The Impact of Financial Leverage on a Firm's Investment Decisions

Brian Kipkirui Koech
071753

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School of Finance and Applied Economics
Strathmore University
Nairobi, Kenya

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Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Proposal contains no material previously published or written by another person except where due reference is made in the Research Proposal itself.

BRIAN KIPKIRUI KOECH ..... [*Name of Candidate*]

..... [*Signature*]

09/12/2015 ..... [*Date*]

This Research Proposal has been submitted for examination with my approval as the Supervisor.

DR. CHEPKEMEI ..... [*Name of Supervisor*]

..... [*Signature*]

09/12/15 ..... [*Date*]

School of Finance and Applied Economics

Strathmore University

Abstract

This paper studies the impact of leverage on a firm's investment. The impact is measured for both high and low growth firms. The evidence is provided by use of the listed companies in the Construction & Allied and Commercial & Services segments of the Nairobi Securities Exchange (NSE). The approach involves structural estimation and in particular the Simulated Method of Moments (SMM). It furthers the prior research that has been done. However, the results are not consistent with what was concluded. In this case the effect of leverage on investment is positive.

Key words: *simulated method of moments, structural estimation, leverage and investment*

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NSE	-	Nairobi Stock Exchange
SMM	-	Simulated Method of Moments

1. Introduction

Background

In corporate finance, the impact of financial leverage on a firm's investment decision is a central issue. In order to achieve their set objectives, firms have to efficiently manage the funds at their disposal. Furthermore, to keep up or to remain ahead of their rivals, they have to make capital investments in areas such as: technology, infrastructure, product development and many more. There are several sources for funding such investments and financial leverage is one of them (Aivazian, Ge, & Qiu, 2005).

Financial leverage can be simply defined as the use of debt to acquire additional assets and/or increase production (Odit & Chittoo, 2008). In the past, financial leverage was looked down upon and considered an evil and that an uptake of debt led to financial distress. However, this view has been cast aside and considered obsolete. Moreover, financial leverage is now an important aspect in the production of goods and services. According to Odit & Chittoo (2008) financial leverage is an important component in capital structure along with equity and retained earnings.

As a debt financing instrument, financial leverage has both positive and negative attributes (McConnell & Servaes, 1995). A firm with greater debt than equity is considered to be highly leveraged. The leverage can be used for operation purposes or for investment. However, this comes with increased risk. If the leverage is used for investment and the investment moves against the investor, the loss will be greater than if it was not leveraged (Odit & Chittoo, 2008). The vice versa is true if the investment performs as expected. Therefore, we see that leverage amplifies both profits and losses.

However, some authors have contradicting ideas towards financial leverage. For example, Modigliani & Miller (1958) states that we should not, "waste our limited worrying capacity on the second order and largely self-correcting problems like financial leverage." This statement has been challenged over the years by empirical literatures which imply that financing considerations have an influence on the investment relations. Furthermore, there is an explanation for why highly leveraged

firms are less likely to exploit valuable growth opportunities as opposed to low leveraged firms (Myers, 1977).

According to Myers (1977) high leverage overhang reduces the incentives of the shareholder-management coalition in control of the firm to invest in positive net present value of investment opportunities, since the benefits accrue to the bondholders rather than to the shareholders. Thus, highly levered firms are less likely to exploit valuable growth opportunities as compared to firm with low levels of leverage. Related under-investment theory centres on a liquidity effect in that firms with large debt commitment invest less no matter what their growth opportunities. Theoretically, even if leverage creates potential under-investment incentives, the effect could be reduced by the firm corrective measures. Ultimately, leverage is lowered if future growth opportunities are recognized sufficiently early (Odit & Chittoo, 2008).

