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RESEARCH REPORT

18 SEPTEMBER 2018

Capital Structure Determinants for Mining Firms in Sub-Saharan Africa

Report submitted in partial fulfilment of the requirements for the degree of

Master of Management in Finance and Investment

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ABSTRACT

We use static and dynamic panel data models to determine the capital structure determinants for mining firms in Sub Saharan Africa. Our sample of 50 mining firms was divided into non-cross listed firms and firms cross listed on international stock exchanges. Estimation methods which were used for the static models include OLS, FE and RE. For the dynamic model, modern estimation techniques such as sys-GMM were used. Using various measures of leverage, we find that tangibility of assets, firm size, growth prospects, profitability and non-debt tax shields are significant determinants of leverage. We find strong evidence that the Pecking Order Theory also exists for mining firms. Lagged leverage is a significant determinant of capital structure, suggesting that mining firms do indeed adjust their leverage towards an optimal capital structure. Our results show that there are differences in capital structure behaviour between non-cross listed and cross listed mining firms. Where the biggest differences are in financing strategies with regards to short-term debt. We find that non-cross listed firms use more short-term debt than cross listed firms. The impact of the commodity price cycle on capital structure was also investigated. The commodity price cycle is an insignificant determinant of leverage. However, mining firms will issue more debt when the commodity prices are in a boom cycle.

DECLARATION

I, Zamahlobo Ntombela declare that this research report is my original work. This research report is submitted in partial fulfilment of the requirements for the degree of Master of Management in Finance and Investment at the University of Witwatersrand. This research report has not been submitted before, for another degree in any university.

Zamahlobo Ntombela	**Date**

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1. INTRODUCTION

1.1 Background of the Study

Sub-Saharan African ("SSA") economies are endowed with an abundance of natural resources. The SSA region hosts approximately 30% of the world's total mineral reserve and currently produces approximately 60 metal and mining products (African Development Bank, 2012). SSA is regarded to have the highest percentage of the global deposits when it comes minerals such as diamonds, platinum, manganese, cobalt and gold. Table 1 below shows the commodities in which SSA countries are amongst the top 10 global producers.

Table 1.Global ranking by production, (*World Atlas, 2017)*

Mineral	Country	Rank
Manganese	South Africa	1
Vanadium	South Africa	1
Cobalt	Democratic Republic of Congo	1
Diamond	Botswana	2
Gold	South Africa	2
Nickel	Botswana	2
Platinum	Zimbabwe	3
Copper	Democratic Republic of Congo	5
Coal	South Africa	7
Iron Ore	South Africa	7

These materials are raw material inputs for downstream industries such as power generation, steel and infrastructure, automotive and transport, electrical appliances, electronics, petroleum, and jewellery. Thus, these minerals are essential for global economic growth, and maintaining and improving standards of living of the global population.

The mining sector can contribute positively to the local economy of the producing country. Firstly, it creates employment and improves the skills of labour force. In South Africa the mining industry employs 6% of all the employed people (Chamber of Mines of South Africa, 2017). Secondly, it facilitates the growth of mining related services businesses and development of downstream businesses. Finally, the mining industry can be a catalyst for technology and research and development.

Almost 40% of countries in SSA generate more than 75% of their export earnings from mineral products (African Development Bank Group, 2017). According to the World Bank Group (2017) commodity prices increased by approximately 20% per annum between 2004 and 2011. In the same period, there was an average 2.7% per annum growth rate in SSA's GDP per capita (UNDP, 2016). With such an industry having a big impact on SSA's economy, it is

important to understand how to finance mining projects, and if SSA is equipped for such financing needs.

According to RFC Corporate Finance Ltd (2001), in the early development of a mining project, the risk and expected returns are at their highest. Therefore, at this stage of the project the cost of capital will be high. This can be financed through venture capital/equity funding. Once the project has gone through the various feasibility stages and a decision has been taken to implement the project, the risk is regarded to be at its lowest. At this point firms will typically use a combination of debt and equity for implementation of the project. Thus, the capital-intensive nature of mining firms needs strong capital markets and financial institutions which can provide debt and equity.

Financial discipline and optimisation of capital structure is an important factor for mining firms if they want to access capital. For example, when it comes to credit ratings agencies, the better the debt management the higher the credit rating. Higher credit ratings can boost investor confidence, promote investment into that firm and reduce the cost of capital. During the recent commodity price bust, many firms were downgraded to junk status (PWC, 2017). As seen from Figure *1* and Figure *2*, mining firms had high corporate debt levels and negative cash flows.

In an attempt to strengthen the balance sheet and boost the capital structure, firms had to pay off debt through cost cutting, thus increasing cash flow from operations, sell assets and minority stake divestments, and issue fresh debt to refinance old debt (PWC, 2017). Due to the efforts mentioned above, the anticipated rebound in commodity prices, and an increase free cash flow. Investor confidence is expected to strengthen, and leverage ratios are forecasted to decline. Consequently mining firms will have better access to capital, and with continued financial discipline can provide excellent returns (Deloitte, 2017; Ernest & Young, 2017).

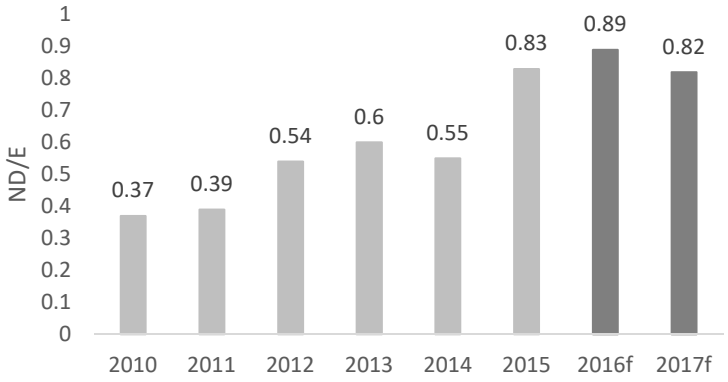


Figure 1. Financial Leverage in the Mining Sector, (*Deloitte, 2017)*

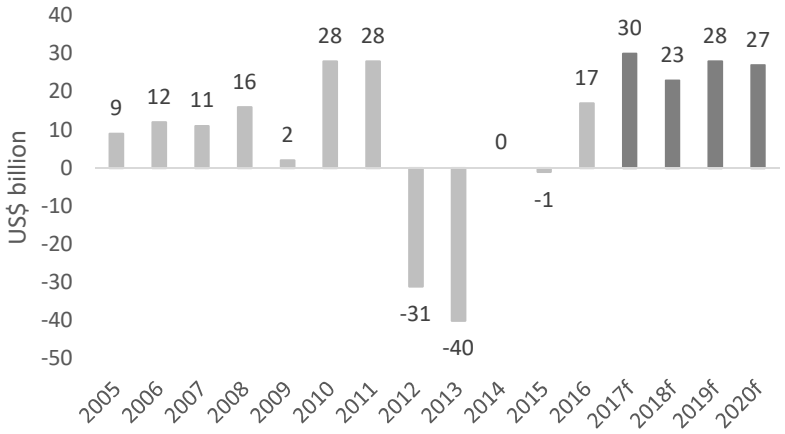


Figure 2. Free Cash Flow of Major Mining Companies, (*Morgan Stanley, 2016)*

The current state of the mining industry and prospects of the industry leads us to the capital structure debate specifically for mining firms operating within SSA. Like most firms, mining firms have the options to finance their operations through debt or equity instruments such as loans, bonds, convertible bonds, initial public offerings ("IPO"), and follow-on equity. Therefore, the choice in capital structure can ultimately affect the value of the firm.

Literature has shown that capital structure models can have predictive power for a firm's capital structure decisions. Factors such as profitability, tangibility of assets, growth prospects, tax shields, business risk and firm size have been found to be significant determinants of leverage (Mittoo & Zhang, 2008; Rajan & Zingales, 1995; Titman & Wessels, 1988; Wald, 1999). These financial variables are the same drivers for capital structure determinants for developed and developing economies (Booth, Aivazian, Demirguc-Kunt, & Maksimovic, 2001). Therefore, capital structure choice is portable between developing and developed economies.

Research on extending the capital structure debate for firms operating in Africa is scant, particularly on an industry level. Booth et al. (2001) found that firms in developing countries are less leveraged than firms in developed economies. Gwatidzo and Ojah (2009) confirmed that leverage levels in Africa are similar to other developing economies such as Brazil, Mexico and Malaysia. In addition, African firms are generally financed internally and if external financing is required, short-term debt is used (Kodongo, Mokoaleli-Mokoteli, & Maina, 2015; Ombati & Ojah, 2016). This suggests that there are institutional differences which can be attributed to the differences in capital structures between firms operating in Africa and in developed economies.

It has been found that capital markets can be a tool which facilitate the transfer of funds from surplus to deficit units, foster the transmission mechanism of monetary policy and enable an environment for robust economic activity (Gwatidzo & Ojah, 2009). Researchers highlighted the importance of an active equity market and a well-developed legal system to foster firm growth (Demirgüç-Kunt & Maksimovic, 1998). This was later emphasised by Booth et al. (2001), the more developed the equity markets, the less debt a firm will use. Ngugi (2008) also noted that although firms in emerging markets seem to follow the pecking order theory, it could be a consequence of market imperfections. In extending the research on financing decision for firms operating in SSA, Ombati and Ojah (2016) stressed that there are distinct differences in capital structure decisions for firms that are financially constrained and firms which are unconstrained. Whereby financially unconstrained firms are firms which would most likely have access to well-functioning capital markets.

Research has shown that where the domestic capital markets lack, firms will cross list their shares on other stock exchanges (Adelegan, 2009). The main reasons cited for cross listing include access to capital markets and stronger investor protection rights on other exchanges (Karolyi, 2006; Temouri, Driffield, & Bhaumik, 2016). Looking at Temouri et al. (2016) data of listed firms from 2006-2013, in South Africa there were a total of 602 firms listed of which 191 were cross listed. This translates to approximately 30% of the firms. It was also found that 20% will list on major exchanges such as New York, London and Hong Kong.

This begs the questions, is there really value in cross listing a mining firm operating in SSA on another exchange, given that the operating risk within SSA is the same? If a firm has exposure to international capital markets, does this have an impact on the financing of the firm? This research hopes to answer these questions such that stakeholders can gain better insight into how to better finance the mining industry.

Recently commodity prices have taken a plunge and have declined by approximately 6% per annum from 2012 to 2016 (World Bank Group, 2017). This significantly affected the ability of mining firms to generate free cash flows, as seen in Figure 2. According to PWC (2017), in the wake of the commodity price boom, mining firms would borrow and invest in building up capacity. At times they would increase production by investing in marginally profitable and expensive projects. When commodity prices started declining by 2012, firms recorded significant impairments of investments that were made at the beginning of the cycle. There was excessive debt relative to asset values and ultimately distress and bankruptcy across the mining sector.

Researchers have argued that the business cycle should be a determinant for default risk (Hackbarth, Miao, & Morellec, 2006). Therefore, it should affect a firm's capital structure

choice. Research has shown that leverage can be countercyclical to business cycles (Hackbarth et al., 2006; Halling, Yu, & Zechner, 2016; Korajczyk et al., 2003). In other words, in a recession firms will opt to use more leverage. It has been found though, in certain instances that financially constrained firms have pro-cyclical leverage dynamics (Korajczyk et al., 2003). Given that Gwatidzo and Ojah (2009) stated that firms in SSA are susceptible to external shocks as they are small, and less diversified compared to other developed economies.

This leads us to believe that due to the commodity price cycles there could possibly be differences in financing behaviour of mining firms dependent on the commodity price. Exposure to international capital markets, there could also lead to differences in financing behaviour between firms that are cross listed and firms that are not.

The market consensus is that the commodity price bust is over and that commodity prices will start picking up again. The World Bank Group (2017) estimates that metals prices will increase by 10.8% in 2017 and a further 0.8% in 2018. The recent swings in commodity prices and the impact they have on mining firms and ultimately the economies of SSA, has reignited discussions on how SSA mining firms can operate as a going concern throughout the commodity price cycles. For mining firms not to repeat the same mistakes, the question is how can mining firms finance their CAPEX projects to increase supply with minimum risk of bankruptcy when commodity prices decline?

At an industry level, Naidu (1986) compared capital structure determinants for various industries in South Africa and Australia. His results show that the relative to the other industries mining firms use the least amount of short-term debt and long-term debt is limited to 10-15%. Islam and Khandaker (2015) analysed the financing behaviour of Australian firms in mining and those in non-mining activities. He found that capital structure choice is driven by profitability, tangibility of assets and firm size. Additionally, mining firms are more sensitive to profitability, whereas non-mining firms are more sensitive to asset tangibility.

The most recent study on capital structure determinants for mining firms, used panel data techniques were used to investigate the capital structure determinants of Latin American mining firms (Gómez, Castro, & Ortega, 2016). The countries included in his study were Mexico, Brazil, Colombia Chile and Peru. In his research he found that tangibility of assets, firm size and profitability and lagged leverage are significant determinants of leverage.

Inspiration was drawn from his study to apply it to firms within SSA. Firstly, this study will be an empirical analysis of the mechanism and determinants for capital structure behaviour and trends over time for mining firms operating within SSA. Secondly, we will attempt to answer how access to capital markets affects a firm's financing decisions. This will be done by

evaluating the financing decisions of firms that are not cross listed relative to those that are. Finally, this study will assess how commodity price booms and busts affect capital structure decisions of mining firms.

1.2 Statement of Problem

SSA is one of the wealthiest regions when it comes to natural resources in the ground and the export revenue generated from mining activity contributes significantly to the local GDP. The recent decline in commodity prices, coupled with declining free cash flows and high leverage ratios had a negative impact on the mining industry. This resulted in some mining firms being financially distressed and ultimately being downgraded by credit ratings agencies (Deloitte, 2017; PWC, 2017). It also negatively affected the economies of resource driven African countries. With the market anticipating a recovery in commodity prices, mining firms must maintain financial discipline to increase shareholder returns. Thus, it is imperative to understand how mining firms can be financed sustainably throughout the cycles.

Much research has been done on the financing decisions of firms operating in developed regions and other developing economies. Like other developing markets, SSA cannot be easily categorised into a banking orientated economy, or a capital market economy as the developed regions. SSA is different from other developing markets in terms of financial development and institutional infrastructure. Not much research has been done in this field specifically for SSA, thus it is important to expand our knowledge in this field.

There is very limited capital structure research which has been done specifically for mining firms operating within SSA region. Firms in SSA are susceptible to external shocks and commodities are generally a volatile industry. With so many SSA economies dependent on commodities, it is important to understand the financing dynamics of mining firms, how capital markets affects capital structure decisions and the impact of commodity price booms and busts.

1.3 Objectives of the Study

The objectives of the study are the following;

I. Ascertain the determinants of capital structure for mining firms in SSA
II. Compare capital structure determinants for mining firms in SSA that are not cross listed to those that are cross listed
III. Analyse the impact of commodity price booms and busts on capital structure decisions

1.4 Research Questions

The research seeks to answer the following questions;

I. What are the drivers for capital structure decisions for mining firms operating in SSA?
II. What is the impact of cross listing a mining firm, on the firm's capital structure decisions?
III. Do commodity price booms and busts have a material impact on a firm's capital structure choice?

1.5 Significance of the Study

This research will unpack the capital structure debate for mining firms specifically operating in SSA. The study will assist entrepreneurs, investors, financial institutions, policy makers and regulators and other relevant stakeholders to gain an insight into what are the relevant capital structure determinants in the context of mining firms operating within SSA.

The study will give mining firms a framework for financial planning through commodity price booms and busts. It will answer some of the industry questions on cross listing and if it is beneficial for mining firms operating within SSA. Financial institutions will have a framework to design financial products which are suitable specifically for mining firms operating in SSA. The research will provide regulators, and policy makers with an insight on how they can intervene in the mining sector to improve access to finance.

2. LITERATURE REVIEW

2.1 Foundations of Capital Structure Theory

Capital structure theory can be defined as the systematic approach of financing a business's activities through a combination of debt and equity. As part of the financial management function of a firm, the capital structure decisions can have an impact on the firm's value. Given that capital comes at a cost, the financial manager needs to determine the most appropriate capital structure for the firm, which will not erode the value of the firm. Capital can either be in the form of debt, equity or a hybrid structure of debt and equity. Debt and equity can come in the form of many types of instruments such as bonds, revolving credit facilities, ordinary and preference shares. Given the number of options available for financing firms, many theories have been developed explaining the determinants of capital structure of a firm.

2.1.1 MM Propositions

Modigliani and Miller (1958) ("MM") proposition I and II laid the foundations for capital structure theory. MM assumed that in a world where the main objective is to maximise the market value of the firm, if a project will raise the market value of a firm, it is worth undertaking. MM's proposition I is that, the value of a levered firm is the same as the value of an unlevered firm. Therefore, the market value of a firm is independent of its capital structure. Proposition II states that the required expected return on equity is a linear function of the firm's debt-to-equity ratio. Therefore, the higher the leverage ratio the higher the cost of equity. MM's theory is plausible under the assumption of perfect market conditions, no taxes and individuals and households can borrow at the same rate as firms.

These theories were criticized for not being applicable in the real world. In reality, corporates must pay taxes and interest is tax deductible. Therefore, Proposition I in a world with taxes states that the value a firm is directly proportional to the debt-to-equity ratio. Post MM's theories several theories developed, such as the static trade off theory, pecking order theory and agency costs theory.

2.1.2 Static Trade Off Theory

MM's propositions imply that a firm can use debt as much as it can, and the firm's value will be maximised. However research has shown that there is a limit to the use of debt arising from many practical issues such as financial distress costs and agency costs (Kraus & Litszeberger, 1972). MM's propositions would still hold assuming perfect capital markets, however in reality the use of excessive debt can lead to bankruptcy. Therefore the firm's value would be affected

by bankruptcy penalties. Myers (1984) amongst other researchers argued that there is an optimal capital structure.

Assuming that the firm's assets and investment plans are held constant, the optimal capital structure is a trade-off between the benefits and costs of borrowing. This is known as the Static Trade-off Hypothesis. Researchers have argued that the optimal capital structure is a balance between the tax advantage of debt and the various leverage related costs such as the cost of financial distress. Costs related to financial distress include administration costs, legal and agency costs. A firm which is close to bankruptcy will also incur indirect bankruptcy costs such as a decrease in profits because of people not wanting to do business with them (Titman & Wessels, 1988). Myers (1984) further stated that there are two implications of financial distress costs;

1. Holding all things constant, risky firms will use debt less. This is due to risky firms having a higher probability of defaulting. Therefore, a safe firm which is not threatened by financial distress or has not defaulted, will have more capacity to use debt.
2. There is an inverse relationship between the use of debt and the tangibility of assets. A firm with tangible assets will use debt less than a firm which has specialised, intangible assets and growth opportunities. Therefore, the expected cost of financial distress is also dependent on the value which will be lost should the firm be bankrupt.

The optimal capital structure debate primarily centres around, how significant is the value of the tax benefit and do the leverage related costs have a material effect. Ideally the Static Trade-off Theory, suggests that firms have an optimal debt ratio which they work towards and try to maintain. It also suggests that larger firm will most likely be more diversified therefore the probability of financial distress is lower. Since bankruptcy costs are low, the firm has more capacity to take on more debt.

Research on the static trade off theory generally yields low R^2 values (Myers, 1984). Therefore not much reliance has been placed on the theory, as the explanatory power of the empirical models is weak. Chen (2004) pointed out that the static trade off theory fails to explain the stock market's reaction to when a firm announces a transaction which will affect leverage. The static trade off theory though, does give a plausible explanation as to why firms would moderate their use of debt.

2.1.3 Pecking Order Theory

The Pecking Order Theory contradicts the Static Trade-off theory, in that it suggests that there is no optimal capital structure for a firm. Instead the capital structure is a consequence of the firm's requirement for the use of external financing. In Donaldson (1961) chapter about

management's attitude to non-debt sources of financing. He observed that management generally leaned towards internal financing before considering external financing. The only time a firm would use external financing, is if the firm absolutely needed to use external finance due to unforeseen circumstances.

Empirical evidence has shown that common stock issues result in the highest negative returns relative to other securities such as bonds and preferred stock (Smith, 1986). Reasons which he suggested for this market behaviour are;

1. A change in the optimal capital structure of a firm, also reflects the new value of the firm.
2. Investors value the firm based on the implied cash flow change.
3. The more unanticipated the announcement of the security issue, the more there will be a shock in the stock price.
4. Information asymmetries, where the investors believe that the stock price is overvalued.
5. The implied changes in the ownership structure.

Myers (1984) argued that capital structure decisions are mainly informed by information asymmetry effects. The general perception is that management of the firms have more information than the investors. Due to this, management issue common stock when the stock is overpriced. Investors will therefore drive the share price down to get a fair value, thus the negative returns. To avoid this, firms will have a pecking order when it comes to issuing securities. According to Myers (1984) the pecking order is as follows;

1. A firm will always use internal financing first.
2. The investment policy is set, and if there is a valuable investment opportunity, the firm will amend their dividend policy such that the firm has financing for the investment.
3. If the internal cash flows are less than the required amount for the investment, the firm will draw down on its cash balance or marketable securities.
4. If all the internal resources have been exhausted, and the firm has no option but to use external finance, the firm will issue the safest security first. This can be debt, then a hybrid security between debt and equity and as the last option equity.

The pecking order theory does not hold for all firms but there is empirical evidence which shows that it exists. Myers (1984) highlighted the following stylized facts about corporate financing behaviour;

1. On average firms will finance their investments using internally generated funds and debt.
2. Firms will time their security issues when security prices are high. There is a higher probability of a firm issuing stock when the stock price has risen compared to when it has dropped.
3. There is a positive relationship between the rate of capital expenditure (in fixed plant and equipment), and level of debt. Firms with valuable intangible assets and growth opportunities will borrow less than firms with tangible assets.
4. Stock prices tend to increase when a firm offers to convert debt into equity, and the stock price falls when they offer to convert equity into debt.
5. Stock prices decrease when a firm offers a stock issue, and stock prices increase when a firm announce a stock repurchase.

Much research has been done on the pecking order theory and it has been found that asymmetric information theories fit empirical data better (Chen, 2004; Myers, 1984).

2.1.4 Corporate Taxes

Following Modigliani and Miller (1958) proposition, the impact of taxes on firm capital structure choice was investigated more thoroughly by DeAngelo and Masulis (1980). His research argued that debt is not the only mechanism a firm can use as a tax shield. There are alternative tax shields such as research and development, depreciation, and investment tax credits. Therefore, firms which have higher investment related tax shields will have little incentive to use debt. DeAngelo and Masulis (1980) had the following hypothesis;

1. Leverage has an impact on firm value.
2. Due to the market prices of debt and equity, the after-tax cash flows are more favourable to debt financing relative to the after-personal tax cash flow.
3. The higher the non-debt tax shields, the lower the leverage.
4. A decrease in the firm's marginal bankruptcy costs will increase the use of leverage.
5. The lower the corporate tax rate, the lower the debt that will be used.

The empirical evidence shows that non debt tax shields are more economically significant relative to debt tax shields. DeAngelo and Masulis (1980) backs this up with data from US based firms from the period of 1964-1973. Despite low levels of bankruptcy rates in this period, 27% of the firms paid no taxes in a given year. This suggests that non-debt tax shield was being used to reduce the taxes paid. Additionally, firm leverage differs across industries but is consistent between firms within an industry. It was found that firms in the Drugs, Mining and Oil Industries generally have low leverage ratios. DeAngelo and Masulis (1980) suggest that

the reason for this is firms in these industries receive tax incentives, which increase their non-debt tax shields. Tax incentives can include research and development costs and depletion allowances for mining and oil companies.

Empirical evidence also supports Modigliani and Miller (1958) theory, that in a world with taxes leverage has an impact on firm value. Finally, there is evidence to suggest that there is a positive relationship between corporate tax rates and leverage.

In conclusion DeAngelo and Masulis (1980) research was important in highlighting that debt is not the only tax shield which is considered by firms. There are non-debt tax shields which can be used as substitutes for debt, therefore contradicting the Modigliani and Miller (1958) theory. (DeAngelo & Masulis, 1980) research though was criticised for the difficulty of finding accurate proxies which measure non-debt tax shields (a. Antoniou, Guney, & Paudyal, 2006; Titman & Wessels, 1988).

2.1.5 Agency Cost

In most firms, management act as the agents for the shareholders. The shareholder's trust that the managers will run the firm in the best interest of the shareholders. However this relationship is troubled with conflicts of interest. Jensen (1986) defined agency theory as the analysis of such conflicts and his paper focused on how firms can minimise agency costs and conflicts.

Dividend pay outs to shareholders reduce the resources under management's control, therefore management has less power. In the case of high growth firms, there are more resources under management's control, therefore giving more power to management. Competition in product and factor markets can drive prices down to the average cost of making a product. Therefore managers have to drive efficiencies and productivity to ensure the survival of the firm (Jensen, 1986).

Free cash flows are also a major source of conflict between shareholders and management. Surplus free cash flows post the investment in projects cause conflict as to how much pay-out the shareholders should get. Management tends to use the free cash flows to invest in projects which are below the cost of capital, or wasting it on organization inefficiencies. Jensen (1986) suggests that the use of debt can be a way to reduce the agency cost of free cash flows. This is because debt is an obligation, and management must be motivated to find innovative ways to make sure they repay the debt. If managers would like to raise more debt at a good price, they would need a good credit rating score.

In summary it can be said that the foundations of capital structure theory are also valid for mining firms. It is important to understand the drivers of financing decisions for mining firms as they can ultimately determine the value of the firm. Mining firms have the option to finance their projects through various equity and debt instruments. Their financing decisions can either follow the Static Trade-Off Theory or the Pecking Order. It has been seen that mining firms tend to maintain low leverage ratios (DeAngelo & Masulis, 1980). This is because they benefit more from non-debt tax shields such as depreciation and other tax incentives.

It can also be assumed that sustained levels of high commodity prices also can stimulate management to invest in projects which are not in the best interest of the shareholders. A substantial increase in free cash flows, could stimulate investment in "white elephant" projects. Whereby the high cost impact, is only truly realised in a commodity price bust. Management of mining firms need proper incentives, to maximise the value of the firm when commodity prices are high and to run financially sustainable mining operations even at low commodity prices.

2.2 Modern Research on Capital Structure Theory

Capital structure theory is criticised in that, it has not as developed as asset pricing models and capital market theories. Thus, Barclay and Smith (2005) analysed capital structure theory and the empirical evidence. The main criticism of capital structure theory is that it is more qualitative than quantitative. The theories are not mutually exclusive therefore, different theories will have different outcomes. Some of the variables of capital structure theory are difficult to measure i.e. signalling/information asymmetry effects, non-debt tax shields. According to Barclay and Smith (2005) currently capital structure theory is unable to answer the capital structure debate. However, the trade-off between debt and equity can be used in decision making processes for corporate managers.

2.2.1 International Capital Structure Theory

Prior to Titman and Wessels (1988), capital structure theory empirical studies had been estimated using regressions with proxies for unobservable theoretical attributes. The problem identified with this method, is that there are no unique attributes for what one wants to measure. Often the attributes are related, thus making it difficult to get proxies that isolate the attributes which are of interest. This results in variables that are not representative of the attributes. In using these variables in a regression, one tends to get error-in-variable problems. There may be a correlation between the measurement errors in the proxy variables and the measurement errors in the dependent variable, therefore creating spurious correlation. Titman

and Wessels (1988) used liner structural modelling techniques to overcome the challenges of previous empirical research.

Titman and Wessels (1988) found that firms with unique, or highly specialized products use less debt. Smaller firms use more short-term debt relative to large firms. Variables such as expected growth, non-debt tax shields, volatility or collateral value of assets are statistically insignificant when predicting a firm's leverage ratio. What was interesting in his research is that the more profitable the firm, the less debt which it uses. This research is consistent with the Pecking Order Theory, that firms will use internal resources before external financing. Titman and Wessels (1988) suggested that the variables which were not statically significant could be because of the proxies used for the independent variable. More research should be done in experimenting with different proxies which adequately represent the attributes.

Most of the capital structure research before Rajan and Zingales (1995), was based on data for firms in the United States of America ("US"). Rajan and Zingales (1995) focused his research on the G-7 countries which included the US, Canada, Germany, United Kingdom ("UK"), France, Italy and Japan. Although his research was for countries which have the same level of economic development, it highlighted the importance of country specific institutional factors which may affect firm's capital structure decisions. In using more detailed measures, and comparable calculations of leverage, Rajan and Zingales (1995) was able to come to conclusions which were different from earlier research.

In his research he found that depending on the measure of leverage that was used, different countries would show different levels of leverage. Therefore, demonstrating the importance of using the right measure of leverage for empirical analysis, depending on what the researcher wants to analyse. UK and Germany tend to have lower usage of debt and the other countries are relatively the same. It is believed that the power of the banking sector influences the capital structure decisions. However, in Rajan and Zingales (1995) research this was not the case, as Japan and the US have different institutions and the US and the UK have similar capital markets. Thus, demonstrating that economic factors underlying the independent variables may play a role in capital structure choice.

Rajan and Zingales (1995) also analysed the influence of macroeconomic factors on leverage decision. He demonstrated that institutional factors such as the effective tax rate, bankruptcy laws, the power of the banking sector and the size of the capital markets and patterns of ownership may have an influence on the capital structure choice. In his analysis Rajan and Zingales (1995) observed trends between these factors and capital structure decisions and

implied that there is relationship. Thus, further research and empirical evidence needed to be done in this field to determine if these factors are statistically significant.

At a firm level analysis, Rajan and Zingales (1995) focused on tangibility of assets, growth, firm size, and profitability as independent variables. Firstly, tangibility of assets is always positively correlated, but the coefficients were similar throughout the sample. This contradicted financial theory as it is expected that in bank orientated countries, tangibility of assets should matter less. Secondly, growth is negatively correlated to leverage. Rajan and Zingales (1995) implies that the reason for this could be that firm's issue more equity when the share price is high relative to the book value. Since the issuance of equity securities is timed, the firm can temporarily have low leverage ratios at the time of issue. Thirdly, size is positively correlated except for Germany and France. However, there was no conclusive evidence as to why this is the case. Lastly, profitability is negatively correlated, whereby the relationship is stronger for larger firms than for smaller firms. The explanatory power of these variables ranges from 5-30%, suggesting a weak relationship. Therefore, more accurate proxies are required, and this could be done with more data.

Similar to Rajan and Zingales (1995), Wald (1999) compared capital structure decisions for firms in France, Germany, Japan, UK and the US. However, his research was focused on understanding how institutional differences, and capital markets can affect a firm's capital structure choice. In his research he included variables such as earnings risk, non-debt tax shields, firm size and growth. Wald (1999) investigated long-term debt for firms over a 5-year period (1993-1998). Instead of using the classical linear regression model he used a heteroskedastic tobit estimator.

