* 1.

Combs, J. G., Russell Crook, T., & Shook, C. L. (2005). The dimensionality of organizational performance and its implications for strategic management research. In *Research methodology in strategy and management* (pp. 259-286). Emerald Group Publishing Limited.

Custódio, & Metzger. (2014). Financial expert CEOs: CEO′s work experience and firm′s financial policies. *Journal of Financial Economics, 114*(1), 125-154.

Cyert, R. M., & March, J. G. (1963). A behavioral theory of the firm. *Englewood Cliffs, NJ, 2*.

Deng, Kang, & Low. (2013). Corporate social responsibility and stakeholder value maximization: Evidence from mergers. *Journal of Financial Economics, 110*(1), 87-109.

Denis, D., & Sibilkov, V. (2010). Financial Constraints, Investment, and the Value of Cash Holdings. *The Review of Financial Studies, 23*(1), 247-269.

Downes, P. M., Hanslow, K., & Tulip, P. (2014). The Effect of the Mining Boom on the Australian Economy. *RBA Research Discussion Paper,* No 2014-08.

Fama, & French. (1988). Dividend yields and expected stock returns. *Journal of Financial Economics, 22*(1), 3-25.

Ferreira, & Matos (2008). The colors of investors' money: The role of institutional investors around the world. *Journal of Financial Economics, 88*(3), 499-533.

Filip, A., & Raffournier, B. (2014). Financial crisis and earnings management: The European evidence. *The International Journal of Accounting, 49*(4), 455-478.

Fisher, L. (1959). Determinants of risk premiums on corporate bonds. *Journal of Political Economy, 67*(3), 217-237.

Foucault, & Fresard. (2014). Learning from peers' stock prices and corporate investment. *Journal of Financial Economics,111*(3), 554-577.

Francis, B., Hasan, I., & Wu, Q. (2015). Professors in the Boardroom and Their Impact on Corporate Governance and Firm Performance. *Financial Management, 44*(3), 547-581.

Frank, & Shen. (2016). Investment and the weighted average cost of capital. *Journal of Financial Economics, 119*(2), 300-315.

Gan, J. (2007). Collateral, debt capacity, and corporate investment: Evidence from a natural experiment. *Journal of Financial Economics 85*(3): 709-734.

Ganguli, S. K., & Agrawal, S. (2009). Ownership structure and firm performance: An empirical study on listed mid-cap Indian companies. *IUP Journal of Applied Finance, 15*(12), 37.

Gilchrist, Simon, & Himmelberg, Charles (1999). Investment: Fundamentals and finance. In Ben S. Bernanke, & Julio J. Rotemberg (Eds.). *NBER Macroeconomics Annual 1998 (Vol. 13).* MIT Press.

Gochoco-Bautista, Sotocinal, & Wang. (2014). Corporate Investments in Asian Markets: Financial Conditions, Financial Development, and Financial Constraints. *World Development, 57*, 63-78.

Gordon, Myron J. (1959). Dividends, Earnings and Stock Prices. *Review of Economics and Statistics. The MIT Press. 41* (2): 99–105. doi:10.2307/1927792

Graham, & Harvey. (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics, 60*(2), 187-243.

Gray, P., Koh, P., & Tong, Y. (2009). Accruals quality, information risk and cost of capital: Evidence from Australia. *Journal of Business Finance and Accounting, 36*(1-2), 51-72.

Gul, S., Irshad, F., & Zaman, K. (2011). Factors Affecting Bank Profitability in Pakistan. *Romanian Economic Journal, 14*(39).

Gulen, H., & Ion, M. (2016). Policy Uncertainty and Corporate Investment. *The Review of Financial Studies, 29*(3), 523-564.

Hamadi, & Heinen. (2015). Firm performance when ownership is very concentrated: Evidence from a semiparametric panel. *Journal of Empirical Finance, 34*, 172-194.