Another problem which has received much attention is over-investment theory. This theory was also brought forward by Myers. It can be explained as investment expenditure beyond that required to maintain assets in place and to finance expected new investments in positive NPV projects whereas. Here there is a conflict between mangers and shareholders. Managers perceive an opportunity to expand the business even if that means undertaking poor projects and reducing shareholder welfare. The manager's "abilities" to carry such a policy is restrained by the availability of cash flow and further tightened by the financing of debt. Hence, leverage is one mechanism for overcoming the over-investment problem suggesting a negative relationship between debt and investment for firm with low growth opportunities. Too much debt also is not considered to be good as it may lead to financial distress and agency problems (Odit & Chittoo, 2008).

Previous studies on the relationship between leverage, investment and growth such as Long & Malitz (1985) and Lang, Ofek, & Stulz (1996), use pooling regressions and make several assumptions in their analyses. The two studies faced several criticisms. Furthermore, Aivazian, Ge, & Qiu (2005) and Odit & Chittoo (2008) stepped up and used a panel methodology to further the previous studies. They still faced several challenges in their studies. In this paper a dynamic model and structural estimation are applied to add on to the previous studies that were done.

1.1. Problem statement

Several studies have been conducted by academics to examine the impact of financial leverage on a firm's investment. One of the most controversial issues studied in the literature on financial leverage was whether to leave it alone as it self-corrects as done by Modigliani & Miller (1958) or to pay attention to the fact that different levels of leverage have different impacts as done by Myers (1977).

The study in relation to Canadian firms by Aivazian, Ge, & Qiu (2005) and in relation to Mauritian firms by Odit & Chittoo (2008) revealed similar results despite the use of different approaches. They both went further to observe the impact of leverage on both low growth and high growth firms.

This study differed from the existing empirical works in two ways. This was in that the evidence was based on the Kenyan non-financial listed companies. Furthermore, the companies make up the Commercial & Services and Construction & Allied segments of the NSE and the fact that Kenya had a slightly different institutional environment compared to both Canada and Mauritius. The difference was greater with regard to Canada. Furthermore, the use of dynamic models and structural estimation was a gap yet to be filled in the line of this research.

1.2. Research objectives

1. To determine the impact of financial leverage on a firm's investment using the companies that make up the Commercial & Services and Construction & Allied segments of the NSE.

1.3. Research questions

1. What is the impact of financial leverage on a firm's investment using the companies that make up the Commercial & Services and Construction & Allied segments of the NSE?

1.4. Significance of the study

This study evaluates the impact of financial leverage on a firm's investment decisions with regard to the companies that make up the Commercial & Services and Construction & Allied segments of the NSE. Through the use of a dynamic model and structural estimation the purpose will be achieved especially with regard to firms faced with low and high growth opportunities. This is critical as the firms look to balance out the level of leverage they can have for maximum productivity.

The choice of these two segments is because of the nature of the business they are doing and the challenges faced by the different companies. In the Commercial & Services segment there is an array of companies in different industries, faced with different challenges and they observe slightly different regulations. However, there are companies that are high users of debt and this worked to my advantage in the research. In the Construction & Allied segment, there is also an array of different firms but in this case, they are all in the same industry. Furthermore, they also take up a lot of debt to fund their investment which is a bonus for this research. Some of the challenges faced by the companies in these two segments include mismanagement decisions and misuse of funds.

This study adds on to the empirical studies that have been conducted in the past and to the already known facts by providing empirical evidence from the companies that make up the Commercial & Services and Construction & Allied segments of the Nairobi Securities Exchange (NSE).

2. Literature review

2.1. Introduction

It is known that leverage has a negative impact on investment. This has been proven by several studies using different methods. The focus has been on the influence of the effect of leverage on both the high growth and low growth fims. Furthermore, how the effect compares across these two types of firms. The studies started from Modigliani & Miller (1958) all the way to the likes of Hennessy and Whited (2007). All these studies will be talked about next.