He found that firms in Japan, UK and France were using more debt even though they were riskier based on volatile earnings. The reason for this could be lower financial distress costs or agency problems. Tangibility of assets was positively correlated to debt for all the countries. Non-debt tax shields were also measured as the depreciation to total assets and he found that there was a negative correlation. This is consistent with DeAngelo and Masulis (1980) theory. Profitability is negatively correlated to leverage for all the countries with Japan and US having the largest coefficients in magnitude. This suggests that the pecking order theory as described by Myers (1984) is relevant. According to Wald (1999) a lower profitability coefficient suggests that there are institutional factors which reduce information asymmetries, therefore profitability is not such an important determinant.

Growth is positively correlated with debt except for the US. Reasons suggested for this is that in the US the high growth firms are tech firms with easier access to debt and equity. Therefore, highlighting the importance of the industry within a firm operates in. Another reason is that the accounting reporting standards in the US are stricter for equity which implies a lower cost of equity. Therefore, firms with a high growth will use more equity because of the lower cost. His findings also show that the larger the firm the more debt it will use, however this excludes firms in Germany. The reason he suggest is that larger firms use debt to reduce agency costs, as per the Jensen (1986) theory. This is not the case for Germany as large institutional investors control most of the firms. Therefore, they have better control of management.

Similar to Rajan and Zingales (1995) research, Wald (1999) implied relationships between institutional factors and leverage. More research needed to be done on the direct relationship between institutional factors in different countries, and the differences in leverage determinants.

Consequently researchers analysed the determinant's of capital structure for market oriented economies (UK and the US) and bank oriented economies (France, Germany, and Japan) (a. Antoniou et al., 2006). Panel data and a two-step sys-Gmm model was used to study the relationship between market leverage, firm level and country level variables.

The results show that market-oriented economies have lower leverage ratios. This could be due to a fragmented ownership structure, thus not having close ties with banking institutions. In pooling all the data from the different countries, it is seen that profitability, growth opportunities and the effective tax rate are negatively correlated to leverage. He also finds that non-debt tax shields are positively correlated to leverage, this is similar to Titman and Wessels (1988). Tangibility of assets and firm size are also statistically significant and positively correlated to leverage.

In analysing each country separately, it was seen that the magnitude of the coefficient of the profitability variable differs for each country, and it is the highest for the US. These results are consistent with Wald (1999). This can be attributed to country specific factors. Growth is negatively correlated and statistically insignificant in the US. The negative relationship is attributed to higher financial distress costs in higher growth firms. Tangibility of assets is statistically significant and has a positive correlation to debt. However, the market orientated countries have a smaller coefficient. This suggest that collateral is not that significant in market orientated counties, and this could be due to an arm's length relationship with the lenders. The size of the firm is statistically significant, and it has a positive relationship with debt except with

the US. There is a negative relationship with non-debt tax shields and leverage for all the countries except France.

The lagged leverage dependent variable is statistically significant and has a positive correlation. This suggests that there is an optimal capital structure for the firms. There is also an increase in the explanatory power of the model when the lagged dependent variable is added. A. Antoniou et al. (2008) suggest that the speed of adjustment for firms is dependent on the institutional factors and corporate governance systems. This is evident by Germany and Japan having the lowest speed of adjustment. Firms operating in these countries have a close relationship with creditors and information asymmetries are low. Therefore, they do not need to maintain a capital structure to signal a healthy firm to stakeholders.

A. Antoniou et al. (2008) concluded by stating that the firm's capital structure choice is not only influenced by firm level factors, but also by the institutional factors which the firm operates in (Rajan & Zingales, 1995; Wald, 1999). These researchers highlighted the importance of accurate proxies for firm level and country specific factors which influence capital structure choice. Various models were used over the years to explain capital structure determinants. The limitations of their research, is that it compared countries of similar economic development. Booth et al. (2001) further explored the capital structure debate by using firm level data, to compare capital structure determinants of developing countries to developed countries.

Booth et al. (2001) focused on the question, can the stylized facts about capital structure determinants be extended to developing economies? His research though was limited by data, as reporting systems in developing countries were not as sophisticated as developed countries. Booth et al. (2001) compared the results he obtained from developing countries to Rajan and Zingales (1995) research.

In his research he found that the aggregate debt levels of developing countries were generally lower than the G-7 countries, ranging from 30% in Brazil to 73% in South Korea the most developed country out of the sample. South Korea is also the exception with debt ratios similar to G-7 countries. Developing countries are also found to have much lower levels of long-term debt, which is consistent with previous research done by Demirgüç-Kunt & Maksimovic (1998).

Booth et al. (2001) also analysed the nature of the macroeconomic, financial sector, and capital markets in each country. In analysing the structure of the capital markets, Booth et al. (2001) found that the sample firms had a strong presence in the local capital markets. The

most active markets were found to be South Korea, Thailand and Zimbabwe. Pakistan and Turkey had the least active markets. His data shows that the financial sector is not liberalised, as there is still evidence extensive government ownership and regulation. Therefore, relative to developed nations, developing markets cannot be easily categorised into banking orientated economies. Due to the diverse nature of the macro-economy, banking sector and capital markets, Booth et al. (2001) found that there were no clear relationships between these factors and capital structure choice.

Although not statistically significant, the results of the OLS regression from the pooled regression show that there is a negative correlation between debt and equity market capitalization, and a positive relationship with liquid liabilities to GDP. Therefore, the more developed the equity market, firms will use less debt and the more developed the banking sector the more debt firm's use. The results also indicate that the higher the tax advantage of using debt the higher the debt. In his concluding remarks Booth et al. (2001) states that although other macroeconomic factors such as, real GDP growth and inflation have an influence on capital structure determinants. The explanatory powers of these variables are weak (R^2 of 25-28%). Therefore, more research needs to be done in this field to test other variables.

In assessing the firm level variables, Booth et al. (2001) used three different measures of firm leverage (total debt, long-term book debt ratio, long-term market-debt ratio). Average tax rate return on assets, tangibility of assets, size, business risk, and growth were the independent variables. Instead of using a pooled regression model, or aggregates like previous research, Booth et al. (2001) opted to use a fixed effects model which is more accurate model. Previous research had shown that there are country specific factors which influence the capital structure decisions and there were no proxies to measure these effects. The fixed effects model allows for the intercept to vary across firms and/or time, therefore capturing the effects of omitted variables. Booth et al. (2001) found that by using the fixed effects model, the R^2 was higher compared to the simple pooled regression. Thus, suggesting that the fixed effects model has better explanatory power.

Booth et al. (2001) found that the coefficients of the independent variables vary in sign and in magnitude across the different countries and depend on the estimation model used. The most consistent variable was profitability, it was consistently negative and significant. This confirms Myers (1984) pecking order theory and Rajan and Zingales (1995) empirical research. Booth et al. (2001) attributes this relationship to significant agency and information asymmetry problems and under development of the long-term bond markets in developing countries.

Tangibility of assets is negatively correlated with leverage ratios, however this decreases when the total debt ratio is used as a measure of leverage. Booth et al. (2001) suggests that this result is consistent with the static trade-off theory with regards to financial distress, and the pecking order theory with regards to information asymmetry costs.

Following research by Booth et al. (2001), more recent capital structure research was done on an international scale (de Jong, Kabir, & Nguyen, 2008). The objective of the research was to analyse firm specific factors and direct country-level factors on a more global scale. Thus, capital structure choice was analysed for approximately 42 countries.

de Jong et al. (2008) used panel data covering the period 1997-2001 and an OLS regression model to analyse determinant of long-term debt. It was found that industrialised economies such as Australia and Germany have low debt ratios (less than 10%) and developing counties such as Argentina and India have higher debt ratios (15%). Consistent with previous literature, tangibility of assets and firm size is positive and statistically significant for most countries. In only 50% of the countries is growth significant and has a negative relationship to leverage. This result is consistent with agency theory, where high growth firms use less debt to limit wealth to shareholders instead of creditors. Profitability is negatively correlated and significant for more than 50% of the countries, this suggests that the pecking order theory is followed globally. As for the country level factors, he found that the GDP growth rate, investor rights protection and the bond market development are statistically significant factors.

Subsequently, Mittoo and Zhang (2008) extended the research to compare capital structure determinants for Multinational companies (MNC) in Canada relative to Domestic companies (DC). It was found that Canadian MNC's which have access to international bond markets will have 8%-point higher leverage ratios relative to firms which do not have access. Therefore, MNC's generally have higher total debt and long-term debt relative to DC's. Similarly to research by Naidu, (1986), resources firms have the lowest debt ratios relative to the other industries. Using a Fixed Effects Model, he finds that size and tangibility of assets are positive and statistically significant. Growth prospects, non-debt tax shields and risk are significant and negatively correlated to debt. However, most of the independent variables were statistically insignificant for short-term debt. Mittoo and Zhang (2008) were able to demonstrate that having access to international capital markets can have an impact on a firm's capital structure choice.

In conclusion, capital structure research on an international scale shows us that the determinants of leverage are portable between firms operating in developing or developed

economies (Booth et al., 2001). However, the sign of the coefficient and the level of significance will differ for several variables. Modern estimation techniques such as the Fixed Effects and Random Effects improved the explanatory power of capital structure models. The determinants of leverage are tangibility of assets, firm size, profitability, business risk, growth and the average tax rate. Research has also shown that firm specific determinants of capital structure are more informative than the country specific variables.

2.2.2 Sub Saharan Africa Capital Structure Theory

Although Booth et al. (2001) research focused on developing countries, only Zimbabwe is located within Sub-Saharan Africa. Very little research has been conducted in trying to understand capital structure determinants for firms operating in SSA. According to Gwatidzo and Ojah (2009) the institutional infrastructure in countries in Africa is different to developed markets, the legal environment in terms of property rights and investor protection is also lagging behind. Therefore, capital structure determinants for firms within SAA, could be different from other emerging or developing economies.

Subsequently, several researchers have attempted to unpack the capital structure debate specifically for firms operating in SSA. Abor and Biekpe (2005) researched the capital structure decisions for listed firms in Ghana over a 6-year period (1998-2003). The research methodology followed the traditional pooled OLS regression estimation methods. Leverage was the dependent variable, with firm size, asset tangibility, profitability, growth, corporate tax and business risk as the independent variables.

The results show that the mean debt ratio for firms operating in Ghana is 0.5850. There is a statistically significant and positive relationship between firm size and leverage. Asset tangibility is negatively correlated to leverage, this finding similar to Booth et al. (2001) for developing countries. A reason suggested for this by Abor and Biekpe (2005) is that firms with more tangible assets have a higher operational risk, thus do not want to increase their financial risk by adding more debt. In addition, these firms tend to be listed; therefore, they are exposed to equity markets. Profitability is negatively correlated which is line with most empirical studies and the pecking order theory. High risk firms tend to use less debt to moderate their financial risk. High growth firms use more debt to finance their growth activities. This is consistent with Booth et al. (2001). Corporate tax rate and leverage are negatively correlated, and this is contradicts Modigliani and Miller (1958) theory. A possible reason suggested by Abor and Biekpe (2005) is that listed firms in Ghana enjoy tax rebates, therefore firms prefer equity funding.

Research on capital financing behaviour for listed firms in Kenya was conducted by Ngugi (2008) over a 9 year period (1990-1999). Using a static model, he found that tax rates, growth, tangibility of assets and profitability were statistically insignificant but were the expected signs. A dynamic model shows that the adjustment speed is 0.7011. According to Ngugi (2008) this high adjustment rate is attributed to low debt ratios in Kenya over this period. Therefore, it was easier for firms to adjust their capital structure. It should be noted though that during the period analysed, Kenya was characterized by a sharp increase in interest rates Ngugi (2008). Non-debt tax shields are negatively correlated to leverage. Therefore, Kenyan firms use non-debt tax shields as a substitute for debt tax shields. It was also found that non-debt tax shields are only significant for firms which have a high proportion of tangible assets.

With regards to financial distress and leverage, he found that the higher the change in size for a firm the lower the leverage. Ngugi (2008) suggests that due to a lack of skilled managers, as the size of the firm changes there is a greater need for monitoring thus lower debt. Similar to previous research, profitability is statistically significant and negatively correlated to leverage. This supports the pecking order theory. The market condition factors show that the higher the interest and stock market volatility, the lower the leverage ratio This is expected as high interest rates increase the cost of debt, and a high stock market volatility can be an indicator for an active equity market. GDP and leverage are positively correlated suggesting confidence in the economy (Ngugi, 2008).

Gwatidzo and Ojah (2009) extended the research topic of capital structure determinants to five African countries, Ghana, Kenya, Nigeria, South Africa and Zimbabwe. Using panel data of listed firms Gwatidzo and Ojah (2009) used pooled regression models, fixed effects and random effects models to determine capital structure determinants. The independent variables included profitability, risk, and tangibility of assets, age and corporate tax. The dependent variables were different measures of leverage, total debt, long-term debt and short-term debt. It was found that that African firms use more short-term debt then long-term debt, which is consistent with earlier research and other developing countries (Booth et al., 2001; Demirgüç-Kunt & Maksimovic, 1998). Other results which he found to be specific to SSA countries were;

1. Profitability is only negatively correlated and significant for Ghana, South Africa, and Zimbabwe. Thus following the pecking order theory (Booth et al., 2001; Myers & Majluf, 1984; Rajan & Zingales, 1995).
2. The size of the firm is positively correlated and significant for South Africa and Zimbabwe. This suggests that larger firms can easily raise debt, due to their diversification and low risk nature. Kenya is the opposite in that size is negatively correlated. For Nigeria the results are inconsistent and Ghana it is insignificant.

3. Corporate tax is only significant in Zimbabwe and is positively correlated. Suggesting that MM's propositions are prevalent in Zimbabwe (Modigliani & Miller, 1958).
4. The tangibility of assets is negatively correlated in Ghana and Zimbabwe, which is consistent with research for developing economies (Booth et al., 2001). In the case of Nigeria and South Africa, tangibility of assets is positively correlated leverage. This is consistent with research for developed countries (a. Antoniou et al., 2006; Mittoo & Zhang, 2008; Rajan & Zingales, 1995; Wald, 1999).
5. In the context of this research, age is used as proxy for reputation. There are mixed results in terms of the sign of the coefficients and significance in different countries.

In comparing country specific factors, it was found that Kenyan and Nigerian firms generally have lower debt levels than South Africa. When controlling for country specific institutional factors, it was found that leverage is positively correlated to tangibility and size, and negatively correlated to profitability and age. This is consistent with the pecking order theory. Gwatidzo and Ojah (2009) noted that the variables which are significant, are firm specific variables which could be private market remedies for inadequate institutional infrastructure.

Following Gwatidzo and Ojah (2009), the capital structure debate for SSA was further assessed on a country specific scale. Research by Kodongo et al. (2015) focused on leverage and firm performance for Kenyan firms in the period 2002 through to 2011. The average long-term debt to equity ratio for Kenyan firms was 0.5147, which is similar to that of firms in Ghana (Abor & Biekpe, 2005). The leverage ratio increases to 0.847 for short-term debt, which is similar to Gwatidzo and Ojah (2009) for firms operating in SSA. Reasons suggested for this financing behaviour is due to long-term debt financing not being easily accessible in SSA capital markets, or the high costs associated with long-term financing (Ombati & Ojah, 2016).

Kodongo et al. (2015) research was different in that leverage was used as an independent variable, and profitability as a dependent variable. The results show that there is negative relationship between profitability and leverage. The leverage variables are statistically significant for total debt to equity and long-term debt to equity ratios. The results imply that the more debt a firm uses the more the profitability is eroded. In addition, Kodongo et al. (2015) investigated the relationship between firm value and capital structure, where Tobin's Q was used as a proxy for a firm's value. Although there is a negative relationship between firm value and capital structure, the coefficients are statistically insignificant. These findings are consistent with Modigliani and Miller (1958) capital structure irrelevance theory.

The negative and significant relationship between leverage and profitability is consistent for small and large firms. For larger firms, leverage is only significant for long-term debt. The sign for profitability is consistent on all the models, which suggests that there could be high costs associated with long-term debt, resulting in Kenyan firms using more equity for funding (Kodongo et al., 2015).

2.2.3 Industry Specific Capital Structure Theory

In attempting to narrow the capital structure research down from country specific to industry specific dynamics, Naidu (1986) focused on capital structure choices for Australian and South African firms. His sample was segmented to highlight the differences in capital structure strategies for different industries in South Africa and Australia.

He found that in both countries, the mining sector debt usage is less than 40%. Whilst for other industries such as the paper industry it was higher than 50%. This is consistent with DeAngelo and Masulis (1980) research for leverage ratios within the mining sector. In SA the differences in leverage between industries is statistically insignificant. Given the low industry diversification in SA, the probability of different industries maintaining a similar capital structure strategy is highly probable (Naidu, 1986). In addition, capital structure policies could be similar across industries due to the high presence of institutional investors. Naidu (1986) research was key to understanding that there are differences in capital structure strategies for different industries.

In analysing the sample for short-term debt financing dynamics, Naidu (1986) found that relative to the other industries, mining firms in Australia use the least amount short-term debt. This is approximately 15% compared to more than 20% for other industries. South African mining firms also use the least amount of short-term debt, on average it is 20% whereas for the other industries it is more than 25%. In his findings Naidu (1986) highlights that due to the cyclical nature of the mining industry, firms limit their long-term debt to approximately 10-15% of total assets. Short-term debt usage between different industries is statistically significant for both SA and Australia. Unlike long-term debt, where there were no differences found in financing behaviour between different industries in SA, there are distinct differences when it comes to short-term debt financing. The reason for this could be the working capital nature of different industries Naidu (1986)

Naidu (1986) research had the limitation that the sample period was from 1980 to 1982. It was later seen in research that there are significant differences between capital structure choice in SA pre and post financial liberalisation (Chipeta, Wolmarans, & Vermaak, 2012). Naidu (1986)

research would fall under the pre-liberalisation regime. Therefore, these findings could no longer be valid for SA mining firms. Another limitation is that panel data techniques were not used, and results were presented as a cross sectional analysis per annum.

Islam and Khandaker (2015) extended capital structure research for mining firms by applying modern analytical techniques. As shown in previous research, firm leverage decisions can be a result of the industry in which a firm operates. It is common for an industry to have an optimal capital structure and in assessing the risk of the firm one compares it to the industry average capital structure. Islam and Khandaker (2015) studied firm leverage decisions for listed Australian firms across different industries. The sample was divided between mining firms and other industries (non-mining) for the period 2000-2012.

Using a Fixed Effects model, he demonstrated that the main variables determining capital structure choice are profitability, tangibility of assets and firm size. Firstly, tangibility of assets is statically significant and positive for mining firms. Therefore, the more assets in the firm the more leveraged the firm will be. This result is inconsistent with the results found for firms operating in developing countries (Abor & Biekpe, 2005; Booth et al., 2001; Gwatidzo & Ojah, 2009). However, it is also is consistent with firms operating in developed countries (a. Antoniou et al., 2006; Mittoo & Zhang, 2008; Rajan & Zingales, 1995; Wald, 1999), and for South African and Nigerian firms (Gwatidzo & Ojah, 2009). In contrast tangibility of assets is insignificant for non-mining firms.

Secondly, equity issues are lower for firms with high leverage. This suggests that there is a preference to use debt when it comes to external financing. Profitability is significant and negatively correlated to leverage for mining firms, whereas for non-mining firms it is positive. Therefore mining companies tend to follow the pecking order theory. Islam and Khandaker (2015) suggests that the pecking order theory is largely driven by the growth opportunities of the firm.

In applying the dummy variable approach to test for statistically significant differences in coefficients for mining and non-mining firms Islam and Khandaker (2015) was able to show that there significant differences between industries. His results show that mining firms are more sensitive to profitability, whereas non-mining firms are more sensitive to asset tangibility.

Rather than comparing the mining industry to other industries, Gómez et al. (2016) conducted a study specifically for mining firms operating in Latin America. The countries investigated

included Mexico, Brazil, Colombia Chile and Peru. The summary statistics show that are different levels of debt between the countries, where Colombian firms have the lowest level of debt.

Using a static fixed effects model, the results show that tangibility, size and profit are negatively related to leverage, and growth is statistically insignificant. The results for tangibility of assets contradict Islam & Khandaker (2015) research for Australian mining firms. Empirical research has shown that tangibility of assets tends to be positive for developed economies. Gómez et al (2016) study is similar to results for developing economies, where tangibility of assets is negatively correlated to leverage. The Latin American countries which Gómez et al. (2016) are also regarded as developing economies. This suggests that tangibility of assets may not be a function of firm level factors but rather a factor of the underlying economy. The most robust variable which was consistent for all the firms and was statistically significant in all the countries is profitability. This is consistent with most empirical research.

Using a sys-GMM dynamic model, the lagged leverage variable is statistically significant, and the coefficient is high. This suggests that the higher the debt levels in a firm, the higher the likelihood that they will use more debt. In this model, size and growth were found to be insignificant. Tangibility of assets is statistically significant with a positive relationship to leverage. This contradicts the results from the static model.

With all the different estimation models that were applied, the profitability coefficient kept the same sign and level of significance. This is consistent with the pecking order theory, and previous empirical studies. This suggests that despite whether a firm is in a developing or developed economy and despite the industry in which it operates, profitability is a key determinant for capital structure decisions.

It has been seen from earlier research that capital structure theory is indeed portable between the developed and developing countries (Booth et al., 2001). Although the determinants of capital structure can differ in magnitude and signs for different countries, they have similar variables which are statistically significant. The empirical analysis methods have evolved from using pooled regression techniques to more accurate models such as Fixed Effects, Random Effects and dynamic sys-GMM models. The empirical evidence shows that firm specific variables such as tangibility of assets, growth, firm size, age, profitability are important determinants of capital structure. Profitability has been the most consistent variable in explain financing decisions, thus firms seem to follow the pecking order theory as proposed by Myers (1984). On the other hand, macroeconomic variables such as tax, market capitalisation, GDP have generally been weak determinants of capital structure. Some authors have attributed this weak relationship to the proxies used as macroeconomic variables.

Specifically, to note for firms within SSA is that capital structure decisions are similar to other developing regions. We also find that within SSA there are significant differences in financing patterns between long-term and short-term debt. Finally, capital structure research for mining firms is rare. What we do know is capital structure theory is also portable to mining firms. Mining firms generally have low leverage values and significant leverage factors include profitability, tangibility of assets and firm size. Currently what we do know about the mining sector's financing behaviour is limited, especially for firms operating within SSA. Therefore, there is a need to expand on the existing literature, such that we can develop a capital structure framework specifically for mining firms in SSA.

2.3 Cross Listing of Firms and Capital Structure

Given the modern literature on capital structure theory, empirical evidence has demonstrated that most firms conform to the pecking order theory when it comes to financing decisions. To reiterate the pecking order theory states that a firm will use internal funds to finance its investments and only when the internal funds have been exhausted, will a firm use external financing Myers (1984). When raising external funds, a firm will issue the safest securities first, for example debt, then hybrid securities then equity. Some researchers have questioned the practical implications of the pecking order theory, for example in the event that external financing is limited in the country within which a firm operates, what other options does a firm have when it comes to raising capital (Ngugi, 2008; Ombati & Ojah, 2016).

Rajan and Zingales (1995) implied that country specific factors such effective tax rate, bankruptcy laws, the power of the banking sector, the size of the capital markets, and patterns of ownership have an influence on a firm's capital structure choice. Subsequently Demirgüç-Kunt and Maksimovic (1998) further highlighted the importance of an active equity market and a well-developed legal system to foster firm growth. Later Booth et al. (2001) found that the more developed the equity markets, firms will tend to use less debt. In addition, Gwatidzo & Ojah (2009) proposed that there are financial institutional constraints which exist in Africa, which ultimately have an impact on firm's capital structure decisions. The conclusion we can draw from this, is that financial institutions and the debt and equity capital markets can ultimately influence a firm's capital structure choice.

In an attempt to explain the impact financial markets have on capital structure choice at a firm level, Chipeta et al. (2012) hypothesised that firms operating in a financially liberal economy should be able to adjust quickly to the desired capital structure. This is because a financially liberal economy is normally associated with the presence of an efficient stock market, global

financial institutions, and an active public debt market. On the other hand, firms operating in an environment which is financially constrained will adjust more slowly.

Using dynamic models such as Diff-GMM and Sys-GMM Chipeta et al. (2012) analysed the financing behaviour of listed South African firms between 1989 and 2007. The period between 1989-1994 was characterized as the pre-liberalisation period and the period 1995-2007 as the post liberalisation regime. Empirical results show that, post liberation transaction costs reduced, the speed of optimal capital structure adjustment increased, and there is a stronger relationship between firm specific factors and leverage.

In the pre-liberation regime only growth, tax rate and the speed of adjustment are statistically significant and positively correlated to leverage. The post liberalisation results show that growth is negatively correlated, and this could be due to underinvestment problem associated with debt (Ngugi, 2008). Asset tangibility is negatively correlated to leverage and, this could be due to the risks associated with high asset value firms (Chipeta et al., 2012). This result contradicts earlier research for South African firms, where there is positive relationship (Gwatidzo & Ojah, 2009). Profitability is positively correlated, confirming the static order theory but contradicts most research which follows the pecking order theory. Size is negatively correlated, suggesting that information asymmetry is not a material issue when issuing securities. The tax rate is negatively correlated to leverage. In the time period observed, tax rates in SA were decreasing, therefore there was no incentive for firms to use debt as a tax shield (Chipeta et al., 2012).

It has been seen in previous research that there are significant differences between the determinants of leverage and short-term and long-term debt (Gwatidzo & Ojah, 2009; Kodongo et al., 2015; Rajan & Zingales, 1995). In analysing the debt maturity structure Chipeta et al. (2012) found that in the pre liberalisation regime, profitability, size and taxes are statistically significant for securing long-term debt. Therefore, the higher the profitability, and the larger the size of the firm the more long-term debt that is accessible. In addition, the higher the tax rate the longer the debt maturity. In the post liberalisation regime, high growth firms are associated with more short-term debt. Whereas firms with high asset tangibility, profitability and taxes tend to use more long-term debt. The size of the firm though is negatively correlated to long-term debt. This contradicts the notion that larger firms have a lower risk of financial distress and thus should be able to borrow on a long-term basis (Myers, 1984).

Chipeta et al. (2012) research was critical in demonstrating that in the South African context, financial development has an impact on the capital structure decisions of a firm. Similarly, other research also demonstrated that using dynamic model estimation techniques can yield different results relative to the static models (Gómez et al., 2016). In an attempt to further

understand the effects of financing and institutional constraints on African firm's capital structure decisions, Ombati and Ojah (2016) extended the classical firm level regression to include country specific factors. The objective of the paper was to explore the importance of firm specific and country-level factors on capital structure choice.

The research results show that country level factors influence capital structure decisions indirectly, for example financial market development influences tax shield, tangibility and age. Firm specific variables are more influential than country specific variables when it comes to leverage. Booth et al. (2001) also found that financial variables are a more informative determinant of capital structure than knowing the country of origin of a firm.

Moreover, Ombati and Ojah (2016) analysed the financing patterns of financially constrained firms relative to financially unconstrained firms. The research results show that firms which were financially unconstrained mainly use equity. Approximately 80% of their financing structure was equity (the higher the profitability the higher the retained earnings). Constrained firms used more debt in their capital structure. Reasons for this, is that unconstrained firms could have more access to capital markets (Ombati & Ojah, 2016). In addition, these unconstrained firms tend to be larger, more profitable and have a lower tangibility of assets. Statistically significant determinants of capital structure for unconstrained firms are tangibility and profitability, whereas constrained firms are affected by size, tax shield and age. The research highlights that, the drivers of financing decisions can be different for firms depending on the capital markets a firm has access to.

Karolyi (2006) stated that equity markets facilitate cross border capital flows. Therefore, countries are working actively to improve their capital markets. In addition, there is increased competition between stock exchanges to attract firms to list and increase trading volumes. In his research he suggests that firms may choose to cross list their shares due to increased access to capital markets. The other reason for cross listing in international markets is based on stronger investor protection rights on other exchanges.

Ombati and Ojah (2016) confirmed Karolyi (2006) research in that, the only country-level variable which influences capital structure is investor rights. Investor rights are positively correlated to leverage, suggesting that the stronger the investor rights the more leverage a firm will use. On the other hand, Demirgüç-Kunt and Maksimovic (1998) found that the size of the market is not as significant for firm growth but it is the activity in the market.

To expand on the cross listing research, Adelegan (2009) investigated the impact of regional cross listing on stock prices for firms operating within SSA. Although not empirically tested, she suggested that cross-listing of a firm's stock, benefits the firm by providing a larger investor base which in turn lowers the cost of equity. Secondly, the firms are most likely to have better

transparency when it comes to corporate governance. This was also later confirmed by Temouri et al. (2016).

In an attempt to answer questions on the impact cross listing has on firm value, Adelegan (2009) used event study methodologies to determine the reaction of the stock market to cross-listing announcements. The results show that there are positive abnormal returns during the date of the cross listing. This implies that cross listing increases the firm value. However, the magnitude of the return, differs from country to country and at a firm level. Although the research did not include the effect of cross listing on leverage, it highlighted that there is an incentive for firms to cross list their stocks.

The concept of cross listing was later investigated by Temouri et al. (2016), and the research focused on cross listing strategies for firms operating in emerging markets such as Indonesia, Mexico, Poland, and South Africa. It was argued that cross listing for firms in emerging markets is a mechanism for them to internationalise their capital market base in terms of debt and equity. Temouri et al. (2016) proposes that by cross listing, a firm will have better access to external capital and the cost of capital decreases. In addition, he proposes that cross listed firms will be less financially constrained then firms that are not cross listed.

Analysing Temouri et al. (2016) data of listed firms from 2006-2013, in South Africa there were a total of 602 firms listed of which 191 were cross listed. This translate to approximately 30% of the firms. It was found that 20% of the firms will list on major exchanges such as New York, London and Hong Kong. Furthermore 30% will cross list on a developing market exchange. The regression results for all the emerging market countries show that;

1. A firm that is informationally opaque has a higher probability of cross listing.
2. As the firm's financial performance improves with regards to profitability and cash flows the higher the likelihood they will cross list.
3. Inefficiency is lower for cross listed firms, this in turn suggests that these firms are less financially constrained and will thus have access to more capital at a lower cost.
4. Investor protection rights is also one of the main reasons why firms cross list.

Temouri et al. (2016) was able to demonstrate that cross listing can be used by firms to escape weak institutional environments. This is similar to findings from other researchers (Karolyi, 2006). It was also seen that firms operating under a financially liberated economy have different financing behaviours to firms that are not (Chipeta et al., 2012). Ombati and Ojah (2016) demonstrated that there are significant differences in capital structure choice between financially constrained firms and financially unconstrained firms. Therefore, what one could conclude from research, is that cross listed firms could exhibit different financing behaviour to firms that are not cross listed.

It is plausible to assume that within the mining sector in SSA there are firms that are financially constrained and firms that are financially unconstrained. It is possible that these firms will exhibit different financing behaviour. We have also seen that there are incentives for firms to cross list their stocks such as access to lower cost of funds, increased firms value, corporate governance and investor protection rights. Therefore, given the benefits of cross listing, do different capital markets influence a mining firms financing behaviour? Essentially this study will answer the question, given the same operational risk of mining firms in SSA, how does access to international capital markets impact capital structure choice.