Hameed, A., Morck, R., Shen, J., & Yeung, B. (2015). Information, Analysts, and Stock Return Comovement. *The Review of Financial Studies, 28*(11), 3153-3187.

Hettler, B., & Forst, A. (2017). Disproportionate insider control and firm performance. *Accounting & Finance,* 06/22/2017.

Hoskisson, R. E., Hitt, M. A., Wan, W. P., & Yiu, D. (1999). Theory and research in strategic management: Swings of a pendulum. *Journal of management, 25*(3), 417-456.

Houston, J., Jiang, L., Lin, C., & MA, Y. (2014). Political Connections and the Cost of Bank Loans. *Journal of Accounting Research, 52*(1), 193-243.

Huang, R., & Ritter, J. (2009). Testing Theories of Capital Structure and Estimating the Speed of Adjustment. *Journal of Financial and Quantitative Analysis, 44*(2), 237-271.

Imbens, G., & Wooldridge, J. (2009). Recent Developments in the Econometrics of Program Evaluation. *Journal of Economic Literature, 47*(1), 5-86.

Isakov, & Weisskopf. (2014). Are founding families special blockholders? An investigation of controlling shareholder influence on firm performance. *Journal of Banking and Finance, 41*, 1-16.

Iyer, D. N., & Miller, K. D. (2008). Performance feedback, slack, and the timing of acquisitions. *Academy of Management Journal, 51*(4), 808-822.

Jameson, Prevost, & Puthenpurackal. (2014). Controlling shareholders, board structure, and firm performance: Evidence from India. *Journal of Corporate Finance, 27*, 1-20.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American economic review, 76*(2), 323-329.

Jensen, M. C. (1993). The modern industrial revolution, exit, and the failure of internal control systems. *the Journal of Finance, 48*(3), 831-880.

Jung, J., Herbohn, K., & Clarkson, P. (2016). Carbon Risk, Carbon Risk Awareness and the Cost of Debt Financing. Journal of Business Ethics, *Journal of Business Ethics*, 5/28/2016.

Kahle, & Stulz. (2013). Access to capital, investment, and the financial crisis. *Journal of Financial Economics, 110*(2), 280-299.

Kim, J. B., Simunic, D. A., Stein, M. T., & Yi, C. H. (2011). Voluntary audits and the cost of debt capital for privately held firms: Korean evidence. *Contemporary accounting research, 28*(2), 585-615.

Kiyotaki, N., & Moore, J. (1997). Credit Cycles. *Journal of Political Economy*, *105*(2), 211-248.

Lang, & Stulz. (1992). Contagion and competitive intra-industry effects of bankruptcy announcements: An empirical analysis. *Journal of Financial Economics, 32*(1), 45-60.

Leary, M. (2009). Bank Loan Supply, Lender Choice, and Corporate Capital Structure. *Journal of Finance, 64*(3), 1143-1185.

Li, Lu, Mittoo, & Zhang. (2015). Board independence, ownership concentration and corporate performance—Chinese evidence. *International Review of Financial Analysis, 41*, 162-175.

Li, Meng, Wang, & Zhou. (2008). Political connections, financing and firm performance: Evidence from Chinese private firms. *Journal of Development Economics, 87*(2), 283-299.

Li, X. (2015). Accounting Conservatism and the Cost of Capital: An International Analysis. *Journal of Business Finance & Accounting, 42*(5-6), 555-582.

Lim, Wang, & Zeng. (2018). China's "Mercantilist" Government Subsidies, the Cost of Debt and Firm Performance. *Journal of Banking and Finance, 86*, 37-52.

Lin, & Fu. (2017). Does institutional ownership influence firm performance? Evidence from China. *International Review of Economics and Finance, 49,* 17-57.

Lins, K., Servaes, H., & Tamayo, A. (2017). Social Capital, Trust, and Firm Performance: The Value of Corporate Social Responsibility during the Financial Crisis. *Journal of Finance, 72*(4), 1785-1824.