2.2. Theoretical Review

According to Modigliani & Miller (1958) only recently have economists begun to face up seriously to the problem of the cost of capital cum risk. In the process they have found their interests and endeavours merging with those of the finance specialist and the managerial economist who have lived with the problem longer and more intimately. In this joint search to establish the principles which govern rational investment and financial policy in a world of uncertainty two main lines of attack can be discerned. These lines represent attempts to extrapolate to the world of uncertainty each of the two criteria; profit maximization and market value maximization. According to the first criterion, a physical asset is worth acquiring if it will increase the net profit of the owners of the firm. But net profit will increase only if the expected rate of return of the asset exceeds the rate of interest. According to the second criterion, an asset is worth acquiring if it increases the value of the owners' equity, i.e., if it adds more to the market value of the firm than the costs of acquisition. Note that, under either criterion, the cost of capital is equal to the interest rate on bonds, regardless of whether the funds are acquired through debt instruments or through new issues of common stock. Thus, if this holds and one is in a world of sure returns, the distinction between debt and equity funds reduces largely to one of terminology (Modigliani & Miller, 1958).

Furthermore, Modigliani & Miller (1958) support the market value maximization approach as it provides the basis for an operational definition of the cost of capital and a workable theory of investment. Under this approach any investment project and its subsequent financing plan must pass only the following test: Will the project, as financed, raise the market value of the firm's shares? If so, it is worth undertaking; if not, its return is less than the marginal cost of capital to the firm.

This kind of test is entirely independent of the tastes of the current owners. This is because market prices will reflect not only their preferences but those of all potential owners as well. If any current stockholder disagrees with management and the market over the valuation of the project, he is free to sell out and re-invest elsewhere, but will still benefit from the capital appreciation resulting from the management's decision.

However, the potential advantages of the market value maximization approach has been appreciated a long time ago and thus leaves one wondering what has been brought out analytically. The analytical development has been hindered by the lack of adequate theory on the effect of financial structure on market valuations, and on how these effects can be inferred from objective market data. A theory of investment of the firm under conditions of uncertainty was then developed by Modigliani & Miller (1958). Moreover, this theory is to be used to answer the cost-of-capital question. Their study was done on a firm and industry level, this is because the interests of various specialists concerned with the cost-of-capital problem come most closely together.

In their analysis, prices of inputs and other products are taken as given for the firm and industry. Furthermore, 'prices' of certain income streams are treated as constant and given from outside the model. This is consistent with the Marshallian pricing theory which Modigliani & Miller (1958) relied on in their static, partial-equilibrium approach in development of their theories.

To exhibit the mechanism determining the relative prices of shares under these conditions, Modigliani & Miller (1958) make the following two assumptions about the nature of bonds and the bond market, though they are actually stronger than is necessary and were relaxed later in their analyses. First, all bonds (including any debts issued by households for the purpose of carrying shares) are assumed to yield a constant income per unit of time, and this income is regarded as certain by all traders regardless of the issuer. Second, bonds, like stocks, are traded in a perfect market, where the term perfect is to be taken in its usual sense as implying that any two commodities which are perfect substitutes for each other must sell, in equilibrium, at the same price.

It follows from the assumptions that; (1) All bonds are in fact perfect substitutes up to a scale factor. It follows from assumption (2) that they must all sell at the same price per dollars' worth of return, or what amounts to the same thing must yield the same rate of return. This rate of return will be referred to as the rate of interest or as the capitalization rate for sure streams.

From these fundamental assumptions Modigliani & Miller (1958) were able to coin their first proposition (MM1). The proposition states that, ***"the average cost of capital to any firm is completely independent of its capital structure and is equal to the capitalization rate of a pure equity stream of its class"***.