2.4 Business Cycles and Capital Structure

The most recent commodity prices boom started in 2004 largely driven by the increase in demand for industrial metals. This demand was driven by rising incomes and large infrastructure investments in emerging markets, such as China, Brazil and India (UNDP, 2016). Infrastructure investment in dams, cities, road, rail and damns increased demand for metals such as iron, copper and coal. In 2011 demand started to decline, however the market had built up production capacity and continued to supply the market. The oversupply resulted in a sharp decline in prices, thus negatively affecting the mining industry.

According to PWC (2016) in 2015 commodity prices were down 25%, and impairments in the mining industry hit an all-time record high of US$53 billion. This was the equivalent to 32% of the actual CAPEX invested since 2010. Therefore impairments, coupled with weak earnings, low returns on equity and increasing debt ratios resulted in several mining firms being downgraded by credit ratings agencies. Given the high-risk premiums which result from being downgraded, the cost of capital for a firm increase. Commodity price booms and busts are external, market driven shocks which a mining firm has little control over. Due to the nature of the industry, it can become difficult for mining firms to plan their CAPEX and funding structure accordingly. This can result in a significant deviation from their optimal capital structure.

To give a bit of context on the impact of the commodity price cycle on the general economy, researchers such as Spatafora and Tytell (2009) have argued that there is a positive correlation between commodity booms and economic growth. The “resource curse” exists and it undercuts consistent growth. This is essential for SSA, as almost 40% of countries in SSA generate more than 75% of their export earnings from mineral products (African Development Bank Group, 2017). Spatafora and Tytell (2009) focused on analysing the link between commodity price cycles and macroeconomic performance. Commodity price cycles affect each country differently, depending on the export value of the commodities. Some of the findings are;

1. Generally, commodity price booms are larger than busts.
2. 30% of the booms are followed by bust, whereby the larger the boom the larger the bust.

The Commodity Terms of Trade ("CTOT") for each country was measured based on a ratio between the weighted real commodity export prices to weighted real commodity import prices. It can be seen that SSA benefited from the last commodity price boom, as there was an increase in the CTOT (Spatafora & Tytell, 2009). Commodity price booms are positively correlated and statistically significant to GDP growth, private consumption growth and investment growth.

Consequently Spatafora and Tytell (2009) paper was key in demonstrating the positive impact which commodity prices can have on a macroeconomic level. However, to the best of our knowledge there has been no research on the impact of commodity price booms and busts have on leverage at a firm level. The closest research that can be related to firm level leverage in mining and external shocks such as commodity prices is research on business cycles and corporate leverage. The concept is similar in that, how do external shocks beyond the firm's control affect the optimal capital structure and the financing behaviour of a firm?

Korajczyk et al. (2003) attempted to explain this by researching the impact of macroeconomic conditions on leverage for firms during the period 1984 to 1999. The sample was segregated between financially constrained and financially unconstrained firms.

Using panel data and a fixed effect model, empirical results show that firm size and asset tangibility are positively correlated to leverage. Profitability is negatively correlated to leverage, once again being consistent with the pecking order theory Myers (1984). The higher the non-debt tax shield the lower the leverage which is consistent with DeAngelo and Masulis (1980).

Korajczyk et al. (2003) used macroeconomic variables as proxies for the business cycle. The results show that for both financially constrained and unconstrained firms, the higher the deviation from the target leverage ratio the higher the probability that debt will be issued. Thus, firms will finance their firms with debt to get to their optimal capital structure. With regards to financially constrained firms, the results show that they are more sensitive to deviations from the target leverage ratio and leverage is pro-cyclical to business cycles.

On the other hand, financially unconstrained firms are more sensitive to macroeconomic conditions, and leverage is counter cyclical. In other words, in a recession financially unconstrained firms tend to issue more debt. According to Korajczyk et al. (2003) this relationship is due to unfavourable market conditions, given low returns in the equity market

or low profitability. Financially constrained firms though will issue more debt when the market is booming due to high collateral values.

Subsequently, Hackbarth et al. (2006) argued that if a firm's cash flows depend on external market conditions, the company will adjust their capital structure and financing policies according to the business cycle. Using a value maximising leverage ratio, his model confirms Korajczyk et al. (2003) results that leverage is counter cyclical. In addition, in a boom a company will adjust their capital structure more frequently and in smaller amounts relative to a recession.

Halling et al. (2016) extended the previous research on business cycles and leverage by using a different method to measure cyclicality. He argued that previous methods had failed to capture the overall effect business cycles have on leverage. Therefore, in his model he used time-varying coefficients.

The research results show that leverage is counter cyclical, where leverage can be up to 2.6% higher in a recession relative to an expansionary economy. The results for the US based firms and the international firms were similar. His results were statistically significant and consistent for most of the different sample subsets. Suggesting that this could be a robust model for explain financing behaviour through business cycles. His research though contradicts Korajczyk et al. (2003) in that he found that for both financially constrained and unconstrained firms, leverage is counter cyclical. Korajczyk et al. (2003) only found this to be true for unconstrained firms.

Halling et al. (2016) found that 25% of the firms are pro cyclical, and the following characteristics were consistent for both financially constrained and unconstrained firms. According to Halling et al. (2016) these firms normally have lower market leverage, are smaller with lower asset tangibility, have higher cash savings and market to book ratios. He goes on to suggest that the reason for this phenomenon, is that in a recession the likelihood of firms of this nature defaulting is higher. Therefore, these firms are in a better position to raise debt in an expansionary economy.

DeAngelo, DeAngelo, and Whited (2011) extended his research to a dynamic capital structure model which captures that firms will temporarily deviate from their optimal capital structure and issue debt to fund investments. It was argued that a firm's optimal capital structure is a function of investment opportunities, taxes, distress costs, cost of equity, and the cost of having cash.

According DeAngelo et al. (2011) transitory debt is the difference between actual and target debt levels. The first model assumes that there are no incentives for issuing debt, and a firm

has no debt outstanding. It was found that the higher the shocks in funding requirements a firm will increase their transitory debt issuance. Adjusting to target leverage takes some time because of serial investment shocks. The transitory debt issued is normally greater than the target debt ratio. DeAngelo et al. (2011) suggests that due to this, firms financing decisions can become quite complex, and the results show that a firm may not follow the pecking order theory according to Myers (1984).

Further investigation had shown that firms which have high unexpected shocks to investment opportunities, tend to have a low leverage ratio at 0.091. Therefore, these firms preserve their debt capacity for future investments. It was also found that this benefit is relatively better to the benefit of tax shields of debt. Finally, firms which have high cash balances, experience higher unexpected shocks to investment, and have marginal profitability.

Using regression models DeAngelo et al. (2011) also tested average industry leverage relative to structural parameters. With an R^2 value of 0.669, the model has strong explanatory powers. He found that shock volatility, profit, cost of adjusting capital stock, debt capacity and the cost of cash balances are statistically significant.

In conclusion, research has shown that commodity price booms and busts can play a significant role in commodity driven exporting countries. Similarly, the impact prices can have on a macroeconomic level, have a direct impact at firm level. Research has shown that a firm adjusts its financing behaviour based on the business cycle (Hackbarth et al., 2006; Halling et al., 2016; Korajczyk et al., 2003). Researchers such as Korajczyk et al. (2003) even imply that financially constrained firms and unconstrained firms are different in the financing patterns.

After approximately 4 years of declining commodity price, in the last quarter of 2016 there was a 10% improvement in most metal prices driven by strong demand as well as supply constraints and falling stocks (World Bank Group, 2017). The World Bank Group (2017) forecasts that metals prices will increase by 10.8% in 2017 and a further 0.8% in 2018. At current prices more than 90% of global mine production across commodities is cash generative therefore a positive mine supply growth is expected as result of this situation (IDC R&I, 2017).

The question is, how mining firms will finance this supply growth? What are the financing strategies for mining firms when there is a boom and when there is a bust, and how can mining firms avoid bankruptcy in a commodity price bust? This research hopes to advance capital structure research, to fill this gap in understanding the financing dynamics of mining firms.

3. DATA AND METHODOLOGY

3.1 Introduction

Literature has shown that there are several factors which influence the capital structure of a mining firm. Factors include firm specific variables and macroeconomic variables such as capital markets and business cycles. Drawing inspiration from Gómez et al. (2016), we hope to answer the capital structure debate for mining firms operating within SSA.

The purpose of this chapter is firstly, to detail the sources and type of data used in our analysis. Secondly, define the variables used in our analysis and the expected relationships based on literature. Finally, describe several estimation methods which were used to develop a predictive model for capital structure determinants for mining firms in SSA.

3.2 Data

The firms used in the investigation are mining firms which are involved in mining activities such as bulk commodities, basic metals or precious metals. The sample was categorised as firms which are listed on a stock exchange in SSA, and firms operating in SSA which are cross listed or listed outside of SSA.

The sources of the data were well known financial information data bases of publicly listed firms such as Bloomberg, Osiris, and company websites. The firm's financial statements were used to calculate the dependent and independent variables.

3.3 Data Analysis

Research has shown that there are different measures of leverage which can used to analyse a firm's financing behaviour. These include market to book value of debt, total debt, long-term debt and short-term debt (Booth et al., 2001; Chipeta et al., 2012). We have seen that in Africa particularly, firms use more short-term debt than long-term debt (Gwatidzo & Ojah, 2009; Kodongo et al., 2015).

The independent variables which are investigated in our research are common variables that are used in capital structure theory and those that are specific to mining firms (Booth et al., 2001; Gómez et al., 2016; Islam & Khandaker, 2015; Naidu, 1986; Ombati & Ojah, 2016). The most applicable dependent variables for our analysis are total debt, long-term debt and short-term debt. The most applicable explanatory variables which explain the capital structure decisions for mining firms, are tangibility of assets, firm size, growth prospects, non-debt tax

shields, profitability and commodity price trend. The section below details the variables which are be used in our analysis.

Leverage

$$LG_T = \frac{Total\ Debt}{Total\ Assets} \quad (1)$$

$$LG_S = \frac{Current\ Debt}{Total\ Assets} \quad (2)$$

$$LG_L = \frac{Long\ Term\ Debt}{Total\ Assets} \quad (3)$$

The dependent variable in our analysis is the level of debt (LG) of a firm. There are several measures which can be used for leverage depending on the objective of the analysis. Different proxies are used for debt, to illustrate the importance of different financial instruments. Some research has measured leverage in terms of short and long-term debt, market and book values of debt (A. Antoniou et al., 2008; Booth et al., 2001; Gwatidzo & Ojah, 2009; Kodongo et al., 2015; Ombati & Ojah, 2016; Titman & Wessels, 1988). Our literature review has shown that firms operating in Africa have different financing strategies to firms in developed economies. To investigate the effect of different financial instruments on capital structure our investigation will include dependent variables such as total debt, short-term debt and long-term debt. This is consistent with capital structure research (Chipeta et al., 2012; Gwatidzo & Ojah, 2009; Kodongo et al., 2015; Naidu, 1986).

Tangibility of Assets

$$TG = \frac{Productive\ Assets}{Total\ Assets} \quad (4)$$

The expected sign for tangibility of assets (TG) of has been mixed. Research has shown that in developed economies the sign will be positive (a. Antoniou et al., 2006; Mittoo & Zhang, 2008; Rajan & Zingales, 1995; Wald, 1999). In Africa, Gwatidzo and Ojah (2009) found this to be case in South Africa and Nigeria. Essentially, a positive sign means that the higher the asset tangibility of the firm, the more debt capacity a firm has. This is because a firm can use its assets as collateral to secure debt. If the firm becomes bankrupt, the salvage value of the

assets is higher. Therefore, creditors are more incentivised to issue debt to firms with a high asset tangibility (Chipeta et al., 2012).

Tangibility of assets though has been found to be have a negative correlation to leverage for developing countries (Booth et al., 2001; Gwatidzo & Ojah, 2009; Ngugi, 2008). The reasons provided for this is that in cases where firms have a high asset tangibility, debt is used to reduce agency costs (Jensen, 1986). In addition, firms which have a high asset tangibility have a high operational risk, therefore they use less debt to reduce financial risk (Myers, 1984).

Specifically for mining firms, the sign has also been mixed where it was positive for Australian mining firms (Islam & Khandaker, 2015), and negative for Latin American Countries (Gómez et al., 2016). The variable has been included because it has been found to be statistically significant for mining firms. It is also expected that the impact of tangibility of assets will differ for the different measures of leverage. This is because the firms will match the maturity of their debt to their tangibility of assets (Booth et al., 2001).

Firm Size

$$SZ = LN\ (Revenue) \qquad (5)$$

According to previous research, the proxy for firm size (SZ) can either be the natural logarithm of revenue or total assets (A. Antoniou et al., 2008; Booth et al., 2001; Chen, 2004; Gwatidzo & Ojah, 2009; Rajan & Zingales, 1995; Wald, 1999). For this research the natural logarithm of revenue will be used as a proxy for firm size. This proxy is used because a firm needs to generate revenue to afford interest payments for debt. A firm can have a large total assets base, but it is possible that it does not generate enough cash flows to pay off debt. Therefore, the natural logarithm of revenue would be a more direct measure on the influence of leverage.

Research has shown that there should be positive relationship between firm size and leverage (A. Antoniou et al., 2008; Booth et al., 2001; Gwatidzo & Ojah, 2009; Ombati & Ojah, 2016; Titman & Wessels, 1988; Wald, 1999). This means that the larger the firm size, the more debt it will use. Larger firms tend to be more diversified and are less susceptible to bankruptcy. This is consistent with the static trade off theory where it is expected that a less risky firms will use more debt (Myers, 1984). According to Wald (1999), firms can also use debt to reduce agency costs.

Some research has found that there is a negative relationship between firm size and leverage (Chen, 2004; Chipeta et al., 2012; Rajan & Zingales, 1995). A possible explanation could be due to information asymmetries. Larger firms are less susceptible to information asymmetry

therefore can issue more securities which are information sensitive such as equity. Another reason for a negative relationship is that larger firms generate more revenue, which means more internally generated funds. Therefore, they can use these funds to finance their activities (Harc, 2015).

Growth Prospects

$$GT = \frac{Book\ value\ of\ assets - book\ value\ of\ equity + market\ value\ of\ equity}{Book\ value\ of\ assets} \quad (6)$$

The proxy which has been used in research for growth prospects (GT) is the market to book value of total assets (Booth et al., 2001; Chipeta et al., 2012; Titman & Wessels, 1988). This variable highlights market timing in growth, investment opportunities and market pricing.

Theory suggests that firms with high growth prospects will use less debt. This is because the associated agency cost between shareholders and bondholders is higher for firms in high growth industries, and growth is an intangible asset (Chipeta et al., 2012; Islam & Khandaker, 2015; Rajan & Zingales, 1995). According to Booth et al. (2001) firms with high growth prospects will tend to use equity to fund growth. This is because in funding growth with equity the shareholder's and management's incentives align.

On the other hand, percentage change in total assets has been used as a proxy for growth (Titman & Wessels, 1988). The results yielded a positive relationship between leverage and growth. Abor & Biekpe (2005) also used a percentage change in sales and found that there is a positive relationship. The reason for the positive relationship is that firms which have high growth prospects, have higher prospects of adding more value to the firm. Therefore, the firm's debt capacity increases.

Mining firm specific research has yielded mixed results, where Islam and Khandaker (2015) found that there was a positive relationship and Gómez et al. (2016) found that there is a negative relationship.

Profitability

$$PF = \frac{Net\ Income}{Total\ Assets} \quad (7)$$

The profitability (PF) variable is included due to the debate of the static trade off theory and the pecking order theory. According to the static trade off theory, the more profitable the firm is the more debt it will utilise, as it has more debt capacity (Myers, 1984). This was confirmed

by Jensen (1986) as he argued that according to the agency cost theory, the relationship should be positive. Debt can be used as an instrument to reduce agency costs as it is an obligation. The pecking order theory contradicts the static trade off theory in that it states, a firm will utilise its internal resources first before issuing debt, due to the costs which are associated with information asymmetry (Myers, 1984). Therefore, a negative relationship should be expected between profitability and leverage.

In most research the empirical evidence shows that profitability is statically significant, and has a negative relationship to leverage, irrespective of the type of economy, the country a firm operates in, and the industry in which it is in (Abor & Biekpe, 2005; Booth et al., 2001; Gwatidzo & Ojah, 2009; Kodongo et al., 2015; Rajan & Zingales, 1995). The static trade off theory though has been evident in some research, where there was a positive relationship between profitability and leverage (Chipeta et al., 2012; Islam & Khandaker, 2015).

Tax Shields

$$NDTS = \frac{Depreciation}{Total\ Assets} \qquad (7)$$

According to Modigliani and Miller (1958) there should be a positive relationship between the tax rate and debt. Gwatidzo and Ojah (2009) found this relationship to be statically significant and positively correlated for only for Zimbabwe. Research has also found that there can be a negative correlation (Abor & Biekpe, 2005; Chipeta et al., 2012). Other research found that the effective tax rate was a statistically insignificant variable for the determination of leverage (Gwatidzo & Ojah, 2009; Ngugi, 2008). Therefore, there have been mixed results on the significance of non-debt tax shields and the expected sign of the variable.

In this research non-debt tax shields (NDTS) is used as a proxy for taxes. This is because for cross listed firms it would be difficult to determine which corporate tax rate to use. According to DeAngelo and Masulis (1980), there should be a negative relationship between non debt tax shields and leverage. Subsequent research confirmed this theory (Chipeta et al., 2012; Wald, 1999). Reasons suggested for a negative relationship is that firms substitute the use of debt as a tax shield with non-debt tax shields, such as depreciation and research and development. In this way the risk associated with bankruptcy due to the high use of debt is mitigated.

On the other hand, some research has yielded positive results (a. Antoniou et al., 2006; Mittoo & Zhang, 2008). Firms with high non-debt tax shields tend to have a higher asset tangibility. Therefore, it would be expected that they will have a higher debt capacity. The current

empirical research is therefore inconclusive when it comes to non-debt tax shields and leverage.

Commodity Price Trend

$$Commodity\ price\ boom\ = 1 \quad (8)$$

$$Commodity\ price\ bust\ = 0 \quad (9)$$

The commodity price trend variable is included because in the recent commodity price bust firms were downgraded by ratings agencies (PWC, 2017). We also know that there are high risk premiums associated with being downgraded, thus increasing the cost of debt. According to our knowledge, there is currently no empirical research on the commodity price trend and the influence on capital structure. The closest research we have is the impact of business cycles on firm capital structure.

The impact of business cycles on leverage can be quantified by using dummy variables for an expansionary or contracting economy (Hackbarth et al., 2006). The other method is to use macroeconomic variables and analyse the signs of the coefficients (Korajczyk et al., 2003). As a measure of how external shocks impact leverage decisions, the impact of commodity prices on leverage will be used. A dummy variable approach is used to indicate whether the commodity prices are in boom or bust regime. To indicate a boom the value 1 is used and to indicate a bust the value 0 is used.

According to literature, leverage and business cycles differ depending on whether a company is financially constrained or not (Korajczyk et al., 2003). For financially constrained firms, positive shocks are positively correlated to leverage. Unfavourable market conditions will make equity costlier, therefore it is easier to issue debt when the market is in a recession. On the other hand, for financially unconstrained firms there is a negative correlation. Bankruptcy risk is higher in a recession therefore they will issue less debt. Some researchers though have confirmed counter cyclical market dynamics for both financially constrained and unconstrained firms (Hackbarth et al., 2006; Halling et al., 2016).

Macroeconomic Factors

For the purposes of this paper, macroeconomic factors such as legislation, investor protection rights, capital markets volatility, interest, inflation, and GDP are not included in the model. The reason for this, is that the sample is split between cross listed firms and non-cross listed firms. Cross-listed firms are registered on multiple exchanges in several countries, operations can overlap in several countries, and the annual results are reported on a consolidated basis.

Therefore, it becomes difficult to determine which country's macroeconomic variables should be used. Research has also shown that macroeconomic factors tend to show a weak relationship when determining leverage (Booth et al., 2001; Ngugi, 2008; Ombati & Ojah, 2016; Rajan & Zingales, 1995).

3.4 Econometric Models

Panel data techniques are used for the analysis of the data. Panel data is used as it includes the cross-sectional data and the time series data. Therefore allowing for a more robust model, as one can model the differences in the firms (Gwatidzo & Ojah, 2009). The generic form of a panel data model is as follows;

$$Y_{it} = \alpha_i + \beta X_{it} + u_{it} \quad (10)$$

$$u_{it} = \alpha_i + \gamma_t + \varepsilon_{it} \quad (11)$$

Where i is the i_{th} cross-sectional unit, t is the t_{th} time period, X_{it} is the set of explanatory variables in the model and u_{it} is the composite error term. The composite error term consists of α_i , which are the unobserved firm effects that are fixed over time but vary for each firm. The variable γ_t is the time specific effect but it does not vary for each firm, ε_{it} is the error term which is assumed to satisfy white noise.

3.4.1 Static Methods

Panel data analysis can be done with several estimation models. These models include pooled Ordinary Least Squared (OLS) regression, Fixed Effects (FE) and Random Effects (RE). According to Gwatidzo and Ojah (2009) the appropriateness of the model depends on the how the error term is structured, and the correlation between the error term and the explanatory variables. As seen in the literature review section, in most cases the sign of the coefficient and the level of significance for some of the variables will change depending on the estimation method being used.

$$LG_{it} = \beta_0 + \beta_1 TG_{it} + \beta_2 SZ_{it} + \beta_3 GT_{it} + \beta_4 PF_{it} + \beta_5 NDTS_{it} + \beta_6 Trend_{it} + u_{it} \quad (12)$$

The first model which is used to estimate Equation 13 is a pooled OLS regression model. Although this may be the simplest method, the pooled OLS regression model has its limitations. The estimation method assumes that all the intercepts for the different firms are

the same. Therefore it does not account for firm specific factors such as the magnitude of distress costs or industry effects, which we know exist between the different mining firms (Booth et al., 2001).

To resolve for this issue, the second model which is used is an FE estimation model. The model allows to control for firm-specific factors by adding dummy variables. The FE model also captures omitted variables. In an FE model the intercept of the regression or the firm varies cross-sectionally, but it is time invariant. In addition, the coefficient of the variables is fixed cross sectionally and are time invariant. The fixed effects model is normally used when the sample is exhaustive (Gwatidzo & Ojah, 2009). In our research it is expected that the FE model would be more appropriate, because our sample is comprehensive. This is because all the firms in the sample are listed on an exchange, have a similar geographic footprint and they are within the same industry. The limitations of the FE model are that it uses dummy variables, therefore one can get a loss of degrees of freedom and multicollinearity. The FE model has also been found to ineffectively estimate variables that are time invariant.

The third static model which is used is a RE model, whereby the differences across the firms is captured through a disturbance term. Similarly, to the FE model, the intercept of the firms varies cross sectionally, but it is time invariant. The coefficient of the variables is fixed for both cross-sectionally and over time. The main difference between the FE and RE model is that the cross-sectional units have a common intercept, which is fixed cross-sectionally and over time.

The RE model also includes a random variable which varies cross-sectionally, but it is time invariant. Relative to the FE model, the RE model resolves the limitations associated with the estimation of too many variables and the loss of degrees of freedom. The RE model is normally used for samples where the firms were randomly selected from a larger population (Gwatidzo & Ojah, 2009). The major drawback of the RE models is that all of the explanatory variables have to uncorrelated with the composite error term (Baltagi, Bresson, & Pirotte, 2003).

It has been seen in the literature review section that the R^2 value for the FE model tends to be the highest relative to the OLS and the RE model. This suggest that the FE model has the most explanatory power. The higher R^2 for the FE model relative to the pooled OLS model is evidence that there have been omitted variables (Booth et al., 2001). The F-Test is used to test for the joint significance of the explanatory variables of the regression model. The null hypothesis is H_0 the joint coefficients of the variables are not significantly different from zero. If we reject the null hypothesis it means the variables are statistically significant and the independent variables have explanatory power for the dependent variable.

The Hausman test can be used to determine if the FE or the RE model is more correctly specified. According to Baltagi et al. (2003) the RE model assumes that the individual effects and all the regressors are exogenous. Whereas the FE model assumes that the individual effects and all the regressors are endogenic. Therefore, the Hausman test will test for correlation between the explanatory variables and the error term. The null hypothesis of the Hausman test is H_0 – the conditional mean of the disturbances given the regressors is zero. In other words, the explanatory variables and the error term are exogenous. If the null hypothesis is rejected, it means that the explanatory variables and the error term are endogenous, and the FE model is the more appropriate estimation method.

Further robustness checks are done to check for multicollinearity between the different variables by setting up a correlation matrix. To test for spurious regression a unit root test is done. The panel data is analysed by using the Levin, Lin, and Chu, (2002) method. Whereby the null hypothesis is the data H_0: has a unit root, therefore the panel data is non-stationary. If we reject the null hypothesis it means that the data is stationary, and the regression model will not suffer from spurious regression.

3.4.2 Dynamic Models

In the dynamic model a lagged leverage control variable is added to explain if leverage reverts towards an optimal capital structure. A Dynamic Panel Data Model ("DPDM") is used, with a lagged dependent variable to incorporate persistence. The dynamic model is given by the following equation;

$$LG_{it} = \alpha_{it} + \gamma LG_{it-1} + \sum_{k=1}^{n} \beta_k X_{it} + \delta_i + u_{it} \qquad (13)$$

Where LG_{it-1} is the lagged dependent variable, X_{it} is the vector of explanatory variables as specified in the static model, u_{it} is the error term and δ_i is for individual effects due to heterogeneity. Research has shown that to improve precision for a DPDM, different estimator methods are used (A. Antoniou et al., 2008). These include the GMM, the First Difference (diff-GMM), and the System GMM (sys-GMM) method. When it comes to choosing valid instruments for the estimators. The instrument must be correlated with the regressors, but must also be exogenous to the disturbance term (Arellano & Bond, 1991). Therefore, it is common practice to use the lagged regressors as instruments (Chipeta et al., 2012; Gómez et al., 2016).

Literature has shown that the sys-GMM method is a more efficient estimator than the GMM and the diff-GMM estimation method (Blundell & Bond, 1998). The main reasons provided is that the lagged first differenced and lagged instruments are weak instruments for the diff-GMM model. When using the lagged regressors and the sys-GMM technique, the efficiency of the model improves significantly (Blundell & Bond, 1998). The Sargan test or the J-statistic for over identifying restrictions, is used to test if the instruments are valid. The null hypothesis is that H_0: the instruments are not correlated with the residuals. If we fail to reject the null hypothesis then the instruments are exogenous, and the model is correctly specified.

4. EMPIRICAL TEST RESULTS

4.1 Data

The Global Industry Classification Standard, Metals and Mining on Bloomberg was used to identify the firms in the mining industry. This list of firms was verified by using the Osiris database. To ensure that the classification standard was accurate, the firms on the list were further verified by looking up the company website and reviewing their mining activities. The audited financial statements and equity price data was obtained from Bloomberg, for each mining firm. The income statement and the balance sheets were used to calculate the ratios in our data analysis.

The firms that earn a revenue were regarded as operating firms, the ones that do not earn a revenue were regarded as either in the development phase or on care and maintenance. The firms which are in the development phase or on care maintenance were excluded from the sample. This is because there are distinct differences in financing structure between operating mining firms and those that are in the development phase (RFC Corporate Finance Ltd, 2001). Also, the ratios used in our research as explanatory variables, are not applicable for firms that are in the development phase or on care and maintenance.

The time period investigated for the capital structure determinants for mining firms was for the past 11 years (2006 – 2016). This is because the Metals Index (2017) shows a general trend whereby there was a commodity boom from 2006 to 2011 and a bust from 2012 to 2016 (World Bank Group, 2017). Annual data is used from this period due to the nature of the mining industry, whereby major CAPEX investments which require capital do not occur frequently during the year. Also, major capital structure decisions are done in consultation with shareholders which meet once a year.

In the refined sample there was a total of 45 firms of which 21 were non-cross listed and 24 were cross listed. Therefore, almost half of the firms are cross listed. Further investigation of the sample shows that out of the 45 firms, 28 of them are listed in South Africa on the Johannesburg Stock Exchange (“JSE”). Only 4 firms are listed on other stock exchanges within SSA, such as in Zambia, Zimbabwe, and Nigeria. Since most the firms are listed on the JSE the results will be bias towards South Africa.

The reason why most of the firms are listed on the JSE, is because the JSE is ranked amongst the top 20 financial markets globally, with a Market capitalisation of US$736 billion (Word Bank, 2017). Gwatidzo and Ojah (2009) also highlighted that relative to the other capital markets in SSA, South Africa has the most competitive capital market globally. Therefore, for mining firms operating in SSA, the JSE becomes an obvious choice for listing the firm’s stock.

When it comes to cross listing a firm's stock, most of the firms will cross-list in the United Kingdom on the London Stock Exchange, followed by Canada, Toronto Stock Exchange and United States of America ("USA"), New York Stock Exchange. This is consistent with results from Temouri et al. (2016), whereby firms from emerging markets will typically cross-list their stock on the exchanges mentioned above.

Table 2. Cross listing of firms operating in SSA.

Country of Listing	Number of Firms
South Africa (Johannesburg Stock Exchange)	30
Zambia (Lusaka Stock Exchange)	1
Zimbabwe (Zimbabwe Stock Exchange)	4
Nigeria (Nigerian Stock Exchange)	1
United Kingdom (London Stock Exchange)	10
Australia (Australia Stock Exchange)	4
Canada (Toronto Stock Exchange)	6
Germany (Frankfurt Stock Exchange)	1
United States of America (New York Stock Exchange)	6
China (Hong Kong Stock Exchange)	1

After segregating the sample between cross listed and non-cross listed firms, the firm level data was used to calculate the variables. Annual audited financial statements for the years 2006-2016 for each firm were obtained from Bloomberg. The variables for each firm were calculated for each year based on equations 1 to 8. The data for the trend variable was obtained from the World Bank Metals Index, the average change in metals prices was calculated on an annual basis. In a year where there was a price increase it would be regarded as a boom thus assigned the value 1. In a year where there was decrease in prices, the trend variable was assigned the value 0, indicating a commodity bust year.

The following were the main limitations of the data;

1. The data is denominated in US$ therefore exchange rate effects will exist in the data.
2. As already pointed out, the data is bias toward firms listed in South Africa as most the firms are listed on the JSE.
3. On the financial statements of the firms, the depreciation line item is not reported as a single line item in every year for some of the firms. Therefore, there is some data missing to calculate the non-debt tax shield for all the years, for some of the firms.
4. Variables such as age and macroeconomic factors were left out because, the year of incorporation was not available for all the firms especially for the non-cross listed firms. It was also difficult to determine which country's macroeconomic data to use for cross listed countries, as they are listed on multiple exchanges in different countries.
5. Some of the firms do not have data for all the years in the time period. This was more evident in firms which were non-cross listed. Some of the firms were listed after 2006,

for example Glencore PLC was only listed in 2011. Some of the firms were formed as a result of a spin-off/carve-out for example South 32 and Sibanye Gold.