Liu, B., Cullinan, C., Zhang, J., & Wang, F. (2016). Loan guarantees and the cost of debt: Evidence from China. *Applied Economics,* 1-18.

Liu, Miletkov, Wei, & Yang. (2015). Board independence and firm performance in China. *Journal of Corporate Finance, 30*, 223-244.

Long, M. S., & Malitz, I. B. (1985). Investment patterns and financial leverage. In Corporate capital structures in the United States (pp. 325-352). *University of Chicago Press*.

Love, I. (2003). Financial Development and Financing Constraints: International Evidence from the Structural Investment Model. *The Review of Financial Studies, 16*(3), 765-791.

Lugo, S. (2017). Insider ownership and the cost of debt capital: Evidence from bank loans. *International Review of Financial Analysis*.

Ma, Naughton, & Tian (2010). Ownership and ownership concentration: Which is important in determining the performance of China’s listed firms? *Accounting & Finance,50*(4), 871-897.

McLean, I. W. (2012). *Why Australia prospered: The shifting sources of economic growth*. Princeton University Press.

Meyer, B. D. (1995). Natural and Quasi-Experiments in Economics. *Journal of Business & Economic Statistics 13*(2): 151-161.

Meyer, B., Viscusi, W., & Durbin, D. (1995). Workers' compensation and injury duration - evidence from a natural experiment. *American Economic Review, 85*(3), 322-340.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics 5*(2): 147-175.

Myers, S. C. (2003). Financing of Corporations. *Handbook of the Economics of Finance 1*, 215-253.

Miller, K. D., & Chen, W. R. (2004). Variable organizational risk preferences: Tests of the March-Shapira model. *Academy of Management Journal*, *47*(1), 105-115.

Miller, K. D., & Leiblein, M. J. (1996). Corporate risk-return relations: Returns variability versus downside risk. *Academy of Management Journal*, *39*(1), 91-122.

Morck, R., Shleifer, A., & Vishny, R. W. (1988). Management ownership and market valuation: An empirical analysis. *Journal of financial economics*, *20*, 293-315.

Norden, & Van Kampen. (2013). Corporate leverage and the collateral channel. *Journal of Banking and Finance, 37*(12), 5062-5072.

Pham, P., Suchard, J., & Zein, J. (2011). Corporate governance and alternative performance measures: Evidence from Australian firms. *Australian Journal of Management*, *36*(3), 371-386.

Pulvino, T. C. (1998). Do Asset Fire Sales Exist? An Empirical Investigation of Commercial Aircraft Transactions. *The Journal of Finance 53*(3): 939-978.

Pulvino, T. C. (1999). Effects of bankruptcy court protection on asset sales. *Journal of Financial Economics 52*(2): 151-186.

Ratti, Lee, & Seol. (2008). Bank concentration and financial constraints on firm-level investment in *Europe. Journal of Banking and Finance, 32*(12), 2684-2694.

Richard, P. J., Devinney, T. M., Yip, G. S., & Johnson, G. (2009). Measuring organizational performance: Towards methodological best practice. *Journal of management*, *35*(3), 718-804.

Robson, A. (2015). The Australian Economy and Economic Policy During and After the Mining Boom. *Economic Affairs*, *35*(2), 307-316.

Rowe, W. G., & Morrow, J. L. (1999). A note on the dimensionality of the firm financial performance construct using accounting, market, and subjective measures. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration*, *16*(1), 58-71.

Saeidi, Sayedeh Parastoo, Sofian, Saudah, Saeidi, Parvaneh, Saeidi, Sayyedeh Parisa, & Saaeidi, Seyyed Alireza. (2015). How does corporate social responsibility contribute to firm financial performance? The mediating role of competitive advantage, reputation, and customer satisfaction. *Journal of Business Research, 68*(2), 341-350.

Salas-Fumás, V., Rosell-Martínez, J., & Delgado-Gómez, J. (2016). Capacity, investment and market power in the economic value of energy firms. *Energy Economics*, *53*, 28.