Consider any company j and let $\overline{X}_j$ stand as before for the expected return on the assets owned by the company (that is, it is expected profit before deduction of interest). Denote by D_j the market value of the debts of the company; by S_j the market value of its common shares; and by $V_j = S_j + D_j$ the market value of the firm. This proposition can be stated in an equivalent way in terms of the firm's "average cost of capital", $\overline{X}_j / V_j$ which is the ratio of its expected return to the market value of all its securities. The proposition can then be expressed by the equation:

$$\frac{\overline{X}_j}{(S_j+D_j)} = \frac{\overline{X}_j}{V_j} = \rho_k \text{ , for any firm } j, \text{ class } k \qquad (1)$$

If MM1 did not hold, an investor could buy and sell stocks and bonds in such a way as to exchange one income stream for another stream, identical in all relevant respects but selling at a lower price. The exchange would therefore be advantageous to the investor quite independently of his attitudes toward risk. As investors exploit these arbitrage opportunities, the value of the overpriced shares will fall and that of the under-priced shares will rise, thereby tending to eliminate the discrepancy between the market values of the firms (Modigliani & Miller, 1958).

From MM1, Modigliani & Miller (1958) went ahead to develop MM2 which was a continuation from the initial proposition. MM2 states that *"the market price of any share of stock is given by capitalizing its expected return at the continuously variable rate i_j."* The rate of return is on common stock in companies whose capital structure includes some debt: the expected rate of return or yield, i_j the stock of any company j belonging to the k^{th} class is a linear function of leverage as follows:

$$i_j = \rho_k + (\rho_k - r)\frac{D_j}{S_j} \tag{2}$$

The methods and results developed so far by Modigliani & Miller (1958) made several fundamental assumptions which include; (1) Ignoring the presence of corporate profits tax under which interest payments are deductible. (2) Not recognizing the existence of a multiplicity of bonds and interest rates. (3) Not acknowledging the presence of market imperfections which might interfere with the process of arbitrage.

The studies shifted and there was now the introduction of corporate taxes. Myers (1977) was very particular in criticising the propositions by Modigliani & Miller (1958) because they failed to account for the corporate tax. He said, "Neoclassical valuation models, like MM's, which use the same 'cost of capital' to evaluate earnings from present versus future investment, are Mis-specified."

Modigliani & Miller (1958) went ahead to come up with MM3 which served as an optimal investment policy rule. This rule still had not taken into account corporate taxes. MM3, if a firm in class k is acting in the best interest of the stockholders at the time of the decision, it will exploit an investment opportunity if and only if the rate of return on the investment, say $\rho^*$is as large as or larger thanρ^k. That is, *"the cut-off point for investment in the firm will in all cases be ρ^k and will be completely unaffected by the type of security used to finance the investment."* Equivalently, we may say that regardless of the financing used, the marginal cost of capital to a firm is equal to the average cost of capital, which is in turn equal to the capitalization rate for an unlevered stream in the class to which the firm belongs.

With MM1 and MM2, the foundations of a theory of the valuation of firms and shares in a world of uncertainty were achieved albeit having plenty of assumptions that drove away from realism. They have showed, moreover, how this theory can

lead to an operational definition of the cost of capital and how that concept can be used in turn as a basis for rational investment decision-making within the firm. With the further development of MM3 the main objectives were reached.

Building further on the theories initiated by Modigliani & Miller (1958), Myers, (1977) went ahead to work closer towards reality by introducing corporate taxes. To him, some of the oddest practical rules of thumb for judging debt policies are those that depended on ratios of debt to book value of equity or total book capitalization. However, in modern finance theory considers ratios based on market values much more pertinent. It is not that book values are more accurate than stock market values, but simply that they refer to assets already in place. A significant part of many firms' market values is accounted for by assets not yet in place, i.e., by the present value of future growth opportunities. He then goes further to show that the amount of 'debt' supported by growth opportunities will be less, other things equal, than is supported by assets already in place.

To anchor his studies, Myers (1977) incorporated the approach used by Jensen & Meckling (1976) in analysis of agency costs and the optimal capital structure. This was important in his determination of factors that influence corporate borrowing.

He however faced criticism on the issues he raised. A recurring criticism was that the incremental tax advantage of borrowing declines as more debt is issued and interest tax shields become less certain. Others have also noted that personal taxes - specifically the difference between tax rates on capital gains and rates on regular income - reduce the theoretical tax advantage of corporate borrowing and Miller (1977) has presented a model in which the advantage entirely disappears.