The preliminary statistical data is shown on Table *3* to Table *5* for the non-cross listed firms, and Table *6* to Table *8* for the cross listed firms.

4.1.1 Statistical Properties for Non-Cross Listed Firms

The preliminary statistical data shows that non-cross listed firms have a mean total debt ratio of 0.39. This means that the average non-cross listed firm in SSA will employ only 0.39 US$ of debt for every US$ of total assets. This total debt ratio is lower than most of the listed firm studies in SSA. According to Gwatidzo & Ojah (2009) the mean total debt ratio for South African firms is 0.52, 0.49 for Kenyan firms, and 0.59 for Ghanaian firms. Other researchers have confirmed debt ratios of similar levels (Kodongo et al., 2015; Ombati & Ojah, 2016).

Research though has shown that mining firms tend to have lower debt ratios than firms in other industries (DeAngelo & Masulis, 1980; Islam & Khandaker, 2015; Naidu, 1986). The reason for low debt ratios for mining firms relative to the listed company average could be due to the volatility in earnings for mining firms. According to DeAngelo et al. (2011) firms with high investment shocks, have lower debt ratios to preserve their debt capacity for when they need it.

The average non-cross listed firm in SSA also uses more short-term debt than long-term debt, 0.21 and 0.18 respectively. This is not new to firms within SSA, research has shown that firms operating in developing economies tend to have significantly lower lever levels of long-term debt (Booth et al., 2001; Demirgüç-Kunt & Maksimovic, 1998). This was also proven for firms listed on SSA stock exchanges (Gwatidzo & Ojah, 2009; Kodongo et al., 2015). Reasons suggested for this financing behaviour is due to institutional constraints. It is believed that firms operating within SSA have a lack of access to long-term financing or long-term debt is more costly than short-term debt. Due to these limitations non-cross listed mining firms will use the cheapest and most available funding which is short-term debt.

The independent variables show that the mean tangibility of assets is 0.39, the size of the firm is 4.19, the growth prospects are at 1.25, profitability ratio is 0.06 and the NDTS is 0.03. To check for multicollinearity, the relationship between the variables is analysed in a correlation matrix. The correlation coefficients amongst the variables is low, which means that the data does not suffer from multicollinearity. If the data is not stationary, then this could lead to spurious regression results. The panel data is analysed by using the Levin et al. (2002) method. It can be seen from the results on Table *5* that at a 1% significance level the null hypothesis is rejected. Therefore, the data can be regarded as stationary.

Table 3. Non-cross listed firms' descriptive statistics.

	LGT	LGS	LGL	TG	SZ	GT	PF	NDTS	TREND
Mean	0.3941	0.2137	0.1805	0.3930	4.1885	1.2531	0.0578	0.0314	0.4545
Median	0.3500	0.1300	0.1500	0.4400	4.5700	1.0341	0.0300	0.0200	0.0000
Maximum	1.9200	1.4800	1.5100	0.9900	8.8100	9.8029	1.4800	0.2600	1.0000
Minimum	0.0000	0.0000	0.0000	0.0000	-5.6500	0.0000	-0.8900	0.0000	0.0000
Std. Dev.	0.3159	0.2385	0.1795	0.2747	2.9719	1.2264	0.2251	0.0371	0.4990
Skewness	1.5533	2.1986	3.0853	-0.1143	-0.7801	2.6365	1.2605	2.1597	0.1826

Table 4. Non-cross listed firms' correlation matrix.

	LGT	LGS	LGL	TG	SZ	GT	PF	NDTS
LGS	0.8258							
LGL	0.6604	0.1220						
TG	0.3684	0.2914	0.2609					
SZ	0.2168	0.1040	0.2429	0.5424				
GT	0.1912	0.0597	0.2585	0.2609	0.4204			
PF	-0.1883	-0.2504	0.0040	-0.1321	0.1739	0.3507		
NDTS	0.3774	0.3302	0.2269	0.4213	0.3386	0.0752	-0.2039	
TREND	0.0353	0.0158	0.0405	-0.0315	-0.0485	0.1065	0.0916	-0.1104

Table 5. Non-cross listed firms' Levin Lin Chu statistic.

LGT	LGS	LGL	TG	SZ	GT	PF	NDTS
-7.1112	-3.6120	-2.3743	-6.0541	-10.7417	-11.6630	-14.3291	-4.4000
(0.0000)	(0.0002)	(0.0088)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

4.1.2 Statistical Properties for Cross Listed Firms

The preliminary statistical data shows that cross listed firms have a mean total debt ratio of 0.43. This means that the average cross listed firm in SSA will employ only 0.43 US$ of debt for every US$ of total assets. This is higher than the mean total debt ratio of firms that are not cross listed. According to literature this is expected as cross listed firms have access to international bond markets (Mittoo & Zhang, 2008). Developed stock markets also facilitate more transparency, therefore creditors are more incentivised to issue debt (Demirgüç-Kunt & Maksimovic, 1998). The 0.43 level is still lower than the developed economies where debt ratios are normally more than 0.50 (Rajan & Zingales, 1995). The low leverage levels though are consistent with literature for mining firms, where the industry debt levels are generally lower than the rest of the market (Islam & Khandaker, 2015; Naidu, 1986).

The average cross listed firm in SSA uses more long-term debt than short-term debt, 0.25 and 0.20 respectively. The long-term debt ratio is also higher compared to the non-cross listed firms. This supports the theory that a firm cross lists to escape from weak institutional environments (Karolyi, 2006; Temouri et al., 2016). It also supports the theory that long-term debt is cheaper for firms with access to other capital markets (Kodongo et al., 2015; Ombati

& Ojah, 2016). International bond markets promote more competition in the debt markets, therefore the cost of debt is effectively lower (Chipeta et al., 2012). Cross listed firms are also larger in size, have higher growth prospects and have a higher asset tangibility. Coupled with exposure to multiple capital markets cross listed firms can get access to long-term financing, and possibly at a cheaper rate than non-cross listed firms.

Another reason for the higher debt levels for cross listed firms could be to reduce the agency of free cash flow. According to Jensen (1986), management can use free cash flows to invest in projects which are marginally profitable, are below the cost of capital or on organisational inefficiencies. This is evident in investment trends of the top 40 mining firms – some of which are on the cross listed firm's sample - globally in the same time period analysed for our sample firms. According to PWC (2017) mining firms had record high impairments of US$53billion in 2015, and 32% of the CAPEX spent since 2010 has now been written off. Therefore, due to the large impairments, cross listed firms could be using debt to reduce agency costs.

What is interesting to note is that the mean profitability of the cross listed firms is negative in the time period observed. This could be the reason for higher debt ratios (the lower the profitability the lower the equity in the form of retained earnings). The low profitability could also be indicative of high overhead cost structures and higher agency costs.

The data for the cross listed firms was also checked for robustness using a correlation matrix between the variables, this is shown in Table 7. The low correlation coefficients show that there is no serious multicollinearity. The Levin-Lin-Chu panel unit root test statistics also shows that at 1% significance the data is stationary.

Table 6. Cross listed firms' descriptive statistics.

	LGT	LGS	LGL	TG	SZ	GT	PF	NDTS	TREND
Mean	0.4306	0.2046	0.2488	0.5339	5.3744	1.5662	-0.0490	0.0328	0.4545
Median	0.3700	0.1100	0.2100	0.6200	5.4250	1.0624	0.0000	0.0300	0.0000
Maximum	3.9700	3.9700	2.3000	0.9500	12.3600	51.0529	0.5100	0.1800	1.0000
Minimum	0.0000	0.0000	0.0000	0.0000	-4.1400	0.0000	-5.2100	0.0000	0.0000
Std. Dev.	0.4656	0.3988	0.2533	0.2758	3.7994	3.6788	0.3985	0.0308	0.4989
Skewness	3.8006	5.5562	3.4152	-0.9008	-0.1420	10.5996	-8.9599	0.8966	0.1826

Table 7. Cross listed firms' correlation matrix.

	LGT	LGS	LGL	TG	SZ	GT	PF	NDTS
LGS	0.6882							
LGL	0.6707	0.0918						
TG	0.1562	-0.1565	0.3609					
SZ	0.1184	-0.0793	0.2164	0.4778				
GT	0.0769	-0.0255	0.1432	0.0380	-0.0976			
PF	-0.5424	-0.6239	-0.0729	0.1360	0.3110	-0.0952		
NDTS	0.1982	0.0036	0.2636	0.4549	0.3966	-0.0764	0.0197	
TREND	-0.0579	0.0034	-0.0787	-0.1723	-0.1058	0.0469	-0.0043	-0.0955

Table 8. Cross listed firms' Levin Lin Chu statistic.

LGT	LGS	LGL	TG	SZ	GT	PF	NDTS
-7.1112	-3.6120	-2.3743	-6.0541	-10.7417	-11.6630	-14.3291	-4.4000
(0.000)	(0.000)	(0.009)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

4.2 Static Models

In this section, the results of the static models are discussed. The panel data was modelled separately for the non-cross listed and cross listed firms. Each sample was first modelled using ordinary least squares (OLS) estimation method. The robustness and efficiency of the model is further improved by using a Fixed Effects (FE) and a Radom Effects (RE) model. The Hausman test is used to determine the suitability of the models. Each of the variables will be discussed and how they change with each model. The detailed regression results can be seen in Appendix A.

4.2.1 Non-Cross Listed Mining Firms in SSA

The sample of the non-cross listed firms are firms which are only listed on exchanges which are in the SSA. In our sample there are 21 non-cross listed firms of which 17 are listed in South Africa on the JSE. It is expected that the capital structure variables will behave in a similar to firms listed SSA (Abor & Biekpe, 2005; Gwatidzo & Ojah, 2009; Kodongo et al., 2015; Ombati & Ojah, 2016). The results should also be similar to research on mining firms (Gómez et al., 2016; Islam & Khandaker, 2015).

4.2.1.1 Ordinary Least Squares (OLS)

The OLS regression results show that for non-cross listed mining firms listed in SSA, the statistically significant determinants of total debt are tangibility of assets, growth prospects, profitability and non-debt tax shields. As for short-term debt, it is similar to total debt, but the growth prospects become insignificant. For long-term debt only, the growth prospects and the non-debt tax shields are significant.

The adjusted R^2 ranges from 11-22% with long-term debt having the lowest R^2 value and total debt having the highest. This result suggests that the explanatory power of the models is weak, especially for long-term debt. However this adjusted R^2 is common for OLS regressions for capital structure research of this nature (Booth et al., 2001). The F-statistic strongly rejects the null hypothesis which means that the joint coefficients are statistically significant, and they explain the behaviour of firm leverage.

Tangibility of Assets

Tangibility of Assets is statistically significant to the 1% level for total debt, 5% for short-term debt and it is insignificant for long-term debt. The sign of the variable is always positive. Therefore, this means the higher the asset tangibility the more debt the firm will have. This is similar to previous research (Gwatidzo & Ojah, 2009; Islam & Khandaker, 2015; Ombati & Ojah, 2016).

The result is to be expected as the more tangible assets a firm has the more assets the firm cam use as collateral when issuing debt. If the firm becomes bankrupt, the higher the tangible assets are the higher the salvage value. Therefore, creditors are willing to issue more debt to firms with a higher asset tangibility (Chipeta et al., 2012). Collateralised debt is also cheaper than unsecured lending. Therefore, firms with a high asset tangibility are incentivised to use more debt. Asset tangibility is also a way for firms to reduce information asymmetries. Therefore, firms with a higher asset tangibility will have access to more external debt (Gwatidzo & Ojah, 2009).

The tangibility of assets variable is only significant to the 5% level for short-term debt and it is significant to the 1% level for total debt. This means that assets tangibility is less significant for short-term debt. This is expected according to the matching principle, whereby long-term assets are financed with long-term debt (Booth et al., 2001). Firms within SSA also use more short-term debt financing and normally short-term debt does not require collateral (Gwatidzo & Ojah, 2009). This is also consistent with the static trade off theory in terms of financial distress costs. Whereby, to reduce the risk of bankruptcy, the debt used for long-term assets is collateralised (Myers, 1984). The variable is insignificant for long-term debt, and this contradicts the financial theory mentioned above. This could be due to the estimation model used, given that the R^2 value is also low.

Size

The size of the mining firm is statistically insignificant for all the leverage ratios. However, the sign of the coefficient is positive for total debt and long-term debt, but negative for short-term debt. The results suggest that the larger the firm the more debt that they will use.

Gómez et al. (2016) had similar results for mining firms in Latin America. This is because larger mining firms tend to be more diversified geographically or the commodities which they mine. Larger firms are less susceptible to bankruptcy, therefore can access more debt. This is consistent with the static trade off theory (Myers & Majluf, 1984). Larger firms are also more likely to have the ability to negotiate favourable terms with creditors, therefore can have access

to debt at lower interest rates (Chipeta et al., 2012). According to Wald (1999), larger firms can also use debt to reduce agency costs.

In the case of short-term debt, the smaller the firm the more short-term debt they will use. These results are similar to that of Titman and Wessels (1988). Reasons cited for this is that smaller firms are susceptible to higher information asymmetries (Chen, 2004; Chipeta et al., 2012; Rajan & Zingales, 1995). This results in smaller firms having difficulty accessing long-term debt due to their high-risk premium. Therefore, smaller firms will resort to using more short-term debt than long-term debt. This is also the case for most African firms as according to Kodongo et al. (2015). Another reason could be due to institutional factors that smaller firms can only access more short-term debt. Larger firms could also have the ability to finance their short-term needs from internal cash flows, therefore will use less short debt (Harc, 2015). Funding short-term debt from internal cash flows could be mechanism for large firms to limit their use of debt to avoid bankruptcy according to the static trade off theory (Myers, 1984).

Growth Prospects

Growth Prospects for non-cross listed mining firms is statistically significant at a 1% for total debt and long-term debt, but it is insignificant for short-term debt. The variable is also positive for all the leverage ratios. Therefore, the higher the growth prospects for a mining firm the more debt the firm will use. Other researchers had similar results (Abor & Biekpe, 2005; Gómez et al., 2016; Titman & Wessels, 1988). The reason for the positive relationship is that firms which have high growth prospects, have higher prospects of adding more value to the firm. Therefore, the firm's debt capacity increases.

Another reason for the use of more debt when a mining firm has high growth prospects could be to reduce agency costs (Jensen, 1986). A high growth environment which requires tangible assets could be funded through debt (reduce the cost of debt). This could be a mechanism for shareholders to reduce the risk of management funding projects which are marginally profitable. Debt is an obligation therefore the project must be able to pay off the debt.

The growth prospect of a mining firms is the market perception of the value of the assets relative to the book value of assets. In a commodity driven industry, commodity prices are determined by the market. If the market consensus is that commodity prices will increase which will ultimately mean more cash flows and a higher market equity valuation, then the mining firms can take on more debt to fund projects to meet the market demand. If the market consensus is that prices will decrease, therefore less cash flows. The bankruptcy risk becomes higher; therefore, firms will use less debt.

Table 9. Non-cross listed static models. Pooled OLS, FE and RE regression models.

	Total Debt						Short-Term Debt						Long-term Debt					
	OLS		FE		RE		OLS		FE		RE		OLS		FE		RE	
Constant	0.18	*	-0.04		0.06		0.11	*	-0.08	**	0.01		0.07	*	0.03		0.04	
	(0.04)		(0.05)		(0.05)		(0.03)		(0.04)		(0.04)		(0.02)		(0.03)		(0.03)	
Tangibility of Assets	0.24	*	0.66	*	0.53	*	0.16	**	0.38	*	0.34	*	0.07		0.28	*	0.20	*
	(0.09)		(0.11)		(0.09)		(0.07)		(0.08)		(0.07)		(0.05)		(0.07)		(0.06)	
Size	0.00		0.01		0.00		-0.01		0.02	**	0.00		0.00		-0.01		0.00	
	(0.01)		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)		(0.00)		(0.01)		(0.01)	
Growth Prospects	0.05	*	0.07	*	0.06	*	0.02		0.04	*	0.03	**	0.03	*	0.03	*	0.03	*
	(0.02)		(0.02)		(0.02)		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)	
Profitability	-0.25	*	-0.11		-0.14	***	-0.21	*	-0.09		-0.12	***	-0.03		-0.01		-0.02	
	(0.09)		(0.08)		(0.08)		(0.07)		(0.06)		(0.06)		(0.06)		(0.05)		(0.05)	
Non-Debt Tax Shields	2.19	*	1.16	***	1.77	*	1.52	*	0.34		0.91	**	0.69	**	0.83	**	0.80	**
	(0.57)		(0.62)		(0.56)		(0.45)		(0.48)		(0.44)		(0.35)		(0.40)		(0.37)	
Trend	0.04		0.03		0.04		0.03		0.02		0.02		0.02		0.01		0.02	
	(0.04)		(0.03)		(0.03)		(0.03)		(0.02)		(0.02)		(0.02)		(0.02)		(0.02)	
Adjusted R^2	0.22		0.50		0.33		0.16		0.48		0.24		0.11		0.34		0.17	
Durbin-Watson Stat	0.81		1.15		0.99		0.86		1.22		1.07		0.81		1.00		0.95	
F-statistic	11.62		9.97		20.27		8.23		9.11		12.88		5.56		5.51		8.66	
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
Hausman Test					0.00						0.00						0.00	
					(1.00)						(1.00)						(1.00)	
Adjusted Hausman Test					30.66						25.94						8.79	
					(0.00)						(0.00)						(0.12)	

* Statistically significant to the 1% level
** Statistically significant to the 5% level
*** Statistically significant to the 10% level

On the other hand, the growth prospects are insignificant for short-term debt, and are statistically significant to the 1% for total debt and long-term debt. Similarly, to tangibility of assets, a firm's growth prospects are used to secure long-term debt. Growth prospects are a measure of the firm's market to book value of assets. Therefore creditors could be using growth prospects as an indicator to secure long-term debt as per the matching principle (Booth et al., 2001). The reason for the variable not being significant for short-term debt could be also due to model specification.

Profitability

The profitability variable is statistically significant to the 1% level for total debt and short-term debt. The variable is insignificant for long-term debt. The sign of the coefficient is consistently negative for all the leverage ratios. This means that the more profitable a firm is the less debt it will use. This is consistent with the pecking order theory and most empirical research (Abor & Biekpe, 2005; Booth et al., 2001; Gwatidzo & Ojah, 2009; Kodongo et al., 2015). Therefore, mining firms will use internally generated funds first to fund projects. Once the internal funds are exhausted, the firm will use external funds. In using external fund the firm will issue the safest securities first such as debt and then equity (Myers, 1984).

The variable is statistically significant for short-term debt, but it is insignificant for long-term debt. In the case of short-term debt, firms are more likely to use their internal funds as the quantum of the funding is likely to be less than the long-term requirements. Therefore, the firm can afford to use internally generated funds. Since short-term debt is generally not collateralised, lenders could also be using profitability as a factor for debt affordability for short-term funding.

On other hand, the profitability of a firm is not guaranteed in the long-term. The profitability of the firm is based on the Net Income which can be volatile and can be difficult to forecast in the long-term. In this case then profitability would be an insignificant measure of the firm's affordability of long-term debt.

Non-Debt Tax Shields

Non-debt tax shields are statistically significant for total debt and short-term debt to the 1% level and they are statistically significant to the 5% level for long-term debt. The sign of the coefficient is positive for all the leverage variables. This suggests that the higher the non-debt tax shields the higher the leverage. These results are similar to that of Gwatidzo and Ojah (2009) for financially constrained firms. This implies that mining firms use debt to fund their assets, and in turn use the assets as collateral.

These findings contradict that of DeAngelo and Masulis (1980), where it is expected that firms in a capital intensive industry would use the benefit of non-debt tax shields as a substitute for the tax benefit of debt. This in turn reduces their debt levels.

The reason for the contradiction could also be because of the proxy which was used to estimate non-debt tax shields. Titman and Wessels (1988) criticized the non-debt tax shield which is commonly used in theory as not being an accurate proxy for the economic non-debt tax shield. This is because the variable only considers tax deductions related to capital equipment. Tax shields such as research and development, royalties, and selling expenses are not included. The issue with using depreciation as an input for a proxy for non-debt tax shields is that non-debt tax shields are positively correlated with profitability and investment (Graham, 2003). This can also be seen in the correlation matrix in Table *4* , the correlation coefficients for NDTS tend to be higher. Since mining firms are capital intensive, they use debt to fund their assets. In doing so, this induces the positive relationship between non-debt tax shields and debt.

Trend

The trend variable represents the effects of commodity price booms and busts on capital structure decisions. The variable is statistically insignificant for all the leverage variables. This means that commodity prices are not a determinant of capital structure choice for non-cross listed mining firms. The coefficient of the variable though is positive, this suggest that the higher the commodity prices the more leverage the mining firms will use.

Hackbarth et al. (2006) suggested that firms will adjust their capital structure and financing policies according to the business cycle. To the best of our knowledge, currently there is no research on the direct relationship between commodity prices and capital structure. Our results are similar to Korajczyk et al. (2003) business cycle and leverage research. It was found that hat financially constrained firms will use more debt in an expansionary economy. A possible reason for these findings, is that commodity price booms normally result in higher profitability and cash flows for the firm. Thus, creating favourable conditions for issuing debt. The cost of debt may also be cheaper as the firm will be seen as less risky to the lenders. Korajczyk et al. (2003) also suggested that firms will issue more debt in an expansionary economy as the collateral values are also higher.

4.2.1.2 Fixed Effects (FE)

The FE regression results show that for non-cross listed mining firms in SSA, the statistically significant determinants of total debt are tangibility of assets, growth prospects, and non-debt tax shields. As for short-term debt, it is tangibility of assets size and growth prospects. For long-term debt it is tangibility of assets, growth prospects and the non-debt tax shields are significant.

The main differences between the FE and OLS model is that tangibility of assets is statistically significant for long-term debt. Size, and growth prospects are significant for short-term debt, but non-debt tax shields becomes insignificant. Profitability is insignificant for all the leverage variables.

The limitations of the OLS model are that it assumes that intercepts for the different firms are the same. Whereas in the FE model we account for the differences in each firm. Due to these reasons, the signs of the coefficient and the significance of the explanatory variables will differ between the FE and the OLS model.

The adjusted R^2 ranges from 34-50% with long-term debt once again having the lowest R^2 value and total debt having the highest. This result suggests that the explanatory power of the models is much stronger than the OLS model, and there are firm specific effects which affect leverage. It also means that there is an existence of omitted variables, which the pooled OLS regression cannot correct for. The F-statistic strongly rejects the null hypothesis which means that the joint coefficients are statistically significant, and they explain the behaviour of firm leverage.

Tangibility of Assets

Tangibility of assets is statistically significant at the 1% level for all the leverage variables. In the OLS estimation model this variable was statistically insignificant for the long-term debt variable. This suggests that tangibility of assets and leverage varies for each firm, therefore the OLS model was not the best estimation model. The sign of the coefficients is still positive. Therefore, for non-cross listed mining firms, tangibility of assets is a significant determinant of capital structure for any type of debt instrument and the more tangible assets the firm has, the more debt it can access. This is more consistent with literature, where a firm will match its assets with the debt maturity (Booth et al., 2001), and mining firms are no exception.

Size

In the FE model the firm size variable is statistically significant, with a positive coefficient for short-term debt. In the OLS model it was statistically insignificant and negative for short-term debt. The findings of the FE model strongly contradict the OLS model. These findings are similar to research for South African and Zimbabwean firms (Gwatidzo & Ojah, 2009; Ombati & Ojah, 2016). As previously mentioned larger firms tend to be less risky than smaller firms as they are more diverse. Larger firms also tend to be more reputable (less information asymmetry) therefore lenders will trust larger firms more. Therefore, larger firms will have more access to short-term funding, possibly at a cheaper interest rate than a smaller firm.

Growth Prospects

Growth prospects are statistically significant at a 1% level for all the leverage variables. The sign of the coefficients is also positive for all the variables. The main difference between the results of the FE and the OLS model in that growth prospects for short-term debt is also statistically significant in the FE model. Whereas in the OLS model it was not. This could be attributable to the model specification as we see that there is a strong relationship at a 1% level for all the leverage variables. Therefore, growth prospects also play an important role even for short-term financing.

Profitability

In the FE model the profitability ratio is statistically insignificant for all the debt ratios. This contradicts the profitability ratio in the in the OLS model, where it was statistically significant. The sign of coefficient is negative which means that the pecking order theory is still relevant. What is puzzling is that the variable is statistically insignificant for mining firms however in most capital structure theory it is significant (Abor & Biekpe, 2005; Booth et al., 2001; Gwatidzo & Ojah, 2009).

Our findings are similar to Ombati and Ojah (2016) for financially constrained firms in SSA, where profitability is an insignificant determinant of leverage. Ombati and Ojah (2016) defined financially constrained firms as firms which have a financing deficit (operating cash flow divided by investment outlay) below the mean value of the sample. Mining firms in SSA have had declining operating cash flows (PWC,2016). Which means that they are most likely to behave like financially constrained firms. This could explain why profitability is insignificant determinant for non-cross listed mining firms. When financially constrained firms borrow, other determinants are considered such as tangibility of assets, growth and the size of the firm.

Non-Debt Tax Shields

Non-debt tax shields are statistically significant for the total debt ratio and the long-term ratio at the 10% and 5% level respectively. Non-debt tax shields are statistically insignificant for short-term debt. The sign of the coefficient is positive for all the leverage ratios, suggesting that the higher the non-debt tax shields the higher the use of leverage. The reason for this follows the same arguments as discussed in the OLS model.

The major difference between the OLS and the FE model is that non-debt tax shields are insignificant for short-term debt, whilst in the OLS model it was a significant determinant. As explained previously the main driver for non-debt tax shields being significant and positively related to debt is that firms use debt to fund their projects and use the assets as collateral. As seen in our previous results, debt is normally used to fund the long-term assets. Therefore, according to the matching principle non-debt tax shields would be an insignificant determinant for short-term debt use.

Trend

The trend variable is statically insignificant for all the leverage ratios and the coefficients have a positive sign. These finding are similar to the OLS regression results. This means that despite the static model estimation method used the variable still has the same level of significance and sign. Therefore, trend has no significant impact on leverage decisions and mining firms will use more debt in a commodity boom environment.

4.2.1.3 Random Effects (RE)

The RE regression results show that for non-cross listed mining firms, the statistically significant determinants of total debt are tangibility of assets, growth prospects, profitability and non-debt tax shields. As for short-term debt, it is tangibility of assets, growth prospects, profitability, and non-debt tax shields. For long-term debt, it is tangibility of assets, growth prospects and the non-debt tax shields are significant.

The main differences between the RE and FE model is that, profitability and non-debt tax shields are also statistically significant for short-term debt, where in the FE model it was not. Size is only statistically significant for short-term debt in the FE model, where in in the RE model it is not significant for any of the leverage ratios.

Most of the RE results are similar to the FE model in terms of the level of significance of the variables, the sign and the magnitude of the coefficients. This is because for both models the intercept of the firms varies cross sectionally, but it is time invariant. The coefficient of the variables is fixed for both cross-sectionally and over time. The limitations of the FE model are

that it uses dummy variables, therefore one can get a loss of degrees of freedom and multicollinearity. The RE model resolves for these issues. Therefore, there will be some differences in terms of the level of significance of the variables and the sign of the coefficients.

The adjusted R^2 ranges from 17-33% with long-term debt having the lowest R^2 value and total debt having the highest. This result suggests that the explanatory power of the models is much stronger than then the OLS model, however it is weaker than the FE model. This would also be expected as our sample is not random from a larger population size. The firms in the sample are comprehensive. They are all publicly listed firms, operating in the same region and are within the same industry.

To determine which model is more correctly specified between the FE and the RE model a Hausman test was conducted. Where the null hypothesis is H_0 – the conditional mean of the disturbances given the regressors is zero. In conducting the Hausman test it was found that the cross-section test variance is invalid, thus the Hausman statistic would be set to zero. This happens when conducting the Hausman Test if there is a dummy variable added to the regression for industry or period effects. The trend variable in our regression is a dummy variable for period effects. The dummy variable is the same for each firm in the cross-section data for each period. Therefore, when conducting the Hausman test the dummy variable restricts the test.

Due to the limitations of the Hausman test the Trend dummy variable was removed when conducting the test. The results from this test are defined as the “Adjusted Hausman Test” on Table *9* and Table *10*. To ensure that the regression results are not significantly different without the Trend variable the OLS, FE and RE regression were run again. The regression results can be seen in Appendix A.1.3. By omitting the Trend variable, the regression results remain similar. In terms of level of significance, signs and magnitude of the coefficients and the R^2 values of the model.

The Adjusted Hausman Test results show that the null hypothesis is rejected for the total debt and short-term debt model. Therefore, the FE model is correctly specified for the total debt and short-term debt model, and the RE model is correctly specified for the long-term debt model.

The section below will compare the RE results to the FE and the OLS model and conclude what the sign and the significance level of the variables should be. Most of the reasons for the sign and the level of significance for each variable have been discussed in detail in previous sections.

Tangibility of Assets

The tangibility of assets variable is statistically significant at the 1% level for all the debt variables. The sign of the coefficient is also positive for all the ratios. These results are similar to the FE model. In the OLS model the variable was statically insignificant for long-term debt. Therefore, we can conclude that tangibility of assets is highly statistically significant, and positive for all the leverage ratios. It was due to model specification that is was not significant in the OLS regression.

Size

The size variable is statistically insignificant for all the leverage ratios, and the coefficients are positive for all the ratios. In the OLS model the sign of the coefficient was negative for short-term debt. In the FE model the coefficient was statistically significant for short-term debt and the coefficient for long-term debt was negative. We have established that the FE model is only correctly specified for total and short-term debt. Therefore, we can conclude that the size of the firm is only statistically significant for short-term debt and the sign of the coefficient is positive for all leverage ratios.

Growth Prospects

Growth prospects is statistically significant for all the leverage ratios to the 1-5% level and the sign is positive for all the coefficients. The variable was not significant in the OLS model for short-term debt. Since the FE and RE models have better explanatory power, it is safe to assume that growth prospects are a statistically significant determinant for all the leverage ratios, and the sign of the coefficients is positive.

Profitability

The profitability variable is statically significant for total debt and short-term debt and the sign of the coefficients is negative for all the leverage ratios. The results obtained are similar to the OLS regression model, but the level of significance is only 10% compared to 1%. The FE model results were statistically insignificant for all the leverage ratios and the model is more correctly specified for total debt and short-term debt. This means that the level of significance is deteriorating as the model becomes more robust. Therefore, it can be concluded that profitability is a statistically insignificant determinant of leverage. However, the negative coefficient of the signs confirms that the Pecking Order Theory is relevant.