Schneider, T. E. (2011). Is environmental performance a determinant of bond pricing? Evidence from the US pulp and paper and chemical industries. *Contemporary Accounting Research*, *28*(5), 1537-1561.

Servaes, H., & Tamayo, A. (2013). The impact of corporate social responsibility on firm value: The role of customer awareness. *Management Science*, *59*(5), 1045-1061.

Shah, S. Z. A., & Hussain, Z. (2012). Impact of ownership structure on firm performance evidence from non-financial listed companies at Karachi Stock Exchange. *International Research Journal of Finance and Economics*, *84*.

Shailer, & Wang. (2015). Government ownership and the cost of debt for Chinese listed corporations. *Emerging Markets Review, 22*, 1-17.

Shleifer, A., & Vishny, R. (2011). Fire Sales in Finance and Macroeconomics. *Journal of Economic Perspectives*, *25*(1), 29-48.

Shleifer, A., & Vishny, R. (1992). Liquidation Values and Debt Capacity: A Market Equilibrium Approach. *The Journal of Finance 47*(4), 1343-1366.

Singh, S., Tabassum, N., Darwish, T. K., & Batsakis, G. (2017). Corporate Governance and Tobin's Q as a Measure of Organizational Performance. *British Journal of Management*.

Slovin, M. B., Sushka, M. E., & Polonchek, J. A. (1993). The value of bank durability: Borrowers as bank stakeholders. *The Journal of Finance*, *48*(1), 247-266.

Smith, C. W., & Warner, J. B. (1979). On financial contracting: An analysis of bond covenants. *Journal of financial economics*, *7*(2), 117-161.

Tariq, Y. B., & Abbas, Z. (2013). Compliance and multidimensional firm performance: Evaluating the efficacy of rule-based code of corporate governance. *Economic Modelling, 35*, 565-575.

Trueman, B. (1986). The relationship between the level of capital expenditures and firm value. *Journal of Financial and Quantitative Analysis*, *21*(2), 115-129.

Valta, P. (2012). Competition and the cost of debt. *Journal of Financial Economics*, *105*(3), 661-682.

Venkatraman, N., & Ramanujam, V. (1986). Measurement of business performance in strategy research: A comparison of approaches. *Academy of management review*, *11*(4), 801-814.

Wang, W. (2014). Independent Directors and Corporate Performance in China: A Meta-Empirical Study (March 27, 2014). Available at SSRN: https://ssrn.com/abstract=2417078 or http://dx.doi.org/10.2139/ssrn.2417078.

Wang, & Sengupta. (2016). Stakeholder relationships, brand equity, firm performance: A resource-based perspective. *Journal of Business Research, 69*(12), 5561-5568.

Wang, Chen, Yu, & Hsiao. (2015). The effects of corporate social responsibility on brand equity and firm performance. *Journal of Business Research, 68*(11), 2232-2236.

Wan, W., & Yiu, D. (2009). From crisis to opportunity: Environmental jolt, corporate acquisitions, and firm performance. *Strategic Management Journal*, *30*(7), 791-801.

Wooldridge, J. (2007). What's new in econometrics? Lecture 10 difference-in-differences estimation. *NBER Summer Institute, available at: www. nber. org/WNE/Slides7–31–07/slides_10_diffindiffs. pdf, accessed April*, *9*, 2011.

Wu, Z., & Chua, J. H. (2012). Second-order gender effects: the case of US small business borrowing cost. *Entrepreneurship Theory and Practice*, *36*(3), 443-463.

Yang, Han, Li, Yin, & Tian. (2017). Monetary policy, cash holding and corporate investment: Evidence from China. *China Economic Review*, *46*, 110-122.

Zona, F. (2012). Corporate investing as a response to economic downturn: Prospect theory, the behavioural agency model and the role of financial slack. *British Journal of Management*, *23*(S1).