Moreover, the theory presented by Myers (1977) rests not only on costs of monitoring and enforcement of contracts, but also on certain specific imperfections in the market for real options. It is necessary that the value of a growth option vanishes or declines if it is not exercised by the firm.

We know that one alleged advantage of corporate diversification is that diversified firms can borrow more. A combination of assets with less than perfectly correlated returns gives a variance rate for the combination's value that is less than the average rate of the assets considered separately. The usual conclusion is that this increases the amount the firm can or should borrow. The conclusion does not follow from the

theory presented by Myers (1977). He indicates that there should be no consistent relationship between 'diversification' and 'debt capacity'.

Moving on, Myers (1977) had his theory anchored on the assumption of perfect markets and from this is where he manages to conclude his research. The analysis presented in his paper by adds up to a partial theory of the corporate borrowing decision. Although he dealt only with certain simple cases, it still leads to testable propositions.

According to the theory, the amount of debt issued by the firm should be set equal to V^*_d, that amount which maximizes the market value of the firm. It has no direct relationship to the probability of default or the amount lenders are willing to advance.

The theory predicts that V^*_d will be inversely related to the ratio of V_G to V, where V_G is the part of firm value V accounted for by growth opportunities or, more generally, the part of V that is contingent on discretionary future expenditure by the firm. In the broader interpretation discretionary expenditures include all future investment and variable costs, which, if undertaken, increase the end-of-period value of the firm. Although a general measure of this concept is difficult to derive from accounting data, the following specific propositions should hold, other things equal, Myers (1977) says if the theory is right: (1) Assets-in-place should be financed with more debt than growth opportunities. The investment in assets-in-place is a sunk cost and, by definition, not discretionary. (2) For assets-in-place, the following factors should be associated with heavy debt financing: (a) capital-intensity and high operating leverage, and, of course, (b) profitability, ideally measured in terms of expected future value of the firm's assets.

This same argument above explains why firms attempt to match the maturities of their assets and liabilities. He goes further to imply that standard finance theory gives no reason why firms should not finance long-lived assets with short-term debt, or conversely, short-lived assets with long-term debt. But we can interpret matching maturities as an attempt to schedule debt repayments to correspond to the decline in future value of assets currently in place. However, these predictions are not a complete statement of the theory's implications. Others were noted in the

main text of the paper. He even calls for further study on the issue he started and rightly so Lang, Ofek, & Stulz (1996) picked up from where he left off.

2.3. Empirical Evidence

There is now substantial evidence that investment is negatively related to cash flow for firms where the wedge between the cost of external and internal finance is large. However, this evidence does not directly answer the question of how investment affects growth.

Inspite of all the academic and popular debates about the relation between debt and growth, there was almost no empirical evidence on whether leverage significantly affects investment and future growth until Lang, Ofek, & Stulz (1996) went ahead to empirically test these relations. In their paper they investigate the link between leverage and future growth through an examination of the relation at firm level. Despite their literature being predominantly about investment, the link between leverage and future growth is investigated through several different estimates of short-term and long-term future growth using 20 years of Compustat data. The firms of study were in the United States of America (USA).

The measures of growth used by Lang, Ofek, & Stulz (1996) include; (1) Capital expenditures in excess of depreciation normalized by fixed assets. (2) The rate of growth of capital expenditures. (3) The rate of increase of employment.

The use of different measures is as a result of firms being able to use various means to affect their growth. In their panel, firms enter the panel when they meet the requirements and leave once they top meeting the requirements. They also restrict their studies to large industrial firms to avoid omission of data and it is easier to find the relation between leverage and growth in big firms. Furthermore, they use big firms as they portray greater aggregate economic growth implications than the smaller firms.

Lang, Ofek, & Stulz (1996) define leverage as the book ratio of short term and long term debt to the book value of total assets. They use this same definition of leverage in their analysis compared to the three definitions they had for growth.