Non-Debt Tax Shields

The non-debt tax shields ratio is statically significant for all the leverage ratios and the sign of the coefficients is positive for all the leverage ratios. The only difference between the RE model

and the other models, is that is in the FE model non-debt tax shields is statistically insignificant for short-term debt. Since the FE model is more correctly specified for short-term debt, it can be concluded that non-debt tax shields are statistically significant only for total debt and long-term debt. The sign of the coefficients is positive for all the leverage ratios.

Trend

The trend variable is statistically insignificant and the sign of the coefficient. This has been the same for the different models. Therefore, it is safe to conclude that the trend variable has no significance in capital structure choice. Non-cross listed mining firms use more debt when the there is a commodity price boom.

4.2.2 Cross Listed Mining Firms in SSA

The sample of the cross listed firms are the firms which are either listed on exchanges within SSA, have cross listed their securities on other exchanges, or have operating assets within SSA but are listed outside of SSA. In our sample there are 24 cross listed firms, of which majority are listed on the London Stock Exchange, New York Stock Exchange, Toronto Stock Exchange or the Australian Stock Exchange. Most of these exchanges are registered in G-7 countries. These economies are considered to be developed and market orientated economies, therefore it is expected that the results will be comparable to international research (A. Antoniou et al., 2008; Campello, 2003; de Jong et al., 2008; Korajczyk et al., 2003; Mittoo & Zhang, 2008; Rajan & Zingales, 1995; Wald, 1999). These results should also be similar to research on mining firms (Gómez et al., 2016; Islam & Khandaker, 2015).

4.2.2.1 Ordinary Least Squares (OLS)

The OLS regression results show that for cross listed mining firms in SSA, the statistically significant determinants of total debt are firm size, and profitability. Short-term debt determinants are similar to total debt, but tangibility of assets becomes significant. For long-term debt, tangibility of assets, growth prospects, profitability and non-debt tax shields are significant.

The adjusted R^2 ranges from 16-39% with long-term debt having the lowest R^2 value and total debt having the highest. This result suggests that the explanatory power of the models is weak, especially for long-term debt. The adjusted R^2 for the cross listed model is higher than the non-cross listed model. This could be due to more consistent data for cross listed firms. The null hypothesis of the F-Statistic is strongly rejected at the 1% significance level, which means that the joint coefficients are statistically significant.

Table 10. Cross listed firms' static models. Pooled OLS, FE and RE regression models.

	Total Debt						Short-term Debt						Long-term Debt					
	OLS		FE		RE		OLS		FE		RE		OLS		FE		RE	
Constant	0.12	***	-0.09		-0.05		0.19	*	-0.08		0.10	***	0.04		0.00		0.01	
	(0.06)		(0.06)		(0.08)		(0.05)		(0.07)		(0.06)		(0.04)	*	(0.05)		(0.05)	
Tangibility of Assets	0.14		0.30	*	0.31	*	-0.23	*	-0.21	**	-0.15	***	0.25		0.35	*	0.33	*
	(0.10)		(0.10)		(0.09)		(0.08)		(0.11)		(0.09)		(0.06)		(0.08)		(0.07)	
Size	0.03	*	0.06	*	0.05	*	0.02	*	0.08	*	0.04	*	0.01		0.01		0.01	
	(0.01)		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)		(0.00)		(0.01)		(0.01)	
Growth Prospects	0.01		0.00		0.00		-0.01		-0.01		-0.01		0.01	**	0.00		0.00	
	(0.01)		(0.00)		(0.00)		(0.01)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
Profitability	-0.73	*	-0.73	*	-0.73	*	-0.67	*	-0.66	*	-0.66	*	-0.08	**	-0.06	**	-0.07	**
	(0.06)		(0.04)		(0.04)		(0.05)		(0.05)		(0.05)		(0.04)		(0.03)		(0.03)	
Non-Debt Tax Shields	1.16		-0.68		-0.48		0.09		-1.74	**	-0.95		0.94	***	0.57		0.65	
	(0.85)		(0.70)		(0.68)		(0.71)		(0.77)		(0.71)		(0.54)		(0.53)		(0.51)	
Trend	-0.01		0.02		0.01		0.00		0.03		0.01		-0.01		0.00		0.00	
	(0.05)		(0.03)		(0.03)		(0.04)		(0.03)		(0.03)		(0.03)		(0.02)		(0.02)	
Adjusted R^2	0.39		0.74		0.56		0.42		0.57		0.42		0.16		0.48		0.17	
Durbin-Watson Stat	0.46		1.00		0.87		0.79		1.11		0.90		0.81		1.33		1.18	
F-statistic	28.82		26.57		56.70		32.15		12.98		33.20		9.37		9.49		10.13	
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
Hausman Test					0.00						0.00						0.00	
					(1.00)						(1.00)						(1.00)	
Adjusted Hausman Test					7.27						27.77						9.57	
					(0.20)						(0.00)						(0.09)	

* Statistically significant to the 1% level
** Statistically significant to the 5% level
*** Statistically significant to the 10% level

Tangibility of Assets

The tangibility of assets variable is only statistically significant for short-term debt and the coefficient of the variable is negative. The coefficient of the variable is positive though for total debt and long-term debt. The major difference between non-cross listed and cross listed firms is that tangibility of assets is negatively correlated to short-term debt for cross listed firms, where it was negative for non-cross listed firms. This means that the higher the tangible assets in the firm, the less the short-term debt the firm uses. The findings of negative asset tangibility is similar to findings for developing countries (Booth et al., 2001; Gwatidzo & Ojah, 2009; Ngugi, 2008), and Gómez et al. (2016) for mining firms in Latin America. The reason suggested for this is that firms which have a high asset tangibility, have a high operational risk, therefore they mitigate their financial risk by using less debt (Abor & Biekpe, 2005).

These findings suggest that cross listed mining firms indeed use their assets to secure more long-term funding and less for short-term funding (Gwatidzo & Ojah, 2009). This is also confirmed by the positive relationship for tangibility of assets relative to long-term debt in our findings. As discussed previously long-term debt is used to fund long-term assets. Thus, the positive relationship between tangibility of assets and leverage. Since the assets are being used to secure long-term debt there are less assets which can be used to secure short-term debt, thus the negative relationship (Chipeta et al., 2012).

Another reason which supports the findings could be that firms which have a higher assets tangibility have used their assets to generate sufficient retained earnings, therefore they can afford to finance their short-term debt from internal resources (Harc, 2015). This could also explain the differences in signs for cross listed firms relative to non-cross listed firms. Cross listed firms have higher growth prospects and are larger (generate more revenue) relative to non-cross listed firms. This is further confirmed by cross listed firms having lower short-term debt ratios compared to non-cross listed firms in our descriptive statistics.

Another reason why asset tangibility is positively correlated for non-cross listed firms and negative for cross listed firms is due to the reduction of agency costs for non-cross listed firms. Generally information asymmetries are higher for non-cross listed firms than for cross listed firms (Korajczyk et al., 2003). Therefore non cross listed mining firms with a high asset tangibility could be reducing their agency costs by increasing the debt in the firm (Jensen, 1986). The negative relationship could also be a mechanism for cross listed firms to reduce the agency costs between shareholders and bond holders. Therefore the wealth of the firm is limited for creditors (de Jong et al., 2008).

These findings also suggest that non-cross listed firms could be using their assets as collateral to secure short-term financing. According to Booth et al. (2001) this is not the norm, it suggests

that there could be influence from institutional factors. The magnitude of the coefficient is also generally larger for non-cross listed firms than for cross listed firms. This suggests that there is a heavily reliance on asset tangibility to access debt, for non-cross listed firms.

Size

The size of the firm is statistically significant to the 1% level for total term debt and short-term debt. The coefficient of the sign is positive for all the leverage ratios. In the case of non-cross listed firms this variable was statistically insignificant, and the magnitude of the coefficient was lower than the non-cross listed. Therefore, on an international scale, the larger the size of the firm the more debt the firm will use or have access to. This finding is similar for firms operating in developed economies such the US and the UK (A. Antoniou et al., 2008; de Jong et al., 2008; Mittoo & Zhang, 2008).

The size of the firm is only statistically significant for short-term debt and not for long-term debt. As discussed in previous sections, larger firms have a lower bankruptcy risk. Since short-term debt is unsecured, the reputation of the firm and history of debt repayments becomes more relevant. This results in the size of the firm is statistically significant for short-term debt and not for long-term debt.

Cross listed firms tend to be have less information asymmetries and better corporate governance compared to firms that are not cross listed (Karolyi, 2006; Temouri et al., 2016). Since the firms are more transparent, lenders can also rely on the size of the firm to make a funding decision (Demirgüç-Kunt & Maksimovic, 1998). This could explain why the size of the firm is a statistically significant determinant for cross listed firms, whereas for non-cross listed firms it is not.

Growth Prospects

The growth prospects variable is statistically significant to the 5% level only for long-term debt. The sign of the coefficient for short-term debt is negative and it is positive for total debt and long-term debt. The finding of a negative correlation to debt is consistent with international capital structure research (de Jong et al., 2008; Rajan & Zingales, 1995).

This result suggests that firms with high growth prospects will use debt to fund their long-term activities, however for their short-term financing needs they will use less debt. The negative relationship suggests that cross listed mining firms which have high growth prospects, want to limit their debt exposure and fund their short-term activities from internal funds.

It has been seen that firms with high growth prospects will use less debt because of the associated agency costs between bond holders and shareholders (de Jong et al., 2008; Rajan

& Zingales, 1995). Firms with high growth prospects also tend to limit their short-term debt usage because of volatile earnings, and using less debt mitigates the risk of bankruptcy (a. Antoniou et al., 2006). This is also consistent with the static trade off theory (Myers, 1984).

Growth prospects are statistically significant for non-cross listed firms for all the leverage values, whereas for cross listed firms they are only significant for long-term debt. The magnitude of the variable is also less than for cross listed firms. The reason for this could be that due to higher information asymmetries for non-cross listed firms (Korajczyk et al., 2003). In assessing a firm's default risk, lenders could also be taking into consideration the market consensus on the firm's growth prospects. In this way growth prospects become a statistically significant determinant of leverage for non-cross listed firms.

Profitability

The profitability variable is statistically significant for all the leverage ratios, and it is negatively correlated to leverage. This is consistent with the Pecking Order Theory and most of the empirical research as mentioned previously. The variable is statistically significant at a 1% level for total debt and short-term debt and it is significant to the 5% level for long-term debt. This could be due to the difficulty in forecasting profitability in the long-term. Therefore, profitability becomes less significant for long-term debt and factors such as tangibility of assets become more significant.

Relative to non-cross listed the magnitude of the profitability coefficient for cross listed firms is much higher (65% higher). The coefficient is also statistically significant whereas for non-cross listed firms it was not. Previous research has shown that the US generally has the highest magnitude for the profitability coefficient relative to other countries (a. Antoniou et al., 2006; de Jong et al., 2008; Wald, 1999). Therefore, the high coefficient and significance could be due to institutional factors in the US, as most of our cross listed firms are listed in the US.

Another reason for these findings is that, it was seen in the descriptive statistics that the mean profitability ratio for cross listed firms was negative. This suggest that cross listed firms are less profitable than the non-cross listed firms. The cross listed firms also have higher growth prospects and higher leverage ratios. According to Booth et al. (2001) firms with a high growth rate and low profitability will tend to use external funds. Thus, explaining the higher leverage ratios for cross listed firms. Due to high leverage ratios and low profitability, accessing debt may be becoming more difficult for cross listed firms. Hence, why profitability is statistically significant, and the pecking order theory is more relevant for cross listed firms compared to non-cross listed firms.

Non-Debt Tax Shields

The non-debt tax shields variable is statistically significant only for long-term debt. These findings are similar to A. Antoniou et al. (2008) for long-term debt. The coefficient of the variable is positive for all the leverage ratios. Like non-cross listed mining firms, the sign is positive because firms use debt to fund assets and in turn use them as collateral. This theory is further confirmed by the non-debt tax shields variable being statistically significant for long-term debt. Therefore, cross listed firms with high non-debt tax shields will use more long-term debt. For non-cross listed firms, the variable was statistically significant for all the leverage ratios. The reasons as to why the coefficients are statistically significant and higher for non-cross listed firms and not for cross listed firms is still unclear.

Trend

The trend variable is statistically insignificant for all the leverage ratios. Therefore, the commodity price cycle does not have an impact on a mining firms capital structure choice. This result to similar to non-cross listed mining firms. The sign of the coefficient though is negative for total debt and long-term debt. Whereas for non-cross listed it was positive for all the leverage ratios. This result is consistent with findings for leverage and business cycles (Hackbarth et al., 2006; Halling et al., 2016; Korajczyk et al., 2003). Where it was found that leverage is counter cyclical to business cycles.

The results suggest that cross listed mining firms will use more debt when the commodity prices are declining. The reason for this financing behaviour is that cross listed mining firms tend to be larger, less risky firms, with less information asymmetries and with easier access to debt and equity capital markets. When commodity prices are declining, profitability will be lower. Therefore, lower returns in the equity capital markets as the cost of equity increases. Due to this, cross listed firms would rather issue more debt when the commodity prices are low.

On the other hand, non-cross listed firms tend to be smaller with less access to capital markets. Given low commodity prices and profitability, the financial distress cost is high. Therefore, non-cross listed firms have no choice but to issue less debt when the commodity prices are high.

The coefficient of the trend variable is positive for short-term debt though. This suggests that the higher the commodity prices the more short-term debt the cross listed firms will use. The coefficient could be positive because commodity prices are volatile. If there is a sudden increase in commodity prices, cross listed firms will use short-term debt to fund the shortfall.

This is similar to research conducted for external shocks and a firm's transitory debt issuance (DeAngelo et al., 2011).

4.2.2.1 Fixed Effects (FE)

The FE regression results show that for cross listed mining firms listed within SSA, the statistically significant determinants of total debt are tangibility of assets, size, and profitability. Short-term debt is similar to total debt, with the addition of non-debt tax shields. For long-term debt, it is only the tangibility of assets and profitability variables that are statistically significant.

The main differences between the FE and OLS model is that tangibility of assets is significant for short-term debt and long-term debt. In the case of the OLS model, tangibility of assets was not significant for total debt and long-term debt. Growth prospects is insignificant for long-term debt, whereas in the OLS it was significant. The coefficient for non-debt tax shields becomes negative for total and short-term debt, where for the OLS model it was positive for all the leverage ratios. The variable is also statistically insignificant for long-term debt and for the OLS it was not. The trend variable becomes positive for all the leverage ratios, in the OLS model it was negative for total debt and short-term debt.

The adjusted R^2 ranges between 48% and 74% with long-term debt once again having the lowest R^2 value and total debt having the highest. This result suggests that the explanatory power of the models is much stronger than then the OLS model. The adjusted R^2 values for the cross listed model are higher than for the non-cross listed model (34-50%). This suggest that the model and its variables are more suited for cross listed firms. This could also be due to the consistent nature of the data for cross listed firms.

The reasons as to why the FE model results would differ from the OLS model are consistent with previous discussion for non-cross listed firms. The null hypothesis of the F-Statistic is strongly rejected. Therefore, the explanatory variables are determinants of leverage.

Tangibility of Assets

Tangibility of assets is statistically significant at the 1% level for total debt and long-term debt, and it is statistically significant for short-term debt at the 5% level. In the OLS estimation model this variable was statistically insignificant for total debt and long-term debt. Similarly, to the discussion for non-cross listed firms, it could be due to model specification.

The sign of the coefficients is similar to the OLS model where it is positive for total debt and long debt and negative for short-term debt. The major difference between the non-cross listed and cross listed firms is that for short-term debt the coefficient of the variable is positive for

non-cross listed firms and it is negative for cross listed firms. These results are still consistent with the OLS model.

Size

The size variable is statistically significant for total debt and short-term debt only. The coefficient of the variable is positive for all the leverage ratios. There are no major differences between the OLS model and the FE model. There are also no major differences between the non-cross listed and the cross listed firms. The reasons for the relationship have been discussed extensively in previous sections. The magnitude of the coefficients and the level of significance is only slightly higher for cross listed firms compared to non-cross listed firms.

Growth Prospects

The growth prospects variable is statistically insignificant for all the leverage ratios and the sign of the coefficient is positive for total debt and long-term debt. The major difference between the OLS and the FE model, is that the coefficient for the variable was statistically significant to the 5% level for the OLS model and for the FE model it is not statistically significant. These differences could be attributed to model specification.

The main difference between the non-cross listed firms and the cross listed firms is that the sign of the coefficient is negative for short-term debt. Therefore, the higher the growth prospects of cross listed mining firm the less short-term debt it will use. This was the same case for the OLS model.

Profitability

Profitability is statistically significant for all the leverage ratios and the coefficient is negatively correlated. These results are similar to the OLS model and the magnitude of the coefficient is relatively the same. This result highlights the robustness of the profitability variable. Which is consistent with the pecking order theory and most of the empirical research. The differences between the non-cross listed firms and the cross listed firms are similar to the OLS regression.

Non-Debt Tax Shield

The non-debt tax shields variable is significant only for short-term debt, whereas for the OLS model it was only significant for long-term debt. The coefficient of the variable is negative for total debt and short-term debt. In the OLS model it was positive for all the coefficients. The magnitude of the coefficients also gives mixed results. The output results of the FE model tend to be more robust, therefore the differences in the results could be attributed to model specification.

The FE model results for cross listed firms suggests that cross listed mining firms use non-debt tax shields as a substitute for the tax benefit of short-term debt, whereas for long-term debt they do not. These findings are consistent DeAngelo and Masulis (1980) for long-term financing and for short-term debt (A. Antoniou et al., 2008; Titman & Wessels, 1988). The possible reason for why non-debt tax shields is positive for long-term debt but negative for short-term debt could be due to assets being financed using long-term debt. Similarly, to non-cross listed firms, cross listed firms use debt to finance their assets which are in turn used as collateral. Due to more assets which can be used as collateral, the firm's debt capacity increases thus the firm will be inclined to use more debt. Therefore, the higher the non- debt tax shields the higher the long-term debt.

On the other hand, cross listed firms can afford to use their internal resources to finance short-term debt (Harc, 2015). Therefore, the higher the non-debt tax shields, the more the firms will substitute non-debt tax shields for the tax benefit of short-term debt. It can be seen from the regression results that these financing strategies do not hold for non-cross listed firms. This could be due to that they cannot afford to finance their own short-term debt, or due to their limited access to capital markets, there could also be institutional factors which do not allow for such flexibility in financing strategies.

Trend

The trend variable is statistically insignificant for all the leverage ratios. This is similar to the OLS model. The sign of the coefficient becomes positive for all the leverage ratios, whereas in the OLS model it was negative for total debt and long-term debt. These results are similar for non-cross listed firms. The magnitude of the coefficient is also similar for the OLS model and the non-cross listed firms.

These results suggest that trend is indeed an insignificant determinant of leverage for both non-cross listed and cross listed firms. The results are consistent with research where leverage is pro cyclical for financially constrained firms (Korajczyk et al., 2003). Therefore, despite the exposure to international capital markets, mining firms will raise more debt when the commodity prices are higher. The reason for this is that when the commodity prices are low, the risk of default is higher. Therefore, mining firms are better suited to raise debt when commodity prices are booming.

4.2.2.2 Random Effects (RE)

The RE regression results show that for cross listed mining firms in SSA, the statistically significant determinants of total debt and short-term debt are tangibility of assets, size and profitability. In the case of long-term debt only tangibility of assets, and profitability are significant.

The main differences between the RE and FE model is that non-debt tax shields are statistically insignificant for short-term debt. The main differences between the RE model and the OLS are the same as the FE model. Where tangibility of assets is statistically significant for total and long-term debt. Growth prospects and non-debt tax shields are statistically insignificant for long-term debt.

The adjusted R^2 ranges from 17-56% with long-term debt having the lowest R^2 value and total debt having the highest. Similarly, to the non-cross listed model the results suggests that the explanatory power of the models is much stronger than then the OLS model. However, the explanatory power is weaker than the FE model.

The Adjusted Hausman Test results show that the null hypothesis is rejected for the short-term and long-term model. Therefore, the FE model is correctly specified for short-term debt and long-term debt model. The RE model is correctly specified for the total debt. Relative to the non-cross listed model the cross listed model yields more consistent results in terms of the significance of the variables, the signs of the coefficients and the magnitude of the coefficients. This once more confirms that the model is more robust for cross listed firms. The reason for this could be due to the data being more consistent for cross listed firms, or the explanatory variables are more suited for cross listed firms.

The discussion as to why the FE and the RE model results differ, the definition of the adjusted Hausman test and the interpretation of the model robustness checks have been discussed in previous sections. The section below will compare the RE results to the FE and the OLS model and conclude what the sign and the significance level of the variables should be. Most of the reasons for the sign and the level of significance for each variable have been discussed in previous sections.

Tangibility of Assets

The tangibility of assets variable is statistically significant to the 1% level for total debt and long-term debt and it is statistically significant to the 10% level for short-term debt. The sign of the coefficient is positive for total debt and long-term debt. These results are similar to the FE model. In the OLS model the variable was statically insignificant for total debt and long-term

debt. Since the FE and the RE model are more correctly specified we can conclude that tangibility of assets, is statistically significant and positive for total debt and long-term debt. In addition, tangibility of assets is significant to a lesser degree for short-term debt and the sign of the coefficient is negative.

Size

The firm size variable is statistically significant to the 1% level for total debt and short-term debt. The sign for the coefficients is positive for all the leverage ratios. The results are consistent with the OLS and the FE model. The magnitude of the coefficient is also similar in all three models. Therefore, the larger the size of the cross listed mining firm the more debt the firm uses, and this is more significant when it comes to total debt and short-term debt.

Growth Prospects

The growth prospects of a cross listed mining firm are statistically insignificant for all the leverage ratios. The sign of the coefficient is positive for total debt and long-terms debt. However, for short-term debt this is negative. The results obtained here are the similar to the FE model results. The difference with the OLS model is that in the OLS model growth prospects is statistically significant for long-term debt. It has been seen that the FE and RE model are more correctly specified therefore one can conclude that firms with high growth prospects will use more total debt and long-term debt. Whereas they will reduce their debt levels for short-term debt. However, growth prospects are a statistically insignificant determinant of leverage for cross listed firms.

Profitability

The profitability variable is statically significant to the 1% level for total debt and short-term debt and significant to the 5% for long-term debt. The coefficient of the variable is negative for all the leverage ratios. The results are also consistent with the OLS and the FE model. The magnitudes of the coefficients are also similar. Therefore, cross listed firms also follow the pecking order theory, but the significance becomes less for long-term debt.

Non-Debt Tax Shields

The non-debt tax shields variable is statistically insignificant for all the leverage ratios. The sign of the coefficient is negative for total debt and short-term debt. The difference between the RE model and the FE model is that non-debt tax shields is negative for the FE model. The difference with the OLS model is that coefficient is positive for all the leverage ratios and it is statistically significant for long-term debt. The magnitudes of the coefficients also give mixed results. The reason for the results being inconsistent for the non-debt tax shields variable and

consistent for the other variables could be due to data limitations. As highlighted previously, depreciation is not reported as a separate line item every year for all the firms.

Since the FE and RE model are more correctly specified. The results tell us that for cross listed firms the higher the non-debt tax shields, the less total and short-term debt the firm will use. The RE model is more correctly specified for short-term debt, therefore non-debt tax shields are statistically significant only for short-term debt.

Trend

The trend variable is statistically insignificant for all the leverage ratios. The sign of the coefficient is also positive for all the leverage ratios. This result is similar to the FE model. In the OLS model the sign of the coefficient was negative for total debt and long-term debt. The magnitude of the coefficients is also similar. Since the FE model and RE model are more correctly specified we can conclude that the trend variable is not s significant determinant of leverage. In addition, cross listed firms will use more debt when the commodity prices are high.

4.2.3 Discussion

The following section will attempt to summarise the static model regression results for the cross listed firms and the non-cross listed firms. It will highlight the main differences and similarities between non-cross listed and cross listed firms and explain why these differences occur.

Non-Cross Listed Firms

Tangibility of assets is highly statistically significant and positive for all the leverage ratios. Firm size is only statistically significant for short-term debt and the sign of the coefficient is positive for all leverage ratios. Growth prospects is a statistically significant determinant for all the leverage ratios, and the sign of the coefficients is positive for all the leverage ratios. Although profitability is a statistically insignificant determinant of leverage, the negative coefficient of the signs confirms that the Pecking Order Theory is still relevant. Non-debt tax shields are statistically significant only for total debt and long-term debt and the sign of the coefficients is positive for all the leverage ratios. The trend variable has no significance in capital structure choice and non-cross listed mining firms use more debt when the there is a commodity price boom.

Cross Listed Firms

Tangibility of assets is statistically significant and positive for total debt and long-term debt. When it comes to short-term debt, the coefficient is statistically significant to a lesser degree and the sign of the coefficient is negative. Firm size is positively correlated to leverage, and it is only significant when it comes to total debt and short-term debt. Growth prospects is a statistically insignificant determinant of leverage. However, firms with high growth prospects will use more long-term debt and will reduce their debt levels for short-term debt. Profitability is statistically significant for all the leverage ratios, but the significance decreases for long-term debt. The sign of the coefficient is negative for all the leverage ratios. Non-debt tax shields are statistically significant only for short-term debt. The higher the non-debt tax shields the less total and short-term debt the firm will use. The trend variable is not a significant determinant of leverage. Cross listed firms will also use more debt when the commodity prices are high.

Comparison

Non-cross listed and cross listed mining firms within SSA share some similarities, but there are also stark differences in their financing behaviour. The differences are more prevalent when it comes to short-term debt financing.

Tangibility of assets is statically significant and positive for all the leverage ratios. Therefore, the more tangible assets a mining firm has the more debt it uses. This is consistent with the static trade off theory. Firms with a higher asset tangibility will have more assets to use as collateral, therefore will have a higher debt capacity. The difference is for short-term debt, where the tangibility of assets variable is negative for cross listed firms. Cross listed firms could limit their short-term debt use because these firms use more of their assets as collateral to fund long-term debt. Cross listed firms have a higher tangibility of assets, since the operational risk is higher, reducing short-term debt could be a mechanism to reduce their financial risk. Cross listed firms could have higher retained earnings therefore short-term funding can be financed internally. Cross listed firms could be using debt as a means of reducing agency costs between shareholders and creditors.

Non-cross listed firms have a positive relationship between short-term debt and tangibility of assets. This could be due to institutional factors, where assets are being used as collateral for short-term financing. Another reason could be due to higher information asymmetries for non-cross listed firms, these firms could be using debt to reduce the agency cost of free cash flows.

Non-cross listed firms and cross listed firms behave in a similar manner when it comes to the size of the firm and leverage. The larger the size of firm, the more debt the firm uses. This is

particularly significant for short-term usage. Larger firms have a lower bankruptcy risk. Therefore, according to the static trade off theory they will use more debt. Larger firms also reduce their agency costs by increasing debt. The variable is significant for short-term debt because of information asymmetries and the non-collateral nature of short-term debt. Since mining firms are using their assets as collateral to fund long-term debt, creditors will issue more short-term debt to larger, and lower risk firms.

Firms that are non-cross listed and those that are cross listed behave differently when it comes to the growth prospects of the firm. For non-cross listed firms this variable is statistically significant for all leverage ratios and positive. Which means the higher the growth prospects the more leverage the firm will use. This is due to growth prospects being perceived as adding value to a firm. Therefore, increasing the firm's debt capacity.

Cross listed firms are different in that growth prospects are statistically insignificant and the higher the growth prospects the less short-term debt the firm will use. Reasons for this could be due to higher information asymmetries in non-cross listed firms, therefore lenders also rely heavily on the market consensus about a firm's growth prospects to determine the firm's risk profile. On the other hand, cross listed firms will reduce their short-term debt. Firstly, they can fund the short-term growth internally. Secondly, high growth firms have volatile earnings therefore to reduce the risk of bankruptcy, short-term debt is reduced. Thirdly, it is to reduce the associated agency costs between bond holders and shareholders.

Like most empirical research, the profitability variable has a negative relationship with leverage for both non-cross listed and cross listed firms. This is consistent with the pecking order theory, which states that firms will exhaust their internal funds first before issuing securities for external funds. The big difference between non-cross listed firms and cross listed firms is that profitability is statistically significant for non-cross listed firms and it is insignificant for cross listed mining firms.

Profitability has been found to be a statistically insignificant determinant of leverage for financially constrained firms. Therefore, other variables such as tangibility of assets become an important determinant of leverage. The results of the profitability ratio for cross listed firms is consistent with international capital structure research. Which suggests that there could be institutional factors, which cause the variable to be significant. In addition, the cross listed mining firms in our sample have lower profitability, higher growth prospects and higher leverage ratios relative to the non-cross listed firms. Therefore, due to the extensive use of external funding, the pecking order theory is significant.

Non-debt tax shields behave completely different for non-cross listed firms and cross listed firms. The coefficient of the non-debt tax shields is significant for long-term debt for non-cross

listed firms and it is significant for short-term debt for cross listed firms. For long-term debt the variable may have the same positive sign, but for cross listed firms it is negative for short-term debt. These results are consistent with the theory that mining firms use long-term debt to fund their assets which are in turn are used as collateral therefore increasing long-term debt capacity. Therefore, inducing a positive relationship between non-debt tax shields and leverage. Cross listed firms will also use the benefit of non-debt tax shields to substitute the benefit of tax shields for short-term debt. It has been suggested that cross listed firms can afford to fund their short-term debt needs internally, but non-cross listed firms cannot hence the positive relationship.

The trend variable is universally statistically insignificant for all non-cross listed and cross listed mining firms. Therefore, a commodity boom or bust, will not significantly affect a firm's capital structure choice. Mining firms will also raise more debt when the commodity prices are higher. The main reason for this could be because in a commodity boom cycle the probability of default is lower, therefore firms will issue more debt. In a boom market collateral values are also higher, therefore mining firms are in a better position to issue debt.

In sum, the research has shown that the variables such as tangibility of assets, firm size, growth prospects, profitability, and non-debt tax shields are determinants of leverage for mining firms. The level of significance, the sign of the coefficient, and the magnitude of the coefficient is largely dependent on if the firm is cross listed or not. The major differences between non-cross listed and cross listed firms is the financing of short-term debt. The results have confirmed that whether the market is in a commodity boom or bust cycle, the trend is an insignificant determinant of leverage. However, in a booming cycle, mining firms will issue more debt.

4.3 Dynamic Models

In analysing the Durbin-Watson Statistic in Table *9* and Table *10* for the non-cross listed and cross listed firms, it can be seen that there is some level of positive autocorrelation from Table *11*. The Null hypothesis of H_0: no first order serial correlation is rejected for the static models. To improve the model and resolve the autocorrelation issue, it can be assumed that the model is not correctly specified, and a lagged dependent variable should be incorporated in the model. Therefore, the static model is transformed into a dynamic panel data model which includes the lagged dependent leverage variable.

Table 11. DW statistic test for static models.