Zou, H., & Adams, M. (2008). Debt Capacity, Cost of Debt, and Corporate Insurance. Journal of *Financial and Quantitative Analysis, 43*(2), 433-466.

Appendix

Table A1: Impact of mining collapse on ROA

	Dependent variable: ROA					
	(a)	(b)	(c)	(d)	(e)	(f)
Constant	-0.117***	0.120	-0.099	0.032	-0.037	-0.227***
	(0.008)	(0.133)	(0.132)	(0.139)	(0.048)	(0.085)
Mining	-0.130***	0.598***	0.321*	0.524***	0.045	-0.519***
	(0.011)	(0.190)	(0.186)	(0.197)	(0.067)	(0.120)
Collapse	-0.019*					
	(0.011)					
Mining * Collapse	-0.059***					
	(0.016)					
Resources Index		-0.046*				
		(0.025)				
Mining * Resources Index		-0.141***				
		(0.035)				
Energy Index			-0.005			
			(0.024)			
Mining * Energy Index			-0.086***			
			(0.033)			
R&E Index				-0.029		
				(0.025)		
Mining * R&E Index				-0.125***		
				(0.036)		
Iron Ore Price					-0.020*	
					(0.011)	
Mining * Iron Ore Price					-0.046***	
					(0.015)	
Mining to GDP						-0.039
						(0.033)
Mining * Mining to GDP						-0.139***
						(0.046)
Observations	15,985	15,985	15,985	15,985	15,985	15,985
R-squared	0.0279	0.0284	0.0257	0.0271	0.0274	0.0267

Table A1 presents estimates of equation (1) using ROA as the dependent variable based on DatAnalysis data from 2006 through 2015. 'Mining' dummy is used to distinguish between mining companies (the treatment group with an assigned value of 1) and all other non-mining companies excluding financial firms (the control group with an assigned value of 0). 'Collapse' dummy is assigned a value of 0 for years from 2006 through 2010 (the pre-collapse period) and a value of 1 for years from 2011 through 2015 (the post-collapse period. Column (a) shows the basic DID effect whereas columns (b), (c), (d), (e), and (f) show us alternate DID approaches by using continuous variables: resources, energy, resources & energy combined (R&E index) annual export unit value index, Iron Ore agglomerated export price from Australia to China, mining as a percentage of annual GDP respectively, all of which have been lagged by one period and the values are in natural logarithm format. Standard errors are shown in parentheses (*, **, and *** denote significance at 10%, 5%, and 1% levels, respectively).

Table A2: Impact of mining collapse on annual total stock return[14]

	Dependent variable: Annual total stock return					
	(a)	(b)	(c)	(d)	(e)	(f)
Constant	0.300***	0.103	0.564	0.591	0.744	0.728
	(0.074)	(0.369)	(0.528)	(1.282)	(1.379)	(1.762)
Mining	0.326***	0.338***	0.546***	11.482***	11.455***	16.963***
	(0.106)	(0.111)	(0.161)	(1.854)	(1.856)	(2.743)
Collapse	0.164	0.171	0.129			
	(0.107)	(0.107)	(0.138)			
Mining * Collapse	-0.647***	-0.653***	-0.798***			
	(0.149)	(0.150)	(0.229)			
R&E Index				-0.039	-0.069	0.011
				(0.235)	(0.240)	(0.304)
Mining * R&E Index				-2.092***	-2.086***	-3.071***
				(0.338)	(0.338)	(0.501)
Firm size		0.002	-0.022		0.006	-0.017
		(0.019)	(0.027)		(0.019)	(0.027)
Debt ratio		0.050	-0.395		-0.021	-0.458
		(0.268)	(0.368)		(0.267)	(0.366)
GDP growth			0.093*			0.086*
			(0.048)			(0.048)
Sales growth		5.102	4.449		-3.261	-4.152
		(5.547)	(8.017)		(5.714)	(8.277)
Observations	13,761	13,761	8,151	13,761	13,761	8,151
R-squared	0.0017	0.0018	0.0031	0.0055	0.0056	0.0082