Through their analysis they find a negative relation between leverage and all their definitions of growth. Moreover, leverage is negatively correlated with Tobin's q but Tobin's q is positively related with the growth measures. Their choice of either book leverage or market leverage is insignificant as the negative relation between leverage and all their definitions of growth still holds for either of them.

They went further to find out that leverage is less important for firms in industries with good growth opportunities. This is because finance theory explains that leverage reduces the ability of a firm to fully exploit growth opportunities.

However, their study faces two challenges; (1) Leverage could have a significant coefficient because it could proxy for variables that influence growth and have been omitted from their regressions. (2) They treated growth and leverage as endogenous and exogenous respectively but this might not be the case. They might be endogenous as growth and leverage decisions are made simultaneously.

Despite these challenges, Lang, Ofek, & Stulz (1996) managed to conclude their study by showing a significant negative relation between leverage and growth controlling for a number of determinants of growth. Furthermore, the relation is more significant for firms with lower q values i.e. $q<1$.

More empirical tests were done building on the work from Lang, Ofek, & Stulz (1996). Aivazian, Ge, & Qiu (2005) and Odit & Chittoo (2008) carried out their research in Canada and Mauritius respectively. The former used data from publicly traded Canadian firms. The results are similar to those of Lang, Ofek, & Stulz (1996). The similarity in their study is the use of a panel data analysis to control for heterogeneity and test for robustness. However, a difference is that they used a fixed effects model rather than the pooled regression method. The latter used data from publicly traded Mauritian firms. The data was over a 15 year period. They also end up with similar results to Lang, Ofek, & Stulz (1996). They conducted similar tests to those done by Aivazian, Ge, & Qiu (2005).

Moving from the traditional handling of the issue, Hennessy & Whited (2005) develop a dynamic trade-off model with an endogenous choice of leverage, distributions, and real investment in the presence of a graduated corporate income tax, individual taxes on interest and corporate distributions, financial distress costs, and equity flotation costs. They go further to explain several empirical findings

inconsistent with the static trade-off theory. Moreover, they show that there is no target leverage ratio, firms can be savers or heavily levered, leverage is path dependent, leverage is decreasing in lagged liquidity, and leverage varies negatively with an external finance weighted average *Q*. they also used estimates of structural parameters, and found out that simulated model moments match data moments.

McFadden (1989) proposed a simple modification of a conventional method of moments estimator for a discrete response model, replacing response probabilities that require numerical integration with estimators obtained by Monte Carlo simulation. This method of simulated moments (MSM) does not require precise estimates of these probabilities for consistency and asymptotic normality, relying instead on the law of large numbers operating across observations to control simulation error, and hence can use simulations of practical size.

The dynamic trade-off model seeks to provide convincing alternatives to hypotheses like; the non-maximizing behaviour, Pecking Order theory and market timing. The logic presented by Hennessy & Whited (2005) is that "Traditional formulation of the financing decisions place the firm at 'date zero' with no cash at hand. Such firms are at the debt versus external equity financing margin, since each dollar of debt replaces a debt of external equity. The problem with the traditional approach is that corporations do not spend their lives at date zero. Rather they evolve in a stochastic way, finding themselves at different financing margins over time."

Furthermore, Hennessy & Whited (2005) addressed the seeming anomalies by solving and simulating a dynamic model of investment and financing under uncertainty, where the firm faces a realistic tax environment, small equity floatation costs, and financial distress costs. The firm maximizes its value by making two interrelated decisions: How much to invest and whether to finance this investment internally, with debt, or with external equity. The firm can either borrow or save and it can be in one of three equity regimes (positive distributions, zero distributions, or equity issuance.) The firm is considered forward-looking, making current investment and financing decisions in anticipation of future financing needs.