	5% Level		1% Level	
	d_L	d_U	d_L	d_U
	1.697	1.841	1.603	1.746
	Min	Max	Min	Max
Positive Autocorrelation	0.000	1.697	0.000	1.603
Zone of Indecision	1.697	1.841	1.603	1.746
No Autocorrelation	1.841	2.159	1.746	2.254
Zone of Indecision	2.159	2.303	2.254	2.397
Negative Autocorrelation	2.303	4.000	2.397	4.000

Since it has been established that a dynamic model could improve the robustness of the data analysis, a correlogram is constructed to determine how many lagged dependent variables should be added to the model. The correlogram for the leverage variables of the non-cross listed and cross listed firms is shown in the Appendix B. For the panel data the autocorrelation function ("acf") is geometrically declining with an increase in the number of lags. The partial autocorrelation function ("pacf") is only significant in the first lag and thereafter it is not significant. This type of series can be classified as an autoregressive process. Since the pacf is only significant for only the first lag it can be regarded as an autoregressive process of order one, AR (1). An AR (1) model implies that the level of leverage is largely determined by its own value in the preceding year.

To check if the model is parsimonious, an AR (2) and an AR (3) model estimated. The adjusted R^2 results and the information criteria, which is the Akaike Information Criterion ("AIC"), Schwarz Criterion ("SBC") and the Hannan-Quinn Criterion ("HQ") where checked. The AR (1) model is the most correctly specified, as the model results in the highest adjusted R^2 and the lowest AIC, SBC and HQ. The AR (1) results can be seen in Appendix B.

The AR (1) model was estimated and to improve the precision of the model a sys-GMM estimator was used. In using the sys-GMM model, instruments are required to estimate the model and the lagged regressors can be used as instruments. The number of lags used is dependent on the autocorrelation between the instruments and the residuals. The number of lags used was 4 because it is the lowest number of lags where all the models satisfy the J-Statistic. It can be seen in *Table 12* that the p value is greater than 10%, therefore we fail to reject the null hypothesis. We can therefore conclude that the instruments are not correlated with the residuals and the model is correctly specified.

This next section will discuss the capital structure determinants for non-cross listed and cross listed firms using the dynamic models. The main objective of this section is to assess the impact of the lagged leverage variable. The dynamic model will also be compared to the static model and variables which are significantly different from the static model will be discussed. It

has been seen in previous research that the sign of the coefficients or the significance level of the variables can change when using a static or a dynamic model (Gómez et al., 2016).

4.3.1 Non-Cross Listed Mining Firms

In the static model we found that tangibility of assets, firm size, growth prospects and non-debt tax shields were statistically significant determinants of leverage and the sign of the coefficients is positive. Although the trend variable also has a positive coefficient, it is an insignificant determinant of leverage. Profitability is also statistically insignificant, but the coefficient of the variable is negative, consistent with the pecking order theory.

Table 12. Non-cross listed (NCL) and cross listed (CL) firms dynamic model, sys-GMM regression model.

	Total Debt		Short-term Debt		Long-term Debt	
	NCL	CL	NCL	CL	NCL	CL
Lagged Leverage	0.44 *	0.64 *	-0.12	0.49 *	0.27 **	0.83 *
	(0.07)	(0.03)	(0.21)	(0.01)	(0.11)	(0.02)
Tangibility of Assets	0.14	-0.18 *	0.80 **	-0.37 *	0.50 ***	0.54 *
	(0.34)	(0.03)	(0.34)	(0.01)	(0.27)	(0.06)
Size	0.04	0.09 *	0.01	0.07 *	0.02	0.01
	(0.03)	(0.01)	(0.02)	(0.00)	(0.02)	(0.01)
Growth Prospects	0.00	0.11 *	-0.05	-0.02 *	0.07 **	0.02 *
	(0.04)	(0.00)	(0.03)	(0.00)	(0.03)	(0.01)
Profitability	0.04	-1.09 *	0.12	-0.87 *	-0.35	0.01 **
	(0.09)	(0.02)	(0.17)	(0.01)	(0.24)	(0.01)
Non-Debt Tax Shields	2.25	-0.44 *	-0.41	-2.02 *	0.07	1.44 *
	(1.43)	(0.16)	(1.21)	(0.03)	(1.34)	(0.15)
Trend	0.07 *	0.02 *	0.03 **	0.05 *	0.03	0.00
	(0.02)	(0.01)	(0.01)	(0.00)	(0.02)	(0.00)
J-Statistic	14.06	15.23	13.99	17.54	10.90	17.27
	(0.45)	(0.58)	(0.45)	(0.42)	(0.69)	(0.44)

* Statistically significant to the 1% level
** Statistically significant to the 5% level
*** Statistically significant to the 10% level

4.3.1.1 Sys-GMM

The sys-GMM regression results show that for non-cross listed mining firms, the statistically significant determinants of total debt are lagged leverage, and the trend variable. As for short-term debt, it is the tangibility of assets and trend. For long-term debt, it is lagged leverage, tangibility of assets, and growth prospects.

The main differences between the sys-GMM model and the static models is that tangibility of assets is not statistically significant for total debt. Whereas in the static model it was. Firm size is statistically insignificant for short-term debt. Growth prospects are only significant for long-

term debt and the sign of the coefficient is negative for short-term debt. Profitability is positive for total debt and short-term debt. Non-debt tax shields give mixed results in terms of significance and the signs of the coefficient. The trend variable is statistically significant for total debt and short-term debt. The coefficients of the variables mostly kept the sign for total debt and long-term debt. Whereas for short-term debt they differ. The negative coefficient of the short-term debt suggests that the higher the previous short-term debt the less debt the firm uses.

Lagged Leverage

The lagged leverage variable is statistically significant for total debt and long-term debt at the 1% level. The coefficient of the lagged leverage variable is positive for total debt and long-term debt. This implies that the previous debt of a mining firm has a significant impact on their current debt levels. The higher the debt level a firm has, the more debt the firm will use. The significance of the lagged debt variable also suggests that a firm will adjust their debt levels to an optimal capital structure. In other words, non-cross listed mining firms will use debt to get to their optimal capital structure.

The results are consistent with previous research (a. Antoniou et al., 2006; Gómez et al., 2016; Korajczyk et al., 2003). The coefficient of the variables ranges between 0.12-0.44, which suggests a low to medium adjustment level to the optimal capital structure per annum. Where short-term debt has the slowest adjustment. The positive sign of the coefficient suggests that non-cross listed mining firms have enough debt capacity to use more long-term debt. According to literature mining firms generally have lower leverage ratios relative to other industries (Islam & Khandaker, 2015). Naidu (1986) suggested that due to cyclical nature of mining, debt levels are kept to a minimum. It was also seen in research that firms with high unexpected investment shocks will tend to have low leverage (DeAngelo et al., 2011).

The lagged leverage variable is statistically insignificant for short-term debt and the coefficient of the variable is negative for short-term debt. A statistically insignificant lagged variable contradicts previous research (Chipeta et al., 2012). This could be attributed to model specification. The negative sign means that the higher the lagged leverage variable, the less leverage a firm uses. These results are consistent with the static trade off theory where firms will adjust their short-term leverage to mitigate the risk of bankruptcy (Myers, 1984).

Tangibility of Assets

Tangibility of assets is statistically significant for short debt and long-term debt; however, the coefficient of the variables is positive for all the leverage ratios. The results are similar to mining firms in Latin America (Gómez et al., 2016). Therefore, the higher the asset tangibility the more debt the firm will use.

Asset tangibility though is an insignificant determinant of leverage. A. Antoniou et al. (2008) found an insignificant relationship for US firms and market leverage. The difference between the sys-GMM model and the static models is that tangibility of assets is insignificant for total debt, where in the static model it was significant for all the leverage ratios. This could be due to model specification, as asset tangibility has been consistently significant and positive for all the models and dependent variables.

Size

Firm size is statistically insignificant for all the leverage ratios and the sign of the coefficients is positive. These findings are in line with the static models discussed previously, and are similar to findings by Gómez et al. (2016). Therefore, the larger the size the more debt the firm uses. The only difference is that firm size is statistically insignificant for short-term debt, where in the static model it was significant. This suggests that lenders to non-cross listed firms are not taking into consideration the firm size when issuing short-term debt. Other measures such as tangibility of assets are being used to assess a firm's risk.

Growth Prospects

Growth prospects are a significant determinant only for long-term leverage, and the coefficient of the variable is positive. This result is consistent with Gómez et al. (2016) research. Therefore, the higher the growth prospects of a firm, the more leverage the firm will use. As previously discussed, this positive result could be due to the anticipated value add of the growth prospects. For the static model, growth prospects were a statistically significant determinant for all the leverage ratios. The insignificance for short-term debt in this model could be due to the debt maturity matching principle.

What is inconsistent with the results so far is that the coefficient of the variable for growth prospects is negative for short-term debt. This result is similar to cross listed firms, and it is consistent with research for South African firms pre liberalisation (Chipeta et al., 2012). This implies that the higher the growth prospects of a firm, the less short-term debt a firm will use. As per the discussion in previous sections high growth firms have a higher risk due to earnings volatility. Therefore, less short-term debt could be used to reduce bankruptcy risk, as per the static trade off theory (Myers, 1984).

Profitability

The profitability variable is statistically insignificant for all the leverage ratios and the coefficient of the variable is only negative for short-term and long-term debt. The insignificance of the variable further confirms the static model results that profitability is not a significant determinant of leverage for non-cross listed firms.

Short-term debt in this model has a positive coefficient, which contradicts the pecking order theory and most of the empirical results. This result is similar to Chipeta et al. (2012), where the sys-GMM estimation model was also used. Therefore, this result could be due to model specification. What the results tell us though is, the higher the profitability of a firm the more short-term debt they will use. This is consistent with the static trade off theory. It has been suggested that long-term debt is more costly for firms operating within SAA (Kodongo et al., 2015). Therefore, non-cross listed mining firms could be using the generated retained earnings to finance long-term activities. The short-term activities are in turn financed using debt.

Non-Debt Tax Shields

Non-debt tax shields are a statistically insignificant determinant of leverage for all the ratios and the sign of the coefficient is positive for total debt and long-term debt. The dynamic model differs to static model in that for the static model, non-debt tax shields was a significant determinant for total debt and long-term debt. These findings are strongly conflicting, and it is unclear if it should be significant or not.

The coefficient of the variable for short-term debt is negative for the sys-GMM model, whereas in the static model it was positive. Once again these findings are similar to that of pre liberalisation firms in South Africa (Chipeta et al., 2012). These results suggest that the higher the non-debt tax shields the less short-term debt non-cross listed firms will use. Therefore, non -cross listed firms would rather use the tax benefit of non-debt tax shields then to use the tax benefit of short-term debt. This is consistent with DeAngelo and Masulis (1980). These results could be plausible for mining firms which want to reduce their bankruptcy risk. This determinant of leverage though is insignificant.

Trend

The trend variable in the dynamic model is statistically significant for short-term debt and total debt. The sign of the variable is positive for all the leverage ratios. Therefore, the higher the commodity prices the more debt non-cross listed mining firms will use. The trend variable was consistently insignificant for the static models. These results imply that a static model may not be the best model if a trend variable is to be included. The trend is statically significant only

for short-term debt. To the best of our knowledge there no papers which have compared the direct relationship of commodity price trends and short-term debt using a dynamic model.

Commodity prices are volatile, and it could be difficult for a firm to forecast prices for the long-term. To mitigate against bankruptcy risk as per the static trade off theory, firms will place a higher reliance on the commodity price trend only to secure short-term debt. Therefore, the trend variable will only be a significant determinant for short-term debt. The results may also mean that the sudden shocks in commodity prices are funded by short-term debt as suggested by DeAngelo et al. (2011).

4.3.2 Cross Listed Mining Firms

The results from the static model show that tangibility of assets, and firm size, are statistically significant determinants of leverage and the sign of the coefficients is positive. Consistent with most empirical research, profitability is statistically significant, and the coefficient of the variable is negative. Non-debt tax shields are only significant for total and short-term debt, and they are negatively correlated to leverage. Growth prospects are an insignificant determinant of leverage with a negative coefficient for short-term debt. The trend variable is also insignificant and has a positive coefficient.

4.3.2.1 Sys-GMM

In the sys-GMM model for cross listed firms, lagged leverage, tangibility of assets, firm size, growth prospects, profitability, non-debt tax shields and the trend variable are statistically significant for most of the leverage ratios. The only exceptions are firm size, and trend for long-term debt.

The main differences between the static model and the dynamic model is that in the static model, growth prospects, profitability and trend are insignificant for total debt. Growth prospects and trend are insignificant for short-term debt. Growth prospects and non-debt tax shields are insignificant for long-term debt. The signs of the coefficient only differ for tangibility of assets for total debt and for profitability for long-term debt.

Lagged Leverage

The lagged leverage ratio is statistically significant for all the leverage ratios and the sign of the coefficient is positive. This result is similar to non-cross listed firms, except for short-term debt. Where for non-cross-listed firms it is negative and insignificant. The magnitude of the coefficient is higher (49-83%) relative to the coefficient for non-cross listed firms. This suggest that cross listed firms adjust their leverage much faster than non-cross listed firms. This

contradicts previous research where it would be expected that firms which have less information asymmetries would adjust their capital structure more slowly (A. Antoniou et al., 2008). Firms sometimes use the optimal capital structure to signal a financially healthy firm. Firms which have low information asymmetries can afford to deviate from the optimal structure, as there is less pressure to signal financial health. Therefore, it would be expected that cross listed firms would adjust their leverage slower, as they have less information asymmetries than non-cross listed firms. They also have access to other capital markets; therefore, they have more choice in capital raising instruments.

The findings though are similar to firms operating in post liberalisation South Africa (Chipeta et al., 2012). The reason why cross listed firms could be adjusting their capital structure much faster than non-cross listed firms could be due to better institutional factors. Our cross listed firms are listed on exchanges where the markets are more developed, and they are exposed to international bond markets or active bond markets. Therefore, they have access to a variety of financial instruments which enable them to adjust their capital structure faster than firms that are non-cross listed.

Another reason could be due to the low profitability, high growth rate and high leverage ratios of cross listed firms relative to non-cross listed firms. Therefore, due to their high debt ratios cross listed firms need to adjust their leverage to signal a financially healthy firm. According to (PWC, 2016), a number of mining firms were also downgraded to below investment grade in the last 11 years. Therefore, this could be having an impact on cross listed firm's capital structure adjustment levels. Whereby there is pressure on cross listed firms to signal financial discipline to investors.

Tangibility of Assets

Tangibility of assets is statistically significant for all the leverage ratios at a 1% level. The sign of the coefficient is only positive for long-term debt. These results are similar to the static models. The exception is total debt, where the sign of the coefficient is negative for the dynamic model. This implies that cross listed firms with high asset tangibility will use more long-term debt and less short-term debt. These results are similar to Chipeta et al. (2012) for short-term debt. The reasons for this financing behaviour have been discussed in the static model section.

The most consistent difference between cross listed and non-cross listed firms is that cross listed firms with a high asset tangibility will reduce their short-term debt. Non-cross listed firms on the other hand will increase their short-term debt. This is also consistent in the static models. Reasons for this could be due to the higher information asymmetries for non-cross listed firms, asset tangibility could become a significant factor to secure short-term debt. It has

been seen that cross listed firms tend to be larger with a higher asset tangibility. Therefore their assets can generate sufficient cash flows to finance short-term activities from internal funds (Harc, 2015).

Size

The firm size variable is statistically significant for short-term debt and total debt to the 1% level. The coefficient of the sign is positive for all the leverage ratios. This result is similar to the static model. Therefore, the larger the firm size the more debt it will use. Firm size though becomes a less significant factor to secure long-term debt. The main reason for this is due to larger firms having a lower bankruptcy risk, or asset tangibility becomes a more significant factor to secure long-term debt.

The main difference between cross listed and non-cross listed firms is that firm size is insignificant for non-listed firms when it comes to total debt and short-term debt. This variable could be insignificant for non-cross listed firms due to higher information asymmetries for non-cross listed firms and institutional factors within SSA. Whereby even large firms cannot access debt more easily than smaller firms.

Growth Prospects

The growth prospects of a cross listed firm are statistically significant for all leverage ratios. The sign of the coefficient is negative only for short-term debt. Therefore, firms with high growth prospects will use more long-term debt and less short-term debt. The reasons for this are consistent with the reasons mentioned in the previous sections. These results show the importance of reducing agency costs, mitigating the risk of bankruptcy and cross listed firms possibly cross listed firms having enough internal funds to finance their short-term activities.

These results are similar to the static model; however, the level of significance is a strong contradiction. In the static model, growth prospects were an insignificant determinant for all leverage ratios. In Gómez et al. (2016) research this variable was significant for mining firms whereas in Chipeta et al. (2012) research it was significant for post liberalisation firms in South Africa.

The difference between the non-cross listed firms and the cross listed firms is that growth prospects is insignificant for total debt and short-term debt for non-cross listed firms. This could be due to model specification as it was seen in the static model that is was a significant determinant of leverage for non-cross listed firms.

Profitability

The profitability variable is significant for all the leverage ratios and the coefficient of the variable is negative for total debt and short-term debt. This suggests that cross listed firms with a higher profitability will use more long-term debt and less short-term debt. Therefore, cross listed firms follow the pecking order theory when it comes to short-term debt and the static trade off theory when it comes to long-term debt. Profitable cross listed firms could be using more long-term debt because they are regarded to be less risky and therefore the cost of long-term debt could be lower. Based on the results of the static models, this confirms the theory that cross listed firms are using their internal funds to finance their short-term activities and debt is being used to finance their long-term assets.

Non-cross listed firms have different financing strategies to cross listed firms. Firstly, profitability is an insignificant determinant. Secondly, non-cross listed firms with a high profitability use more short-term debt and less long-term debt. This supports the theory that there could institutional factors which make long-term debt costly for firms within SSA (Kodongo et al., 2015). Thus, mining firms that are only exposed to SSA capital markets will use internal resources to fund long-term activities, and cheaper short-term debt to fund short-term activities.

Non-Debt Tax Shields

Non-debt tax shields are a statistically significant determinant of leverage. The coefficient of the variable is positive for long-term debt only. These results are similar to the static model with the only difference being that the variable are significant determinants in the dynamic model. Therefore, cross listed firms with high non-debt tax shields will use more long-term debt but will reduce their short-term debt usage. This result is similar to the findings of the static models.

The main difference between cross listed and non-cross listed firms is the level of significance. For non-cross listed firms, the non-debt tax shields were an insignificant determinant of leverage for the dynamic model, and it was mixed for the static model. Therefore, these differences could be attributed to model specification.

Trend

The trend variable is statistically significant for total debt and short-term debt. The coefficient of the variable is positive for all the leverage ratios. In the static model the variable was insignificant for all the leverage ratios, but the sign was also positive. These results are similar to the results for non-cross listed firms. Therefore, we can conclude that the higher the commodity prices the more debt mining firms will use. However, this becomes even more

significant in the use of short-term debt due to the volatility in commodity prices and mining firms aiming to reduce bankruptcy risk.

4.3.3 Discussion

Similar to the static models, the following section will attempt to summarise the dynamic model regression results for the cross listed firms and the non-cross listed firms. It will also highlight the main differences and similarities between the static and dynamic models. The summary of the regression results can be seen on *Table 13*.

Non-Cross Listed Mining Firms

Non-cross listed mining firms have an optimal capital structure which they adjust their leverage to. The higher the leverage the more total debt and long debt a firm will use, and this is a significant determinant of leverage. Non-cross listed firms though will reduce their short-term debt, and this is an insignificant determinant of leverage. The higher the assets tangibility the more leverage a firm will use, and this is significant determinant only for short-term debt and long-term debt. The firm size is statically insignificant, and the coefficient is positive for all the leverage ratios.

The growth prospects of a firm are positively correlated to total debt, and long-term debt. Growth prospects though are only significant for long-term debt. Profitability is an insignificant determinant of leverage. The sign of the coefficient is only negative for long-term debt. The coefficient for non-debt tax shields is negative for short-term debt but positive for total and long-term debt. The variable is insignificant determinant for all leverage ratios. The trend variable is a significant determinant for total debt and short-term debt. The higher the commodity prices the more debt non-cross listed mining firms will use.

Cross Listed Mining Firms

The lagged leverage variable is significant for all the leverage ratios, and the higher the previous debt the more leverage a firm will use. Tangibility of assets is a significant determinant for all leverage ratios, and the sign of the coefficient is positive only for long-term debt. Firm size is a significant determinant of leverage for total debt and short-term debt. The larger the size of the firm the more leverage they will use.

Cross listed mining firms with high growth prospects, will use more total and long-term debt but reduce their short-term debt levels. Growth prospects are also a significant determinant of leverage. Profitability is a significant determinant of leverage. However, the higher the profitability the more total and long-term debt a firm will use, but short-term debt will be used less. Non-debt tax shields are a significant determinant of leverage, but the coefficient of the

variable is positive only for long-term debt. The commodity price trend is a significant determinant of total debt and short-term debt and the sign of the coefficient is positive for all leverage ratios.

Comparison

Firstly, the main objective of the dynamic models was to determine if mining firms adjust their leverage to an optimal capital structure. Secondly, the dynamic models were used to check the differences in speed of adjustment between cross listed and non-cross listed mining firms. Finally, the dynamic model was used to check the robustness of the results from the static model.

Table 13. Summary of model regression results

	Non-Cross Listed Firms				Cross Listed Firms			
	Static		Dynamic		Static		Dynamic	
Total Debt								
Lagged Leverage			+	*			+	*
Tangibility of Assets	+	*	+		+	*	-	*
Size	+		+		+	*	+	*
Growth Prospects	+	*	+		+		+	*
Profitability	-		+		-	*	-	*
Non-Debt Tax Shields	+	*	+		-		-	*
Trend	+		+	*	+		+	*
Short-term Debt								
Lagged Leverage			-				+	*
Tangibility of Assets	+	*	+	*	-	*	-	*
Size	+	*	+		+	*	+	*
Growth Prospects	+	*	-		-		-	*
Profitability	-		+		-	*	-	*
Non-Debt Tax Shields	+		-		-	*	-	*
Trend	+		+	*	+		+	*
Long-term Debt								
Lagged Leverage			+	*			+	*
Tangibility of Assets	+	*	+	*	+	*	+	*
Size	+		+		+		+	
Growth Prospects	+	*	+	*	+		+	*
Profitability	-		-		-	*	+	*
Non-Debt Tax Shields	+	*	+		+		+	*
Trend	+		+		+		+	

* Statistically significant to the 1%, 5% or 10% level

The lagged leverage variable is the most important variable in the dynamic model as it demonstrates if mining firms have an optimal capital structure. It was seen that the lagged leverage ratio was a significant determinant for most of the leverage ratios. Therefore, confirming that mining firms have an optimal capital structure. Non-cross listed firms will reduce their short-term leverage if their leverage is high. However, the higher the long-term

debt the more leverage the firms will use. Non-cross listed firms on the other hand, increase their short-term and long-term debt if they have higher debt levels. The upward adjustment could be due to mining firms having the capacity to absorb more debt, given their low leverage ratios. Research has demonstrated that mining firms generally have low leverage relative to other industries (Islam & Khandaker, 2015). This was further confirmed by our summary statistics where mining firms in our sample have lower debt levels than the rest of the market.

Cross listed firms will also adjust their leverage much faster than non-cross listed firms. These results contradict most research for firms which have less information asymmetries. However, the results are similar for firms operating in more developed capital markets. Due to better institutional factors, firms in developed markets are to quickly adjust their debt levels to their optimal capital structure. Another reason could be due to the low profitability, high growth and higher debt levels of cross listed mining firms in our sample, the faster adjustment could be to signal financial discipline.

Tangibility of assets is statistically significant and positive most of the time for the static and dynamic models. Therefore, the higher the asset tangibility the more debt the firm will use. This suggests that mining firms are using their assets as collateral. Where we see a major difference is in short-term debt for cross listed firms. In both models the sign of the coefficient is negative. This means that cross listed firms use their assets to secure long-term debt and not to secure short-term debt.

Another reason suggested for this, is that high asset tangibility firms reduce their short-term debt to reduce agency costs between shareholders and bond holders. Cross listed firms will therefore use internal resources, or other instruments to finance short-term debt. This is consistent with the theory that cross listed firms have more options when it comes to debt financial instruments and internal resources. Non-cross listed firms on the other hand could have institutional constraints which lead them to securing short-term debt by using their assets.

The coefficient of the firm size variable is positive for all the leverage ratios in all the estimation models. This means that universally the larger the mining firm the more debt it uses or has access to. The significance level though varies depending on, if the firm is cross listed or not, the type of leverage instrument, and the type of estimation model used.

We find that for non-cross listed firms the firm size is an insignificant determinant of leverage, except for short-term debt in the static model. In the case of cross listed firms, firm size is significant for total debt and short-term debt. Therefore, we can conclude that large mining firms will use more debt and the size of the firm is especially significant for securing short-term debt. This could be due to the non-collateral nature of short-term debt and larger firms being

perceived- due information asymmetries- as less susceptible to bankruptcy. Creditors will therefore emphasise the importance of firm size when it comes to short-term debt.

Universally for all mining firms the higher the growth prospects the more debt that they will use. This is concluded from the positive coefficient for most of the leverage ratios for all the models. Where there is a difference, is in the use of short-term debt for cross listed firms. The sign of the coefficient is negative, both for the static and dynamic model. These results mean that the higher the growth prospects are for cross listed firms the less short-term debt they use. Similarly, to the tangibility of assets argument, this could be due to reducing agency costs and bankruptcy risk. Cross listed firms may also be in a position where they can afford the fund their short-term needs internally, since these firms are also larger than non-cross listed firms.

The level of significance for growth prospects for the non-cross listed and cross listed firms differs depending on the model used. In the static model growth prospects is a statistically significant determinant for non-cross listed firms, whereas for cross listed firms it is not. In the dynamic model, growth prospects are an insignificant determinant for non-cross listed firms, whereas for cross listed firms it is not. Therefore, it is unclear if growth prospects should be a significant determinant of leverage or not.

The profitability ratio is consistently an insignificant determinant of leverage for non-cross listed firms and a significant determinant for cross listed firms. These findings are consistent for firms operating in SSA and for firms which operate in developed economies. This could also be due to non-cross listed firms being “financially constrained”, whereby previous research has shown that profitability is insignificant for such firms. Another reason for this relationship is that cross listed firms use more external financing, therefore making profitability a significant determinant for debt affordability and access.

The sign of the coefficient differs depending on if the firm is cross listed or not, the leverage instrument and the estimation model used. There is evidence of the pecking order theory and the static trade off theory. The static models imply that universally mining firms follow the pecking order theory. Whereby the higher the higher the profitability, the less debt the firm use. The dynamic model though implies that cross listed firms will follow the pecking order theory only for long-term debt. Where the more profitable the firm is the more long-term debt it will use. Non-cross listed firms will follow it only for short-term debt. Where the more profitable a firm is, the more short-term debt it will use.

A plausible explanation for this could be due to the higher cost of long-term debt for mining firms only exposed to capital markets within SSA. Non-cross listed firms prefer to fund their long-term activities using cheaper internal funds and debt for short-term activities. Cross listed

firms on the other hand have access to multiple bond markets and their cost of long-term debt is likely to be lower. Therefore, they will follow the static trade off theory for long-term debt.

The non-debt tax shields variable changes in significance depending on if the firm is cross listed or not, and the type of estimation model used. Most of the time the sign of the coefficient is the same for both the dynamic and the static model. In the case of non-cross listed firms, the higher the non-debt tax shield the more long-term debt, and short-term debt the mining firm will use. On the other hand, cross listed firms with higher non-debt tax shields will use more long-term debt and less short-term debt.

These results confirm that for both non-cross listed and cross listed firms, the sign of the coefficient is positive for long-term debt due to firms using debt to fund their assets. The difference in short-term debt could be that non-cross listed firms are also using short-term debt to fund assets or as collateral. Cross listed firms with a high asset tangibility will use less short-term debt to reduce agency costs, mitigate against bankruptcy and they have enough internal funds to finance short-term activities.

The sign of the coefficient for the trend variable, and the level of significance for non-cross listed firms and cross listed firms is similar. Therefore, financing behaviour for mining firms when it comes to the commodity price is universal. The coefficient of the trend variable is consistently positive for all the leverage ratios. This means that the higher the commodity prices the more leverage the mining firms will use. Implying that mining firms will avoid bankruptcy by issuing more debt when the prices are higher. This ensures that firms will have the ability to pay back the loans. Debt is also probably cheaper during a boom, because the low cash flow risk is mitigated.

The trend variable is insignificant for all the leverage ratios for the static models, but it is significant for total debt and short-term debt for the dynamic model. This suggests that the dynamic model is a better model for trend variable. In the case of non-cross listed and cross listed firms the commodity trend is significant for total debt and short-term debt. The reason for this could be due to the volatile nature of commodity prices. To avoid bankruptcy, firms take the commodity price more into consideration for short-term debt. The sudden shocks in prices are also funded using short-term debt.

To sum up the models, the research has shown that even with a dynamic model, variables such as tangibility of assets, firm size, growth prospects, profitability and non-debt tax shields are still determinates of leverage for mining firms. The signs of the coefficient remain the same for the dynamic and the static model. The main difference is the level of significance of the variables. The level of significance, the sign of the coefficient and the magnitude of the coefficient are still dependent on if the firm is cross listed or not. Short-term debt financing is

the main difference between the firms that are non-cross listed and cross listed firms. Commodity price booms or busts have a significant impact on leverage decisions when using the dynamic model and the sign of the coefficient is consistently positive for all the models.

5. CONCLUSION

The main objective of the research was do determine what the capital structure dynamics are for mining firms within Sub-Saharan Africa. The variables for the regression models were determined from previous literature, and what was deemed to be relevant for mining firms. The determinants of leverage were assessed for different types of financial instruments. In total 42 firms were evaluated with approximately, 500 observations in total. The sample of firms was divided into non-cross listed and cross listed firms. This was to investigate the impact of exposure to international capital markets on capital structure decisions. Static and dynamic regression models were determined using various estimation methods. This was to ascertain the capital structure determinants, and to determine the robustness of the results. The main difference between the static and dynamic models, were the significance levels of the variables. Most of the signs of the coefficients remained the same.

To sum up the results, tangibility of assets, firm size, growth prospects, profitability, non-debt tax shields, commodity price trend and previous leverage are significant determinants of leverage. The determinants of leverage differ between total debt, short-term debt and long-term debt. There also exists differences in the leverage determinants for non-cross listed and cross listed firms, especially for short-term debt.

The research was successful is gaining a better understanding of capital structure for mining firms. The following section will attempt to summarise the results and answer the research questions.

5.1 What are the drivers for capital structure decisions for mining firms operating in SSA?

Our research has shown that the capital structure determinants which are relevant for globally listed firms, are portable to mining firms in SSA. The statistically significant determinants are, tangibility of assets, firm size, growth prospects, profitability, and non-debt tax shields.

The higher the asset tangibility of the mining firm, the more debt the firm will use. Mining firms use debt to finance their assets and the assets are used as collateral. Therefore, the more assets the firm has, the higher its debt capacity and the more debt they will use. This finding is consistent with research for SSA firms.