Table A2 presents estimates of equation (1) using annual total stock return (= capital gains yield + dividend yield) as the dependent variable based on DatAnalysis data from 2006 through 2015. 'Mining' dummy is used to distinguish between mining companies (the treatment group with an assigned value of 1) and all other non-mining companies excluding financial firms (the control group with an assigned value of 0). 'Collapse' dummy is assigned a value of 0 for years from 2006 through 2010 (the pre-collapse period) and a value of 1 for years from 2011 through 2015 (the post-collapse period). R&E Index is the resources and energy annual export unit value index which has been lagged by one period and the values are in natural logarithm format. Column (a) shows the basic DID effect whereas columns (b) and (c) show us DID effect when considering firm-level and economy-level control variables. Similarly, column (d) shows us results of alternative DID using a continuous variable in basic form while columns (e) and (f) with control variables. Standard errors are shown in parentheses (*, **, and *** denote significance at 10%, 5%, and 1% levels, respectively).

[14] Annual total stock return has been measured as the sum of capital gains yield (=annual stock price change) and dividend yield.

Table A3: Impact of mining collapse on cost of debt[15]

	Dependent variable: Cost of debt					
	(a)	(b)	(c)	(d)	(e)	(f)
Constant	0.242***	0.772***	0.902***	0.735	1.288**	1.458***
	(0.027)	(0.153)	(0.168)	(0.476)	(0.517)	(0.537)
Mining	0.027	-0.088*	-0.052	-2.181***	-2.631***	-3.172***
	(0.046)	(0.046)	(0.055)	(0.796)	(0.786)	(0.932)
Collapse	-0.018	-0.041	-0.029			
	(0.040)	(0.040)	(0.041)			
Mining * Collapse	0.217***	0.273***	0.328***			
	(0.066)	(0.065)	(0.078)			
R&E Index				-0.092	-0.099	-0.107
				(0.087)	(0.089)	(0.092)
Mining * R&E Index				0.424***	0.490***	0.601***
				(0.145)	(0.144)	(0.170)
Firm size		-0.016**	-0.024***		-0.017**	-0.024***
		(0.007)	(0.008)		(0.007)	(0.008)
Debt ratio		-1.273***	-1.277***		-1.260***	-1.271***
		(0.097)	(0.110)		(0.097)	(0.110)
GDP growth			-0.019			-0.019
			(0.017)			(0.017)
Sales growth		2.439	3.003		2.672	3.076
		(2.329)	(2.568)		(2.422)	(2.665)
Observations	7,215	7,215	5,618	7,215	7,215	5,618
R-squared	0.0045	0.0322	0.0367	0.0038	0.0311	0.0354

Table A3 presents estimates of equation (1) using cost of debt (= interest expense / total debt) as the dependent variable based on DatAnalysis data from 2006 through 2015. 'Mining' dummy is used to distinguish between mining companies (the treatment group with an assigned value of 1) and all other non-mining companies excluding financial firms (the control group with an assigned value of 0). 'Collapse' dummy is assigned a value of 0 for years from 2006 through 2010 (the pre-collapse period) and a value of 1 for years from 2011 through 2015 (the post-collapse period). R&E Index is the resources and energy annual export unit value index which has been lagged by one period and the values are in natural logarithm format. Column (a) shows the basic DID effect whereas columns (b) and (c) show us DID effect when considering firm-level and economy-level control variables. Similarly, column (d) shows us results of alternative DID using a continuous variable in basic form while columns (e) and (f) with control variables. Standard errors are shown in parentheses (*, **, and *** denote significance at 10%, 5%, and 1% levels, respectively).

[15] Cost of debt has been measured as interest expense divided by total debt for that year (instead of average total debt of current year and the previous year, that we have used as the definition for cost of debt in our thesis). This alternative measurement has been used to check robustness of the results found using earlier definition for cost of debt.