The model used by Hennessy & Whited (2005) is most similar to those developed by Gomes (2001) and Cooley & Quadrini (2001). The key differences between the model and that of Gomes are that they include taxation, model debt issuance explicitly, and allow the corporation to save. They placed greater emphasis on financing since they seeked to explain empirical leverage relationships, whereas Gomes focused upon investment. Cooley & Quadrini (2001) examine industry dynamics in a model that explicitly treats the choice between debt and equity in a setting without taxes.

Hennessy & Whited (2007) went further ahead with the simulated method of moments and applied it to a dynamic model to infer the magnitude of financing costs. They formulate a dynamic structural model of optimal financial and investment policy for a firm facing a broad set of frictions. The frictions include: corporate and financial taxation, bankruptcy costs and linear-quadratic costs of external equity.

However, dynamic corporate finance has not had smooth sailing all through. It has been faced by several criticisms from different authors. The criticisms are both positive and negative the paper by Welch (2012) paper highlights four shortcomings of recent quantitative and deep structure models in corporate finance; (1) These models have omitted too many plausible forces not based on evidence but based on authors' priors. (2) The link between their unobserved structures and their reduced-form empirical evidence has been too weak (even orthogonal forces could have affected their inference). (3) The existing tests have largely ignored many important econometric issues, such as selection and survivorship biases. (4) The models have never been held to reasonable test standards, such as performance in quasi-experimental settings.

However, constructively, the paper offers two primary suggestions; the first is to search for more direct empirical proxies instead of relying on "assumed" first-order conditions. The second is to design quasi-experimental tests of structural models. It illustrates these two points in the context of Hennessy & Whited (2005) and Strebulaev (2007).

Strebulaev & Whited (2013) Went ahead to defend the benefits that dynamic models have presented and how the insights they have provided cannot be achieved

through other ways. Their main issues were the fact that dynamic models often provide quantitative rather than simply qualitative implications. Furthermore, parameter estimates that are obtained from structural estimations are useful for counterfactual ("what if") analysis. Counterfactuals are particularly useful for understanding how firms respond to changes in their environment, and they are sometimes even useful for evaluating policies.

Finally, as pointed out in Taylor (2010) and Breza (2012), although natural experiments are useful for making causal inference, they are less useful for understanding the specific economic forces behind these inferences. In this case, structural estimation of models will fill this gap.

2.4. Summary

From this we are able to see how the study of leverage and investment started a long time ago and how it has been developed by the different authors who took an interest in it.

Furthermore, we can observe the minimal study that has been done using dynamic modelling and structural estimation in determining the effect of leverage on high growth and low growth firms.

This study goes ahead to bridge this gap in part by using dynamic modelling and structural estimation to determine the effect of leverage on high growth and low growth firms.

3. Methodology

This study focuses on the impact that leverage has on investment and whether it is the same for firms with high growth and low growth opportunities. This is done mainly through structural estimation.

According to Strebulaev & Whited (2012), structural estimation is an attempt to fit a model directly to data, to assess the quality of the fit, to identify parameters that govern technology, preferences, and (thus far in corporate finance) largely time-invariant institutional features. In particular, structural estimation ascertains whether optimization models generate data that resemble data from real-world firms. As such, structural estimation is an exercise in using a realistic theoretical structure to interpret the data.

The arm of structural estimation used is the SMM.

3.1. Research design

The study mainly undertakes a quantitative approach to achieve the set research objectives. The main data source for the study is the secondary data from the companies that make up the Commercial & Services and Construction & Allied segments of the NSE. The study period is 10 years from 2004 to 2014.

3.2. Model specification and estimation

The model used is obtained from the analysis done by Hennessy & Whited (2007). They formed a dynamic model that featured endogenous investment, distributions, leverage, and default. The corporation faced taxation, costly bankruptcy, and linear-quadratic equity flotation costs. However, an assumption is the firm does not default and finance is through debt rather than equity.