Large mining firms in SSA use more debt relative to smaller mining firms. This result was particularly significant for short-term debt. Large mining firms have higher earnings, they tend to be more diversified and have a good reputation with lenders. Due to their bankruptcy risk being low, they can access financing easily and most likely at a lower cost. These findings are

consistent with the static trade off theory. In addition, firm size is significant for short-term debt due to higher information asymmetries for cross listed firms and the non-collateral nature of short-term debt.

Mining firms with high growth prospects will tend to use more debt. Growth prospects are particularly significant for non-cross listed firms to secure long-term debt. The reason for the positive relationship is that firms which have high growth prospects, have higher prospects of adding more value to the firm. Therefore, the firm's debt capacity increases.

The profitability of the firm is a determinant of leverage in that, the higher the profitability of the firm the less leverage the firm will use. This is consistent with the pecking order theory and most of the empirical research. We can conclude that mining firms do indeed first use their internal funds for financing projects, and only once they have been exhausted will they issue securities for external funding. If external funding is required, the safest securities such as debt will be issued first.

The theory on non-debt tax shields is that, firms use these tax shields to substitute the tax benefit of debt. This will in turn reduce a firm's debt levels. We find that for mining firms this is not the case as the higher the non-debt tax shields the more debt the firms will use. The main reason for this is that mining firms tend to use debt to finance their fixed assets.

In adding the lagged leverage variable to the dynamic model, the results suggest that mining firms do adjust their leverage to an optimal capital structure. The higher the previous leverage, the more leverage the firm will use. For non-cross listed firms, the higher the leverage the less short-term debt they will use. This is being consistent with the static trade off theory. Where mining firms will balance the marginal benefit of using debt and financial distress costs.

5.2 What is the impact of cross listing a mining firm, on the firm's capital structure decisions?

The research has been able to demonstrate that there are differences in capital structure determinants for non-cross listed and cross listed mining firms. Of the 42 firms, 24 of them were cross listed. Most mining firms will cross list in a developed capital market for example in the US or the UK. Generally cross listed firms use more leverage than non-cross listed firms, however they use less short-term debt. This is attributed to exposure to international bond markets and possibly the lower cost of long-term debt.

Cross listed firms have a higher asset tangibility, are larger in size, and have higher growth prospects. The main differences in financing patterns between non-cross listed and cross listed firms, are driven by short-term financing behaviour and information asymmetries.

We find that for cross listed firms, firms with a high asset tangibility, high growth prospects, high profitability and high non-debt tax shields will use less short-term debt. This could be due to cross listed firms wanting to reduce bankruptcy risk, reduce agency cost between shareholders and bond holders, or their assets have generated enough internal funds to finance their short-term activities.

The growth prospects variables give mixed results in terms of significance for non-cross listed firms and for cross listed firms. To clarify growth prospects is a measure of a firm's market to book value. The variable becomes significant for non-cross listed firms in the static models and is insignificant for cross listed firms. Research has also shown that information asymmetries are higher for non-cross listed firms. Due to this, lenders for non-cross listed firms will also place reliance on the firm's growth prospects, as this the market perception of the firm's future earnings. Therefore, since information asymmetries are lower for cross listed firms, growth prospects become an insignificant determinant of leverage. In the dynamic model the variable is insignificant for non-cross listed firms, and significant for non-cross listed firms. This suggests that due to information asymmetries lenders do not even consider the growth prospects as a determinant of leverage for non-cross listed firms and prefer something more tangible like assets.

Although all the mining firms follow the pecking order theory, profitability is an insignificant determinant of leverage for non-cross listed firms, where for cross listed firms it is. Research has shown that for "financially constrained" firms in SSA, profitability becomes an insignificant determinant and other variables are more significant. Relative to non-cross listed firms, cross listed firms are less profitable, have higher growth prospects and have higher leverage ratios. Due to the extensive use of external financing, profitability becomes a significant factor.

The dynamic model though suggests that non-cross listed mining firms operating in SSA follow the pecking order theory for long-term debt and the static trade off theory for short-term debt. Cross listed firms on the other hand follow the pecking order theory for short-term debt and the static trade off theory for long-term debt. This could be due to financial institutional factors which limit a non-cross listed firm's use of long-term debt. Generally cross listed firms are larger with a higher asset tangibility. Therefore, cross listed firms could also have enough internal funds to finance their short-term activities.

Cross listed firms also adjust their leverage to the target capital structure and the relationship with previous debt is also positive. However, they adjust their leverage much faster than non-cross listed mining firms. These results contradict research for firms which have less information asymmetries. Where is it expected that due to lower information asymmetries, cross listed mining firms can afford to adjust their leverage slower. A possible reason for this

could be due to cross listed firms having access to multiple bond markets. Therefore, they have the options in financial instruments which enable them to adjust their capital structure more quickly. Cross listed firms also have a higher use of external finance. Therefore, they need to use the optimal capital structure to signal a financially healthy firm.

5.3 Do commodity booms and busts have a material impact on a firm's capital structure choice?

It has been seen that the recent commodity busts resulted in several mining firms recorded high impairments, low free cash flows, and high debt levels. These resulted in some mining firms being downgraded by credit ratings agencies. Due to the high-risk premium associated with a downgrade, it was imperative to understand if commodity prices have an impact on a mining firm's capital structure decisions. This was done by adding a dummy trend variable to our regression model.

The regression results show that the commodity price trend is an insignificant determinant of leverage for the static model. This could be due to the difficulty in forecasting commodity prices therefore firms do not place much reliance on them. Another reason for the insignificance could be model specification. It was seen in the dynamic model that the trend variable is a significant determinant for total debt and short-term debt. This could be due to the volatility in commodity prices. This translate to a volatility in earnings, therefore the commodity price becomes a significant determinant of short-term debt to minimise bankruptcy risk. If we take the results of the static model, perhaps it would be a good idea for mining firms to develop better forecasting methods and place a heavier reliance on commodity prices. This could assist them in the future to avoid ratings downgrades and build sustainable financial confidence for investors.

Mining firms though do exercise financial discipline. When commodity prices are booming they borrow more, and when they are declining they borrow less. In this way they can avoid bankruptcy, collateral values are also higher, and the cost of debt is lower.

5.4 Significance of the Study and Future Research.

The study has been successful in unpacking the capital structure debate for mining firms operating in SSA. We have been able to demonstrate which determinants of capital structure are significant and which ones are not. Therefore, mining firms will be able to make more informed decisions about their capital structure. The research was able to show that there are advantages for SSA firms to cross listing on international exchanges. This enables the firm to have more flexible financing strategies, especially with regards to short-term debt and long-

term debt financing. Cross listing the firm also reduces information asymmetries, therefore increasing investor confidence.

The research has also been able aid policy makers and regulators to direct them in which key areas to focus on. This includes introducing stricter company disclosure policies which will reduce information asymmetries. In this way mining firms can have more flexibility in financial strategies, and more investors can be attracted to SSA. The research has been relevant for financial institutions in that they need to introduce more long-term financing instruments for SSA firms or more innovative short-term financing solutions.

The research also confirmed the impact of commodity booms and busts on the capital structure. Although mining firms are exercising financial discipline, by only increasing debt when the commodity prices are higher. More needs to be done to incorporate the commodity price trend in leverage decisions such that it becomes a significant factor. This will enable mining firms to avoid financial distress and ratings downgrades when commodity prices decline.

Although the research was successful in answering the research questions and demonstrating relevance there is still room for improvement in the research. Future research can be done to compare the capital structure determinant for mining firms in different commodities. Perhaps the capital determinants for a coal mining company are significantly different to a precious metals mine. Research should be done comparing SSA mining firms to other regions. It was seen that mining firms in some ways mining firms behave similarly to Latin American firms and Australian firms. However, a direct comparison needs to be done for the same time period.

It has been seen that macroeconomic variables can be determinants for leverage, therefore the regressions should be done separately for each country, such that macroeconomic variables can be included. In this way there can be a more direct analysis of the institutional factors. Unfortunately, this could not be done for this research due to the cross listed firms' aspect of the research. Similar research could also be done comparing the impact of cross listing for different industries.

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APPENDIX A: Static Model Regressions

APPENDIX A.1: Static Model Regressions, Non-Cross Listed

APPENDIX A.1.1: Static Model Regressions, OLS

Dependent Variable: LGT
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.180004	0.040248	4.472367	0.0000
TG	0.235176	0.086483	2.719340	0.0071
SZ	-0.002622	0.008190	-0.320083	0.7492
GT	0.047161	0.017713	2.662557	0.0083
PF	-0.245222	0.093739	-2.615999	0.0095
NDTS	2.192951	0.569698	3.849321	0.0002
TREND	0.041424	0.037538	1.103515	0.2710

R-squared	0.237374	Mean dependent var	0.394113
Adjusted R-squared	0.216946	S.D. dependent var	0.315859
S.E. of regression	0.279505	Akaike info criterion	0.318239
Sum squared resid	17.49952	Schwarz criterion	0.422555
Log likelihood	-29.75661	Hannan-Quinn criter.	0.360313
F-statistic	11.62031	Durbin-Watson stat	0.808423
Prob(F-statistic)	0.000000		

Dependent Variable: LGS
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.107395	0.031501	3.409221	0.0008
TG	0.160602	0.067688	2.372662	0.0185
SZ	-0.006190	0.006410	-0.965573	0.3353
GT	0.017700	0.013863	1.276716	0.2030
PF	-0.213131	0.073368	-2.904966	0.0040
NDTS	1.520225	0.445891	3.409406	0.0008
TREND	0.025220	0.029381	0.858383	0.3916

R-squared	0.180564	Mean dependent var	0.213680
Adjusted R-squared	0.158615	S.D. dependent var	0.238493
S.E. of regression	0.218763	Akaike info criterion	-0.171823
Sum squared resid	10.72001	Schwarz criterion	-0.067507
Log likelihood	26.84554	Hannan-Quinn criter.	-0.129749
F-statistic	8.226445	Durbin-Watson stat	0.857253
Prob(F-statistic)	0.000000		

Dependent Variable: LGL
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.072638	0.024437	2.972489	0.0033
TG	0.074740	0.052509	1.423388	0.1560
SZ	0.003397	0.004973	0.683166	0.4952
GT	0.029648	0.010754	2.756792	0.0063
PF	-0.029398	0.056914	-0.516529	0.6060
NDTS	0.686525	0.345895	1.984777	0.0484
TREND	0.015952	0.022792	0.699923	0.4847

R-squared	0.129672	Mean dependent var	0.180519
Adjusted R-squared	0.106360	S.D. dependent var	0.179518
S.E. of regression	0.169703	Akaike info criterion	-0.679701
Sum squared resid	6.450989	Schwarz criterion	-0.575385
Log likelihood	85.50548	Hannan-Quinn criter.	-0.637627
F-statistic	5.562385	Durbin-Watson stat	0.812735
Prob(F-statistic)	0.000021		

APPENDIX A.1.2: Static Model Regressions, FE

Dependent Variable: LGT
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.044050	0.049629	-0.887585	0.3758
TG	0.661070	0.107126	6.170967	0.0000
SZ	0.010078	0.013850	0.727681	0.4676
GT	0.073015	0.018092	4.035662	0.0001
PF	-0.107981	0.083382	-1.295017	0.1968
NDTS	1.162876	0.616236	1.887063	0.0606
TREND	0.031589	0.030277	1.043316	0.2980

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.559722	Mean dependent var	0.394113
Adjusted R-squared	0.503608	S.D. dependent var	0.315859
S.E. of regression	0.222539	Akaike info criterion	-0.057962
Sum squared resid	10.10280	Schwarz criterion	0.344398
Log likelihood	33.69461	Hannan-Quinn criter.	0.104324
F-statistic	9.974744	Durbin-Watson stat	1.154028
Prob(F-statistic)	0.000000		

Dependent Variable: LGS
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.077999	0.038421	-2.030143	0.0436
TG	0.379818	0.082931	4.579922	0.0000
SZ	0.019452	0.010722	1.814271	0.0711
GT	0.038377	0.014006	2.739986	0.0067
PF	-0.092717	0.064550	-1.436368	0.1524
NDTS	0.342552	0.477058	0.718052	0.4735
TREND	0.016378	0.023439	0.698756	0.4855

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.537183	Mean dependent var	0.213680
Adjusted R-squared	0.478197	S.D. dependent var	0.238493
S.E. of regression	0.172278	Akaike info criterion	-0.569948
Sum squared resid	6.054649	Schwarz criterion	-0.167587
Log likelihood	92.82899	Hannan-Quinn criter.	-0.407662
F-statistic	9.106890	Durbin-Watson stat	1.216749
Prob(F-statistic)	0.000000		

Dependent Variable: LGL
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.033704	0.032578	1.034569	0.3021
TG	0.281120	0.070320	3.997743	0.0001
SZ	-0.009449	0.009091	-1.039370	0.2999
GT	0.034912	0.011876	2.939614	0.0037
PF	-0.013455	0.054734	-0.245826	0.8061
NDTS	0.831710	0.404511	2.056089	0.0410
TREND	0.014975	0.019875	0.753466	0.4520

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.412694	Mean dependent var	0.180519
Adjusted R-squared	0.337841	S.D. dependent var	0.179518
S.E. of regression	0.146079	Akaike info criterion	-0.899865
Sum squared resid	4.353192	Schwarz criterion	-0.497504
Log likelihood	130.9344	Hannan-Quinn criter.	-0.737579
F-statistic	5.513415	Durbin-Watson stat	1.004559
Prob(F-statistic)	0.000000		

APPENDIX A.1.3: Static Model Regressions, RE

Dependent Variable: LGT
Method: Panel EGLS (Cross-section random effects)
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.058945	0.049164	1.198955	0.2318
TG	0.525697	0.092217	5.700648	0.0000
SZ	-0.002657	0.010112	-0.262744	0.7930
GT	0.060826	0.016737	3.634253	0.0003
PF	-0.143050	0.081026	-1.765489	0.0788
NDTS	1.773784	0.557913	3.179322	0.0017
TREND	0.035214	0.030145	1.168163	0.2440

Effects Specification	S.D.	Rho
Cross-section random	0.125986	0.2427
Idiosyncratic random	0.222539	0.7573

Weighted Statistics

R-squared	0.351908	Mean dependent var	0.185261
Adjusted R-squared	0.334549	S.D. dependent var	0.287845
S.E. of regression	0.234810	Sum squared resid	12.35046
F-statistic	20.27168	Durbin-Watson stat	0.987136
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.167769	Mean dependent var	0.394113
Sum squared resid	19.09670	Durbin-Watson stat	0.705324

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	6	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	0.661070	0.525697	0.002972	0.0130
SZ	0.010078	-0.002657	0.000090	0.1784
GT	0.073015	0.060826	0.000047	0.0761
PF	-0.107981	-0.143050	0.000387	0.0748
NDTS	1.162876	1.773784	0.068480	0.0196
TREND	0.031589	0.035214	0.000008	0.2003

Cross-section random effects test equation:
Dependent Variable: LGT
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.044050	0.049629	-0.887585	0.3758
TG	0.661070	0.107126	6.170967	0.0000
SZ	0.010078	0.013850	0.727681	0.4676
GT	0.073015	0.018092	4.035662	0.0001
PF	-0.107981	0.083382	-1.295017	0.1968
NDTS	1.162876	0.616236	1.887063	0.0606
TREND	0.031589	0.030277	1.043316	0.2980

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.559722	Mean dependent var	0.394113
Adjusted R-squared	0.503608	S.D. dependent var	0.315859
S.E. of regression	0.222539	Akaike info criterion	-0.057962
Sum squared resid	10.10280	Schwarz criterion	0.344398
Log likelihood	33.69461	Hannan-Quinn criter.	0.104324
F-statistic	9.974744	Durbin-Watson stat	1.154028
Prob(F-statistic)	0.000000		

Dependent Variable: LGS
Method: Panel EGLS (Cross-section random effects)
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005467	0.040423	0.135248	0.8925
TG	0.340597	0.073057	4.662050	0.0000
SZ	0.002060	0.008174	0.252001	0.8013
GT	0.028144	0.013118	2.145428	0.0330
PF	-0.115777	0.063043	-1.836481	0.0676
NDTS	0.908395	0.438659	2.070844	0.0395
TREND	0.018947	0.023353	0.811344	0.4180

Effects Specification	S.D.	Rho
Cross-section random	0.110936	0.2931
Idiosyncratic random	0.172278	0.7069

Weighted Statistics

R-squared	0.256498	Mean dependent var	0.090611
Adjusted R-squared	0.236583	S.D. dependent var	0.206104
S.E. of regression	0.180081	Sum squared resid	7.264094
F-statistic	12.87949	Durbin-Watson stat	1.069425
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.091973	Mean dependent var	0.213680
Sum squared resid	11.87896	Durbin-Watson stat	0.726429

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	6	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	0.379818	0.340597	0.001540	0.3176
SZ	0.019452	0.002060	0.000048	0.0122
GT	0.038377	0.028144	0.000024	0.0371
PF	-0.092717	-0.115777	0.000192	0.0963
NDTS	0.342552	0.908395	0.035162	0.0025
TREND	0.016378	0.018947	0.000004	0.2003

Cross-section random effects test equation:
Dependent Variable: LGS
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.077999	0.038421	-2.030143	0.0436
TG	0.379818	0.082931	4.579922	0.0000
SZ	0.019452	0.010722	1.814271	0.0711
GT	0.038377	0.014006	2.739986	0.0067
PF	-0.092717	0.064550	-1.436368	0.1524
NDTS	0.342552	0.477058	0.718052	0.4735
TREND	0.016378	0.023439	0.698756	0.4855

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.537183	Mean dependent var	0.213680
Adjusted R-squared	0.478197	S.D. dependent var	0.238493
S.E. of regression	0.172278	Akaike info criterion	-0.569948
Sum squared resid	6.054649	Schwarz criterion	-0.167587
Log likelihood	92.82899	Hannan-Quinn criter.	-0.407662
F-statistic	9.106890	Durbin-Watson stat	1.216749
Prob(F-statistic)	0.000000		

Dependent Variable: LGL
Method: Panel EGLS (Cross-section random effects)
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.041580	0.032877	1.264711	0.2073
TG	0.201222	0.060990	3.299268	0.0011
SZ	-0.003413	0.006731	-0.507052	0.6126
GT	0.034309	0.011031	3.110241	0.0021
PF	-0.019292	0.053276	-0.362124	0.7176
NDTS	0.802924	0.368083	2.181366	0.0302
TREND	0.015496	0.019792	0.782932	0.4345

Effects Specification	S.D.	Rho
Cross-section random	0.086131	0.2580
Idiosyncratic random	0.146079	0.7420

Weighted Statistics

R-squared	0.188254	Mean dependent var	0.082189
Adjusted R-squared	0.166510	S.D. dependent var	0.161337
S.E. of regression	0.147293	Sum squared resid	4.859746
F-statistic	8.658045	Durbin-Watson stat	0.952499
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.100017	Mean dependent var	0.180519
Sum squared resid	6.670797	Durbin-Watson stat	0.796891

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	6	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	0.281120	0.201222	0.001225	0.0224
SZ	-0.009449	-0.003413	0.000037	0.3233
GT	0.034912	0.034309	0.000019	0.8911
PF	-0.013455	-0.019292	0.000157	0.6418
NDTS	0.831710	0.802924	0.028144	0.8638
TREND	0.014975	0.015496	0.000003	0.7732

Cross-section random effects test equation:
Dependent Variable: LGL
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.033704	0.032578	1.034569	0.3021
TG	0.281120	0.070320	3.997743	0.0001
SZ	-0.009449	0.009091	-1.039370	0.2999
GT	0.034912	0.011876	2.939614	0.0037
PF	-0.013455	0.054734	-0.245826	0.8061
NDTS	0.831710	0.404511	2.056089	0.0410
TREND	0.014975	0.019875	0.753466	0.4520

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.412694	Mean dependent var	0.180519
Adjusted R-squared	0.337841	S.D. dependent var	0.179518
S.E. of regression	0.146079	Akaike info criterion	-0.899865
Sum squared resid	4.353192	Schwarz criterion	-0.497504
Log likelihood	130.9344	Hannan-Quinn criter.	-0.737579
F-statistic	5.513415	Durbin-Watson stat	1.004559
Prob(F-statistic)	0.000000		

APPENDIX A.1.4: Static Model Regressions, No Trend

	Total Debt			Short-term Debt			Long-term Debt		
	OLS	FE	RE	OLS	FE	RE	OLS	FE	RE
Constant	0.20 *	-0.03	0.08	0.12 *	-0.07 ***	0.01	0.08 *	0.04	0.05
	(0.04)	(0.05)	(0.05)	(0.03) **	(0.04)	(0.04)	(0.02)	(0.03)	(0.03)
Tangibility of Assets	0.24 *	0.67 *	0.53 *	0.16	0.38 *	0.34 *	0.08	0.28 *	0.20 *
	(0.09)	(0.11)	(0.09)	(0.07)	(0.08)	(0.07)	(0.05)	(0.07)	(0.06)
Size	0.00	0.01	0.00	-0.01	0.02 ***	0.00	0.00	-0.01	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Growth Prospects	0.05 *	0.08 *	0.06 *	0.02	0.04 *	0.03 **	0.03 *	0.04 *	0.04 *
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Profitability	-0.24 **	-0.10	-0.14 ***	-0.21 *	-0.09	-0.11 ***	-0.03	-0.01	-0.02
	(0.09)	(0.08)	(0.08)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)
Non-Debt Tax Shields	2.14 *	1.09 **	1.71 *	1.49 *	0.31	0.87 **	0.67 **	0.80 **	0.77 **
	(0.57)	(0.61)	(0.56)	(0.44)	(0.47)	(0.44)	(0.34)	(0.40)	(0.37)
Adjusted R^2	0.22	0.50	0.33	0.16	0.48	0.24	0.11	0.34	0.17
Durbin-Watson Stat	0.81	1.15	0.98	0.86	1.22	1.07	0.81	1.00	0.95
F-statistic	13.69	10.33	24.05	9.74	9.48	15.37	6.59	5.72	10.29
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hausman Test									
Adjusted Hausman Test			30.66			25.94			8.79
			(0.00)			(0.00)			(0.12)

* Statistically significant to the 1% level
** Statistically significant to the 5% level
*** Statistically significant to the 10% level

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	30.658853	5	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	0.665844	0.529608	0.002965	0.0123
SZ	0.009048	-0.003583	0.000089	0.1813
GT	0.075891	0.063589	0.000045	0.0674
PF	-0.101702	-0.137133	0.000377	0.0681
NDTS	1.094079	1.708472	0.067323	0.0179

Cross-section random effects test equation:
Dependent Variable: LGT
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.029057	0.047513	-0.611544	0.5415
TG	0.665844	0.107051	6.219874	0.0000
SZ	0.009048	0.013818	0.654796	0.5133
GT	0.075891	0.017885	4.243253	0.0000
PF	-0.101702	0.083182	-1.222639	0.2229
NDTS	1.094079	0.612830	1.785289	0.0757

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.557373	Mean dependent var	0.394113
Adjusted R-squared	0.503394	S.D. dependent var	0.315859
S.E. of regression	0.222587	Akaike info criterion	-0.061298
Sum squared resid	10.15670	Schwarz criterion	0.326160
Log likelihood	33.07996	Hannan-Quinn criter.	0.094977
F-statistic	10.32574	Durbin-Watson stat	1.149447
Prob(F-statistic)	0.000000		

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	25.936642	5	0.0001

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	0.382294	0.342968	0.001529	0.3145
SZ	0.018918	0.001566	0.000048	0.0121
GT	0.039868	0.029687	0.000023	0.0337
PF	-0.089462	-0.112431	0.000186	0.0922
NDTS	0.306882	0.871263	0.034398	0.0023

Cross-section random effects test equation:
Dependent Variable: LGS
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.070225	0.036728	-1.912006	0.0573
TG	0.382294	0.082752	4.619755	0.0000
SZ	0.018918	0.010681	1.771151	0.0780
GT	0.039868	0.013825	2.883672	0.0044
PF	-0.089462	0.064301	-1.391296	0.1656
NDTS	0.306882	0.473726	0.647805	0.5178

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.536075	Mean dependent var	0.213680
Adjusted R-squared	0.479499	S.D. dependent var	0.238493
S.E. of regression	0.172063	Akaike info criterion	-0.576215
Sum squared resid	6.069141	Schwarz criterion	-0.188757
Log likelihood	92.55288	Hannan-Quinn criter.	-0.419940
F-statistic	9.475288	Durbin-Watson stat	1.219429
Prob(F-statistic)	0.000000		

Dependent Variable: LGL
Method: Panel EGLS (Cross-section random effects)
Sample: 2006 2016
Periods included: 11
Cross-sections included: 21
Total panel (balanced) observations: 231
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.048850	0.031518	1.549936	0.1226
TG	0.203122	0.060898	3.335438	0.0010
SZ	-0.003832	0.006706	-0.571437	0.5683
GT	0.035540	0.010909	3.257871	0.0013
PF	-0.016647	0.053116	-0.313414	0.7543
NDTS	0.773887	0.365878	2.115153	0.0355

Effects Specification		
	S.D.	Rho
Cross-section random	0.086155	0.2585
Idiosyncratic random	0.145925	0.7415

Weighted Statistics

R-squared	0.186129	Mean dependent var	0.082102
Adjusted R-squared	0.168043	S.D. dependent var	0.161326
S.E. of regression	0.147148	Sum squared resid	4.871827
F-statistic	10.29132	Durbin-Watson stat	0.945734
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.097851	Mean dependent var	0.180519
Sum squared resid	6.686851	Durbin-Watson stat	0.791790

APPENDIX A.2: Static Model Regressions, Cross listed Firms

APPENDIX A.2.1: Static Model Regressions, OLS

Dependent Variable: LGT
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.115771	0.060122	1.925589	0.0553
TG	0.144090	0.099795	1.443860	0.1500
SZ	0.030058	0.007278	4.129842	0.0000
GT	0.005619	0.006209	0.905085	0.3663
PF	-0.733401	0.059948	-12.23400	0.0000
NDTS	1.155698	0.849777	1.360001	0.1750
TREND	-0.013721	0.045799	-0.299602	0.7647

R-squared	0.402233	Mean dependent var	0.430644
Adjusted R-squared	0.388277	S.D. dependent var	0.465637
S.E. of regression	0.364187	Akaike info criterion	0.843859
Sum squared resid	34.08648	Schwarz criterion	0.938676
Log likelihood	-104.3894	Hannan-Quinn criter.	0.881959
F-statistic	28.82220	Durbin-Watson stat	0.455970
Prob(F-statistic)	0.000000		

Dependent Variable: LGS
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.193730	0.050332	3.849019	0.0001
TG	-0.232017	0.083545	-2.777159	0.0059
SZ	0.020605	0.006093	3.381662	0.0008
GT	-0.006860	0.005198	-1.319876	0.1881
PF	-0.669777	0.050186	-13.34587	0.0000
NDTS	0.088598	0.711403	0.124540	0.9010
TREND	-0.002128	0.038341	-0.055492	0.9558

R-squared	0.428758	Mean dependent var	0.204583
Adjusted R-squared	0.415422	S.D. dependent var	0.398762
S.E. of regression	0.304884	Akaike info criterion	0.488389
Sum squared resid	23.88931	Schwarz criterion	0.583206
Log likelihood	-57.46738	Hannan-Quinn criter.	0.526490
F-statistic	32.14950	Durbin-Watson stat	0.787629
Prob(F-statistic)	0.000000		

Dependent Variable: LGL
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.035884	0.038321	0.936417	0.3499
TG	0.251983	0.063608	3.961513	0.0001
SZ	0.006103	0.004639	1.315649	0.1895
GT	0.009575	0.003957	2.419522	0.0162
PF	-0.081244	0.038210	-2.126265	0.0344
NDTS	0.936369	0.541635	1.728782	0.0850
TREND	-0.009092	0.029191	-0.311467	0.7557

R-squared	0.179479	Mean dependent var	0.248788
Adjusted R-squared	0.160323	S.D. dependent var	0.253320
S.E. of regression	0.232127	Akaike info criterion	-0.056905
Sum squared resid	13.84794	Schwarz criterion	0.037911
Log likelihood	14.51151	Hannan-Quinn criter.	-0.018805
F-statistic	9.369288	Durbin-Watson stat	0.808451
Prob(F-statistic)	0.000000		

APPENDIX A.2.2: Static Model Regressions, FE

Dependent Variable: LGT
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.089101	0.059618	-1.494534	0.1364
TG	0.302864	0.098716	3.068021	0.0024
SZ	0.062044	0.011248	5.516047	0.0000
GT	0.001824	0.004311	0.422995	0.6727
PF	-0.731757	0.042021	-17.41424	0.0000
NDTS	-0.675049	0.696374	-0.969377	0.3334
TREND	0.017678	0.030569	0.578292	0.5636

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.767081	Mean dependent var	0.430644
Adjusted R-squared	0.738215	S.D. dependent var	0.465637
S.E. of regression	0.238243	Akaike info criterion	0.075590
Sum squared resid	13.28173	Schwarz criterion	0.481948
Log likelihood	20.02214	Hannan-Quinn criter.	0.238877
F-statistic	26.57386	Durbin-Watson stat	0.995259
Prob(F-statistic)	0.000000		

Dependent Variable: LGS
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.075394	0.065500	-1.151064	0.2509
TG	-0.207402	0.108455	-1.912331	0.0571
SZ	0.076278	0.012358	6.172615	0.0000
GT	-0.006643	0.004737	-1.402532	0.1621
PF	-0.664991	0.046166	-14.40433	0.0000
NDTS	-1.736344	0.765073	-2.269515	0.0241
TREND	0.034238	0.033585	1.019462	0.3090

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.616653	Mean dependent var	0.204583
Adjusted R-squared	0.569145	S.D. dependent var	0.398762
S.E. of regression	0.261746	Akaike info criterion	0.263758
Sum squared resid	16.03153	Schwarz criterion	0.670116
Log likelihood	-4.816108	Hannan-Quinn criter.	0.427045
F-statistic	12.97978	Durbin-Watson stat	1.114333
Prob(F-statistic)	0.000000		

Dependent Variable: LGL
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002695	0.045558	-0.059157	0.9529
TG	0.349830	0.075435	4.637527	0.0000
SZ	0.006975	0.008595	0.811487	0.4179
GT	0.003146	0.003295	0.954828	0.3407
PF	-0.064766	0.032110	-2.016971	0.0448
NDTS	0.568272	0.532138	1.067903	0.2867
TREND	0.001033	0.023359	0.044218	0.9648

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.540461	Mean dependent var	0.248788
Adjusted R-squared	0.483510	S.D. dependent var	0.253320
S.E. of regression	0.182054	Akaike info criterion	-0.462378
Sum squared resid	7.755644	Schwarz criterion	-0.056021
Log likelihood	91.03396	Hannan-Quinn criter.	-0.299092
F-statistic	9.489864	Durbin-Watson stat	1.332586
Prob(F-statistic)	0.000000		

APPENDIX A.2.3: Static Model Regressions, RE

Dependent Variable: LGT
Method: Panel EGLS (Cross-section random effects)
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.046550	0.080895	-0.575439	0.5655
TG	0.309383	0.093979	3.292052	0.0011
SZ	0.052805	0.009862	5.354341	0.0000
GT	0.001810	0.004292	0.421617	0.6737
PF	-0.728828	0.041797	-17.43726	0.0000
NDTS	-0.481115	0.684562	-0.702807	0.4828
TREND	0.012015	0.030458	0.394473	0.6936

Effects Specification	S.D.	Rho
Cross-section random	0.286089	0.5905
Idiosyncratic random	0.238243	0.4095

Weighted Statistics

R-squared	0.569679	Mean dependent var	0.104873
Adjusted R-squared	0.559632	S.D. dependent var	0.360716
S.E. of regression	0.239372	Sum squared resid	14.72581
F-statistic	56.70469	Durbin-Watson stat	0.867098
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.353608	Mean dependent var	0.430644
Sum squared resid	36.85918	Durbin-Watson stat	0.399243

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	6	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	0.302864	0.309383	0.000913	0.8292
SZ	0.062044	0.052805	0.000029	0.0876
GT	0.001824	0.001810	0.000000	0.9725
PF	-0.731757	-0.728828	0.000019	0.4985
NDTS	-0.675049	-0.481115	0.016312	0.1289
TREND	0.017678	0.012015	0.000007	0.0298

Cross-section random effects test equation:
Dependent Variable: LGT
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.089101	0.059618	-1.494534	0.1364
TG	0.302864	0.098716	3.068021	0.0024
SZ	0.062044	0.011248	5.516047	0.0000
GT	0.001824	0.004311	0.422995	0.6727
PF	-0.731757	0.042021	-17.41424	0.0000
NDTS	-0.675049	0.696374	-0.969377	0.3334
TREND	0.017678	0.030569	0.578292	0.5636

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.767081	Mean dependent var	0.430644
Adjusted R-squared	0.738215	S.D. dependent var	0.465637
S.E. of regression	0.238243	Akaike info criterion	0.075590
Sum squared resid	13.28173	Schwarz criterion	0.481948
Log likelihood	20.02214	Hannan-Quinn criter.	0.238877
F-statistic	26.57386	Durbin-Watson stat	0.995259
Prob(F-statistic)	0.000000		

Dependent Variable: LGS
Method: Panel EGLS (Cross-section random effects)
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.097802	0.059014	1.657278	0.0987
TG	-0.154604	0.090771	-1.703221	0.0897
SZ	0.036204	0.007956	4.550559	0.0000
GT	-0.007475	0.004645	-1.609466	0.1087
PF	-0.656960	0.045131	-14.55679	0.0000
NDTS	-0.949251	0.708373	-1.340045	0.1814
TREND	0.011941	0.033213	0.359531	0.7195

Effects Specification	S.D.	Rho
Cross-section random	0.124343	0.1841
Idiosyncratic random	0.261746	0.8159

Weighted Statistics

R-squared	0.436683	Mean dependent var	0.109630
Adjusted R-squared	0.423531	S.D. dependent var	0.360273
S.E. of regression	0.273539	Sum squared resid	19.22965
F-statistic	33.20434	Durbin-Watson stat	0.904736
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.401825	Mean dependent var	0.204583
Sum squared resid	25.01566	Durbin-Watson stat	0.703127

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	6	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	-0.207402	-0.154604	0.003523	0.3737
SZ	0.076278	0.036204	0.000089	0.0000
GT	-0.006643	-0.007475	0.000001	0.3708
PF	-0.664991	-0.656960	0.000095	0.4087
NDTS	-1.736344	-0.949251	0.083545	0.0065
TREND	0.034238	0.011941	0.000025	0.0000

Cross-section random effects test equation:
Dependent Variable: LGS
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.075394	0.065500	-1.151064	0.2509
TG	-0.207402	0.108455	-1.912331	0.0571
SZ	0.076278	0.012358	6.172615	0.0000
GT	-0.006643	0.004737	-1.402532	0.1621
PF	-0.664991	0.046166	-14.40433	0.0000
NDTS	-1.736344	0.765073	-2.269515	0.0241
TREND	0.034238	0.033585	1.019462	0.3090

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.616653	Mean dependent var	0.204583
Adjusted R-squared	0.569145	S.D. dependent var	0.398762
S.E. of regression	0.261746	Akaike info criterion	0.263758
Sum squared resid	16.03153	Schwarz criterion	0.670116
Log likelihood	-4.816108	Hannan-Quinn criter.	0.427045
F-statistic	12.97978	Durbin-Watson stat	1.114333
Prob(F-statistic)	0.000000		

Dependent Variable: LGL
Method: Panel EGLS (Cross-section random effects)
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009814	0.048514	0.202289	0.8399
TG	0.330843	0.067958	4.868344	0.0000
SZ	0.005927	0.006552	0.904636	0.3665
GT	0.004065	0.003261	1.246662	0.2137
PF	-0.066960	0.031723	-2.110763	0.0358
NDTS	0.654698	0.511108	1.280939	0.2014
TREND	-0.001434	0.023192	-0.061847	0.9507

Effects Specification	S.D.	Rho
Cross-section random	0.133902	0.3511
Idiosyncratic random	0.182054	0.6489

Weighted Statistics

R-squared	0.191222	Mean dependent var	0.094366
Adjusted R-squared	0.172340	S.D. dependent var	0.201881
S.E. of regression	0.183663	Sum squared resid	8.669176
F-statistic	10.12721	Durbin-Watson stat	1.179279
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.167252	Mean dependent var	0.248788
Sum squared resid	14.05429	Durbin-Watson stat	0.759009

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	9.562698	6	0.1443

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	0.349830	0.330843	0.001072	0.5620
SZ	0.006975	0.005927	0.000031	0.8506
GT	0.003146	0.004065	0.000000	0.0511
PF	-0.064766	-0.066960	0.000025	0.6589
NDTS	0.568272	0.654698	0.021939	0.5596
TREND	0.001033	-0.001434	0.000008	0.3762

Cross-section random effects test equation:
Dependent Variable: LGL
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002695	0.045558	-0.059157	0.9529
TG	0.349830	0.075435	4.637527	0.0000
SZ	0.006975	0.008595	0.811487	0.4179
GT	0.003146	0.003295	0.954828	0.3407
PF	-0.064766	0.032110	-2.016971	0.0448
NDTS	0.568272	0.532138	1.067903	0.2867
TREND	0.001033	0.023359	0.044218	0.9648

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.540461	Mean dependent var	0.248788
Adjusted R-squared	0.483510	S.D. dependent var	0.253320
S.E. of regression	0.182054	Akaike info criterion	-0.462378
Sum squared resid	7.755644	Schwarz criterion	-0.056021
Log likelihood	91.03396	Hannan-Quinn criter.	-0.299092
F-statistic	9.489864	Durbin-Watson stat	1.332586
Prob(F-statistic)	0.000000		

APPENDIX A.2.4: Static Model Regressions, No Trend

	Total Debt			Short-term Debt			Long-term Debt		
	OLS	FEM	REM	OLS	FEM	REM	OLS	FEM	REM
Constant	0.11 **	-0.07	-0.04	0.19 *	-0.05	0.11 **	0.03	0.00	0.01
	0.05	0.05	0.08	0.04	0.06	0.05	0.03	0.04	0.04
Tangibility of Assets	0.15	0.30 *	0.30 *	-0.23 *	-0.22 **	-0.16 ***	0.25 *	0.35 *	0.33 *
	0.10	0.10	0.09	0.08	0.11	0.09	0.06	0.07	0.07
Size	0.03 *	0.06 *	0.05 *	0.02 *	0.07 *	0.04 *	0.01	0.01	0.01
	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
Growth Prospects	0.01	0.00	0.00	-0.01	-0.01	-0.01	0.01 **	0.00	0.00
	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Profitability	-0.73 *	-0.73 *	-0.73 *	-0.67 *	-0.66 *	-0.66 *	-0.08 **	-0.06 **	-0.07 **
	0.06	0.04	0.04	0.05	0.05	0.05	0.04	0.03	0.03
Non-Debt Tax Shields	1.16	-0.67	-0.48	0.09	-1.73 **	-0.95	0.94 ***	0.57	0.65
	0.85	0.70	0.68	0.71	0.77	0.71	0.54	0.53	0.51
Adjusted R^2	0.39	0.74	0.56	0.42	0.57	0.43	0.16	0.49	0.18
Durbin-Watson Stat	0.45	1.00	0.87	0.79	1.12	0.91	0.81	1.33	1.18
F-statistic	34.69	27.59	68.26	38.73	13.40	39.96	11.26	9.87	12.20
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hausman Test									
Hausman Test (No Trend)			7.27			27.77			9.57
			(0.20)			(0.00)			(0.09)

* Statistically significant to the 1% level
** Statistically significant to the 5% level
*** Statistically significant to the 10% level

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	7.265519	5	0.2016

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	0.296060	0.304499	0.000923	0.7812
SZ	0.061259	0.052432	0.000028	0.0968
GT	0.001893	0.001863	0.000000	0.9424
PF	-0.730557	-0.728083	0.000018	0.5591
NDTS	-0.670462	-0.479346	0.016192	0.1331

Cross-section random effects test equation:
Dependent Variable: LGT
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.073415	0.053015	-1.384804	0.1674
TG	0.296060	0.097874	3.024916	0.0028
SZ	0.061259	0.011150	5.494141	0.0000
GT	0.001893	0.004304	0.439882	0.6604
PF	-0.730557	0.041910	-17.43162	0.0000
NDTS	-0.670462	0.695342	-0.964219	0.3359

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.766748	Mean dependent var	0.430644
Adjusted R-squared	0.738957	S.D. dependent var	0.465637
S.E. of regression	0.237905	Akaike info criterion	0.069442
Sum squared resid	13.30071	Schwarz criterion	0.462255
Log likelihood	19.83362	Hannan-Quinn criter.	0.227286
F-statistic	27.58912	Durbin-Watson stat	0.997034
Prob(F-statistic)	0.000000		

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	27.768452	5	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	-0.220579	-0.159312	0.003528	0.3023
SZ	0.074758	0.036023	0.000087	0.0000
GT	-0.006509	-0.007407	0.000001	0.3394
PF	-0.662667	-0.656340	0.000092	0.5102
NDTS	-1.727461	-0.948725	0.083496	0.0070

Cross-section random effects test equation:

Dependent Variable: LGS

Method: Panel Least Squares

Sample: 2006 2016

Periods included: 11

Cross-sections included: 24

Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.045013	0.058332	-0.771666	0.4411
TG	-0.220579	0.107691	-2.048259	0.0416
SZ	0.074758	0.012268	6.093617	0.0000
GT	-0.006509	0.004735	-1.374579	0.1706
PF	-0.662667	0.046114	-14.37032	0.0000
NDTS	-1.727461	0.765087	-2.257861	0.0249

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.614951	Mean dependent var	0.204583
Adjusted R-squared	0.569073	S.D. dependent var	0.398762
S.E. of regression	0.261768	Akaike info criterion	0.260614
Sum squared resid	16.10274	Schwarz criterion	0.653427
Log likelihood	-5.401084	Hannan-Quinn criter.	0.418458
F-statistic	13.40399	Durbin-Watson stat	1.115526
Prob(F-statistic)	0.000000		

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	9.565627	5	0.0885

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
TG	0.349432	0.331508	0.001074	0.5844
SZ	0.006929	0.005962	0.000030	0.8598
GT	0.003150	0.004054	0.000000	0.0570
PF	-0.064695	-0.067031	0.000024	0.6319
NDTS	0.568540	0.654206	0.021732	0.5612

Cross-section random effects test equation:
Dependent Variable: LGL
Method: Panel Least Squares
Sample: 2006 2016
Periods included: 11
Cross-sections included: 24
Total panel (balanced) observations: 264

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001778	0.040483	-0.043932	0.9650
TG	0.349432	0.074738	4.675449	0.0000
SZ	0.006929	0.008514	0.813816	0.4166
GT	0.003150	0.003286	0.958466	0.3388
PF	-0.064695	0.032003	-2.021547	0.0444
NDTS	0.568540	0.530972	1.070753	0.2854

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.540457	Mean dependent var	0.248788
Adjusted R-squared	0.485703	S.D. dependent var	0.253320
S.E. of regression	0.181667	Akaike info criterion	-0.469946
Sum squared resid	7.755709	Schwarz criterion	-0.077133
Log likelihood	91.03285	Hannan-Quinn criter.	-0.312102
F-statistic	9.870638	Durbin-Watson stat	1.332874
Prob(F-statistic)	0.000000		

APPENDIX B: Dynamic Model Regressions

APPENDIX B.1: Dynamic Model Regressions, Non-Cross Listed

APPENDIX B.1.1: Dynamic Model Regressions, Correlogram

LGT
Sample: 2006 2016
Included observations: 231

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|**** |	.|**** |	1	0.605	0.605	85.775	0.000
.|** |	*|. |	2	0.295	-0.113	106.19	0.000
.|* |	.|. |	3	0.119	-0.018	109.53	0.000
.|. |	.|. |	4	0.042	0.004	109.94	0.000
.|. |	.|. |	5	-0.025	-0.059	110.09	0.000
.|. |	.|. |	6	-0.049	-0.003	110.66	0.000
.|. |	.|. |	7	-0.050	-0.009	111.27	0.000
*|. |	*|. |	8	-0.108	-0.113	114.10	0.000
*|. |	.|. |	9	-0.082	0.061	115.73	0.000
.|. |	.|. |	10	-0.050	-0.011	116.34	0.000

LGS
Sample: 2006 2016
Included observations: 231

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|**** |	.|**** |	1	0.597	0.597	83.535	0.000
.|** |	*|. |	2	0.300	-0.088	104.75	0.000
.|* |	.|. |	3	0.140	-0.004	109.40	0.000
.|* |	.|. |	4	0.103	0.062	111.92	0.000
.|* |	.|. |	5	0.076	-0.005	113.31	0.000
.|. |	.|. |	6	0.052	0.000	113.95	0.000
.|. |	.|. |	7	0.029	-0.002	114.16	0.000
.|. |	*|. |	8	-0.047	-0.100	114.69	0.000
.|. |	.|. |	9	-0.033	0.063	114.94	0.000
.|. |	.|. |	10	-0.022	-0.017	115.06	0.000

LGL
Sample: 2006 2016
Included observations: 231

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|***** |	.|***** |	1	0.629	0.629	92.604	0.000
.|*** |	.|. |	2	0.380	-0.026	126.58	0.000
.|** |	.|. |	3	0.225	-0.006	138.57	0.000
.|. |	**|. |	4	-0.011	-0.240	138.61	0.000
*|. |	.|. |	5	-0.084	0.041	140.29	0.000
*|. |	.|. |	6	-0.092	0.007	142.33	0.000
*|. |	.|. |	7	-0.082	0.034	143.94	0.000
.|. |	.|. |	8	-0.061	-0.042	144.83	0.000
.|. |	.|. |	9	-0.041	-0.011	145.24	0.000
.|. |	.|. |	10	-0.029	-0.012	145.44	0.000

Dependent Variable: LGT
Method: Panel Least Squares
Sample (adjusted): 2007 2016
Periods included: 10
Cross-sections included: 21
Total panel (balanced) observations: 210

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.035205	0.031783	1.107689	0.2693
LGT (-1)	0.629328	0.046853	13.43185	0.0000
TG	0.139999	0.062908	2.225444	0.0272
SZ	-0.004365	0.005875	-0.742974	0.4584
GT	0.019515	0.013639	1.430838	0.1540
PF	-0.224147	0.076702	-2.922310	0.0039
NDTS	1.549456	0.421070	3.679808	0.0003
TREND	0.051889	0.027876	1.861395	0.0641

R-squared	0.609724	Mean dependent var	0.400667
Adjusted R-squared	0.596200	S.D. dependent var	0.307735
S.E. of regression	0.195551	Akaike info criterion	-0.388638
Sum squared resid	7.724538	Schwarz criterion	-0.261129
Log likelihood	48.80698	Hannan-Quinn criter.	-0.337091
F-statistic	45.08322	Durbin-Watson stat	1.915227
Prob(F-statistic)	0.000000		

Dependent Variable: LGS
Method: Panel Least Squares
Sample (adjusted): 2007 2016
Periods included: 10
Cross-sections included: 21
Total panel (balanced) observations: 210

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.028365	0.027588	1.028164	0.3051
LGS (-1)	0.659648	0.056614	11.65167	0.0000
TG	0.046686	0.056632	0.824381	0.4107
SZ	-0.003907	0.005271	-0.741254	0.4594
GT	0.006103	0.012146	0.502464	0.6159
PF	-0.128228	0.069097	-1.855768	0.0649
NDTS	1.039821	0.376991	2.758214	0.0063
TREND	0.045224	0.024976	1.810700	0.0717

R-squared	0.507541	Mean dependent var	0.220952
Adjusted R-squared	0.490476	S.D. dependent var	0.245373
S.E. of regression	0.175149	Akaike info criterion	-0.609005
Sum squared resid	6.196810	Schwarz criterion	-0.481496
Log likelihood	71.94556	Hannan-Quinn criter.	-0.557458
F-statistic	29.74095	Durbin-Watson stat	2.045264
Prob(F-statistic)	0.000000		

Dependent Variable: LGL
Method: Panel Least Squares
Sample (adjusted): 2007 2016
Periods included: 10
Cross-sections included: 21
Total panel (balanced) observations: 210

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001136	0.014336	0.079271	0.9369
LGL (-1)	0.639015	0.035356	18.07391	0.0000
TG	0.089458	0.029099	3.074276	0.0024
SZ	-0.000458	0.002740	-0.167172	0.8674
GT	0.012848	0.006338	2.027313	0.0439
PF	-0.089135	0.035615	-2.502715	0.0131
NDTS	0.496977	0.194570	2.554235	0.0114
TREND	0.006786	0.012979	0.522834	0.6017

R-squared	0.679627	Mean dependent var	0.179810
Adjusted R-squared	0.668525	S.D. dependent var	0.158068
S.E. of regression	0.091006	Akaike info criterion	-1.918430
Sum squared resid	1.672987	Schwarz criterion	-1.790921
Log likelihood	209.4351	Hannan-Quinn criter.	-1.866883
F-statistic	61.21637	Durbin-Watson stat	2.296094
Prob(F-statistic)	0.000000		

APPENDIX B.1.2: Dynamic Model Regressions, Sys-GMM

Dependent Variable: LGT
Method: Panel Generalized Method of Moments
Transformation: Orthogonal Deviations
Sample (adjusted): 2011 2016
Periods included: 6
Cross-sections included: 21
Total panel (balanced) observations: 126
White period instrument weighting matrix
White period standard errors & covariance (d.f. corrected)
Instrument specification: @DYN (LGT, -4) TG (-4) SZ (-4) GT (-4) PF (-4) NDTS (-4) TREND (-4)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGT (-1)	0.440544	0.070849	6.218035	0.0000
TG	0.135240	0.339145	0.398766	0.6908
SZ	0.041151	0.025751	1.598039	0.1127
GT	0.004384	0.040453	0.108367	0.9139
PF	0.041304	0.089844	0.459734	0.6465
NDTS	2.249926	1.428489	1.575039	0.1179
TREND	0.074614	0.020035	3.724098	0.0003

Effects Specification

Cross-section fixed (orthogonal deviations)

Mean dependent var	-0.003643	S.D. dependent var	0.254197
S.E. of regression	0.206287	Sum squared resid	5.063973
J-statistic	14.06206	Instrument rank	21
Prob(J-statistic)	0.445098		

Dependent Variable: LGS
Method: Panel Generalized Method of Moments
Transformation: Orthogonal Deviations
Sample (adjusted): 2011 2016
Periods included: 6
Cross-sections included: 21
Total panel (balanced) observations: 126
White period instrument weighting matrix
White period standard errors & covariance (d.f. corrected)
Instrument specification: @DYN (LGS, -4) TG (-4) SZ (-4) GT (-4) PF (-4) NDTS (-4) TREND (-4)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGS (-1)	-0.115946	0.212800	-0.544858	0.5869
TG	0.802441	0.343243	2.337824	0.0211
SZ	0.014062	0.021587	0.651388	0.5161
GT	-0.052479	0.034276	-1.531099	0.1284
PF	0.118266	0.167234	0.707185	0.4808
NDTS	-0.413415	1.209970	-0.341674	0.7332
TREND	0.030076	0.013359	2.251391	0.0262

Effects Specification

Cross-section fixed (orthogonal deviations)

Mean dependent var	-0.002893	S.D. dependent var	0.193248
S.E. of regression	0.191324	Sum squared resid	4.355959
J-statistic	13.98805	Instrument rank	21
Prob(J-statistic)	0.450601		

Dependent Variable: LGL
Method: Panel Generalized Method of Moments
Transformation: Orthogonal Deviations
Sample (adjusted): 2011 2016
Periods included: 6
Cross-sections included: 21
Total panel (balanced) observations: 126
White period instrument weighting matrix
White period standard errors & covariance (d.f. corrected)
Instrument specification: @DYN (LGL, -4) TG (-4) SZ (-4) GT (-4) PF (-4) NDTS (-4) TREND (-4)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGL (-1)	0.270013	0.114182	2.364760	0.0197
TG	0.500347	0.269572	1.856081	0.0659
SZ	0.018759	0.021266	0.882110	0.3795
GT	0.069720	0.033752	2.065651	0.0410
PF	-0.345292	0.239973	-1.438879	0.1528
NDTS	0.066834	1.341808	0.049809	0.9604
TREND	0.029303	0.019736	1.484754	0.1403

Effects Specification

Cross-section fixed (orthogonal deviations)

Mean dependent var	-0.000967	S.D. dependent var	0.121280
S.E. of regression	0.111161	Sum squared resid	1.470467
J-statistic	10.90270	Instrument rank	21
Prob(J-statistic)	0.693663		

APPENDIX B.2: Dynamic Model Regressions, Cross Listed

APPENDIX B.2.1: Dynamic Model Regressions, Correlogram

LGT
Sample: 2006 2016
Included observations: 264

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|**** |	.|**** |	1	0.551	0.551	80.971	0.000
.|*** |	.|* |	2	0.355	0.074	114.70	0.000
.|** |	.|* |	3	0.285	0.092	136.61	0.000
.|** |	.|* |	4	0.273	0.100	156.67	0.000
.|* |	.|. |	5	0.209	-0.003	168.57	0.000
.|* |	*|. |	6	0.108	-0.072	171.73	0.000
.|. |	.|. |	7	0.043	-0.045	172.24	0.000
.|. |	*|. |	8	-0.021	-0.077	172.36	0.000
.|. |	.|. |	9	0.003	0.046	172.36	0.000
.|. |	.|. |	10	0.032	0.053	172.64	0.000

LGS
Sample: 2006 2016
Included observations: 264

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|*** |	.|*** |	1	0.410	0.410	44.810	0.000
.|** |	.|* |	2	0.283	0.138	66.241	0.000
.|* |	.|. |	3	0.134	-0.028	71.042	0.000
.|. |	.|. |	4	0.070	-0.010	72.365	0.000
.|. |	.|. |	5	0.043	0.011	72.869	0.000
.|. |	.|. |	6	-0.024	-0.057	73.021	0.000
.|. |	.|. |	7	-0.003	0.020	73.023	0.000
.|. |	.|. |	8	-0.010	0.002	73.052	0.000
.|. |	.|. |	9	0.010	0.017	73.079	0.000
.|. |	.|. |	10	0.005	-0.003	73.086	0.000

LGL
Sample: 2006 2016
Included observations: 264

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|**** |	.|**** |	1	0.598	0.598	95.603	0.000
.|** |	*|. |	2	0.262	-0.150	113.95	0.000
.|* |	.|* |	3	0.196	0.169	124.33	0.000
.|* |	.|. |	4	0.186	0.024	133.68	0.000
.|** |	.|* |	5	0.249	0.187	150.51	0.000
.|** |	.|. |	6	0.238	-0.011	165.99	0.000
.|* |	*|. |	7	0.097	-0.102	168.55	0.000
.|. |	.|. |	8	0.009	-0.022	168.57	0.000
.|. |	.|. |	9	0.006	-0.008	168.58	0.000
.|. |	.|. |	10	0.002	-0.039	168.58	0.000

Dependent Variable: LGT
Method: Panel Least Squares
Sample (adjusted): 2007 2016
Periods included: 10
Cross-sections included: 24
Total panel (balanced) observations: 240

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.020738	0.049907	0.415527	0.6781
LGT (-1)	0.554393	0.037789	14.67067	0.0000
TG	0.029481	0.078447	0.375805	0.7074
SZ	0.022657	0.005989	3.783312	0.0002
GT	0.000434	0.004821	0.089974	0.9284
PF	-0.705960	0.084033	-8.400984	0.0000
NDTS	0.613097	0.663804	0.923611	0.3566
TREND	-0.016328	0.036465	-0.447769	0.6547

R-squared	0.590596	Mean dependent var	0.435958
Adjusted R-squared	0.578244	S.D. dependent var	0.420480
S.E. of regression	0.273071	Akaike info criterion	0.274597
Sum squared resid	17.29975	Schwarz criterion	0.390618
Log likelihood	-24.95164	Hannan-Quinn criter.	0.321345
F-statistic	47.81113	Durbin-Watson stat	1.131105
Prob(F-statistic)	0.000000		

Dependent Variable: LGS
Method: Panel Least Squares
Sample (adjusted): 2007 2016
Periods included: 10
Cross-sections included: 24
Total panel (balanced) observations: 240

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.140448	0.049164	2.856702	0.0047
LGS (-1)	0.404745	0.041997	9.637542	0.0000
TG	-0.193559	0.076193	-2.540393	0.0117
SZ	0.014430	0.005778	2.497519	0.0132
GT	-0.012592	0.004692	-2.683413	0.0078
PF	-0.535145	0.081279	-6.584007	0.0000
NDTS	-0.090009	0.641963	-0.140209	0.8886
TREND	0.021839	0.035280	0.619024	0.5365

R-squared	0.402440	Mean dependent var	0.199708
Adjusted R-squared	0.384410	S.D. dependent var	0.336634
S.E. of regression	0.264121	Akaike info criterion	0.207950
Sum squared resid	16.18436	Schwarz criterion	0.323971
Log likelihood	-16.95401	Hannan-Quinn criter.	0.254698
F-statistic	22.32080	Durbin-Watson stat	1.450256
Prob(F-statistic)	0.000000		

Dependent Variable: LGL
Method: Panel Least Squares
Sample (adjusted): 2007 2016
Periods included: 10
Cross-sections included: 24
Total panel (balanced) observations: 240

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.014215	0.033364	-0.426048	0.6705
LGL (-1)	0.588076	0.048475	12.13156	0.0000
TG	0.123135	0.053588	2.297826	0.0225
SZ	0.007217	0.004066	1.774885	0.0772
GT	0.002604	0.003268	0.796841	0.4264
PF	-0.275506	0.056824	-4.848413	0.0000
NDTS	0.453319	0.448285	1.011231	0.3130
TREND	-0.009724	0.024713	-0.393463	0.6943

R-squared	0.503800	Mean dependent var	0.261208
Adjusted R-squared	0.488829	S.D. dependent var	0.258191
S.E. of regression	0.184597	Akaike info criterion	-0.508520
Sum squared resid	7.905627	Schwarz criterion	-0.392499
Log likelihood	69.02244	Hannan-Quinn criter.	-0.461772
F-statistic	33.65052	Durbin-Watson stat	1.820755
Prob(F-statistic)	0.000000		

APPENDIX B.2.2: Dynamic Model Regressions, Sys-GMM

Dependent Variable: LGT
Method: Panel Generalized Method of Moments
Transformation: Orthogonal Deviations
Sample (adjusted): 2011 2016
Periods included: 6
Cross-sections included: 24
Total panel (balanced) observations: 144
White period instrument weighting matrix
White period standard errors & covariance (d.f. corrected)
Instrument specification: @DYN (LGT, -4) TG (-4) SZ (-4) GT (-4) PF (-4) NDTS (-4) TREND (-4)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGT (-1)	0.636924	0.034526	18.44740	0.0000
TG	-0.183755	0.034644	-5.304113	0.0000
SZ	0.093960	0.012069	7.784896	0.0000
GT	0.110330	0.004691	23.51761	0.0000
PF	-1.088653	0.022934	-47.46968	0.0000
NDTS	-0.443961	0.157911	-2.811458	0.0057
TREND	0.018413	0.006228	2.956636	0.0037

Effects Specification

Cross-section fixed (orthogonal deviations)

Mean dependent var	-0.035306	S.D. dependent var	0.208649
S.E. of regression	0.277572	Sum squared resid	10.55537
J-statistic	15.22638	Instrument rank	24
Prob(J-statistic)	0.579179		

Dependent Variable: LGS
Method: Panel Generalized Method of Moments
Transformation: Orthogonal Deviations
Sample (adjusted): 2011 2016
Periods included: 6
Cross-sections included: 24
Total panel (balanced) observations: 144
White period instrument weighting matrix
White period standard errors & covariance (d.f. corrected)
Instrument specification: @DYN (LGS, -4) TG (-4) SZ (-4) GT (-4) PF (-4) NDTS (-4) TREND (-4)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGS (-1)	0.487454	0.005165	94.37325	0.0000
TG	-0.374319	0.014072	-26.60023	0.0000
SZ	0.069860	0.004006	17.43970	0.0000
GT	-0.023631	0.000938	-25.18754	0.0000
PF	-0.867806	0.010719	-80.96100	0.0000
NDTS	-2.016462	0.027094	-74.42386	0.0000
TREND	0.045517	0.003767	12.08243	0.0000

Effects Specification

Cross-section fixed (orthogonal deviations)

Mean dependent var	0.019999	S.D. dependent var	0.264054
S.E. of regression	0.255861	Sum squared resid	8.968714
J-statistic	17.53741	Instrument rank	24
Prob(J-statistic)	0.418569		

Dependent Variable: LGL
Method: Panel Generalized Method of Moments
Transformation: Orthogonal Deviations
Sample (adjusted): 2011 2016
Periods included: 6
Cross-sections included: 24
Total panel (balanced) observations: 144
White period instrument weighting matrix
White period standard errors & covariance (d.f. corrected)
Instrument specification: @DYN (LGL, -4) TG (-4) SZ (-4) GT (-4) PF (-4) NDTS (-4) TREND (-4)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGL (-1)	0.829565	0.023799	34.85721	0.0000
TG	0.535148	0.059983	8.921620	0.0000
SZ	0.010024	0.007988	1.254916	0.2116
GT	0.023092	0.005762	4.007607	0.0001
PF	0.013573	0.006578	2.063437	0.0410
NDTS	1.436271	0.146096	9.831014	0.0000
TREND	0.004805	0.004255	1.129213	0.2608

Effects Specification

Cross-section fixed (orthogonal deviations)

Mean dependent var	-0.024304	S.D. dependent var	0.197546
S.E. of regression	0.225204	Sum squared resid	6.948226
J-statistic	17.27252	Instrument rank	24