The Model was then defined by:

$$I/K = (CF/K) + Q + LEVERAGE + (OP\ INCOME/K) \quad (3)$$

This equation is used to generate a panel of simulated data by simulating a series of shocks. The next step is to choose moments that correspond to the objectives set out. Lastly was a methodical search for model parameters that make the simulated moments as close as possible to their corresponding real moments. Estimation requires at least as many moments as model parameters.

Structural estimation does not magically solve all endogeneity problems. Structural estimation accounts for any endogeneity within the model. However, just as any linear econometric model su ers from omitted variables problems to one degree or another, there will always be elements omitted from an estimated structural model.

Symbol	Variable
I	Investment $[K^1 - (1-\delta)K]$
K	Book value of assets.
CF	Cash flow of firm $[(zK^{\alpha} - Kr^{c}(1-\delta) - r^{i}b)/K]$
Q	Tobin's Q. $[(zK^{\alpha} + (1-\delta)K^1 + b)/K]$
$LEVERAGE$	Leverage.
$OP\ INCOME$	Operating Income
z	Shock to the variable.
β	A set of time dummy controlling for high or low growth
r^{c}, r^{i}, b, δ	Corporate tax rate, tax rate on debt, debt level, depreciation respectively

Table 1: Definition and Measurement of Variables

Leverage is defined as the book value of total liabilities divided by book value of total assets or the book value of long term debt divided by book value of total assets. The first has no distinction of long or short term debt while the second one places emphasis on long term debt as a determinant of investment. The study uses the latter definition. Lang, Ofek, & Stulz (1996) advocate for the use of book values of leverage since market value leverage gives too much weight to the deviations in equity values.

Tobin's Q is defined as the market value of total assets of the firm divided by the book value of assets. It was used a proxy measure for growth opportunities. The market value of the firm is calculated as the sum of total liabilities, value of the common stock and estimated value of the preferred stock. The preferred stock is estimated as the preferred dividend times 10 Aivazian, Ge, & Qiu (2005).

Cash flow is measured as the sum of earnings before extraordinary items and depreciation.

The shock z took values in the compact set $Z \equiv [z, \bar{z}]$. Furthermore, the firm's operating profits are $z\pi(K) = zK^{\alpha}$ where $\alpha \in (0, 1)$.

4. Data analysis, results and discussion

4.1. Introduction

This chapter goes ahead to present the analyses and results that were done. However, introducing the symbols as to be used from herein in the tables is as follows:

SR: Sample Run

$\bar{D}/A$: Average Debt/ Average Assets

$\overline{Inv}/A$: Average Investment/Average Assets

$\rho(D, I)$: Serial Correlation between Debt and Income

$\rho(D, Inv)$: Serial Correlation between Debt and Investment

$\sigma(\frac{Inv}{A})$: Standard Deviation of Investment/Assets

$\bar{D}$: Average Debt

$\overline{Inv}$: Average Investment

$\overline{OI}$: Average Operating Income

$\bar{A}$: Average Income

Furthermore, this chapter entails how the moments are computed, how the SMM procedure is carried out and the analysis of the results.

4.2. Moment computation

The tables below show how the moments were computed for the two segments under study.

	Express Ltd	Kenya Airways	Nation Media Group	Standard Group	TPS Serena	Sector Moments
$\overline{D}/A$	0.0738	0.3349	0.0128	0.1242	0.1104	0.2816
$\overline{Inv}/A$	0.0621	0.1582	0.0671	0.0715	0.0614	0.1392
$\rho(D,I)$	-0.0682	-0.3209	-0.144	0.8032	0.7126	-0.1791
$\rho(D,Inv)$	0.3407	0.5693	-0.0065	0.4167	0.5298	0.5156
$\sigma(\frac{Inv}{A})$	0.7115	0.3848	0.0722	0.1091	0.0833	0.3283
$\overline{D}$	61.563	26,612	97.700	338.435	1,019	21,283
$\overline{Inv}$	51.782	12,575	511.929	194.804	567.106	10,101
$\overline{OI}$	44.090	2,667	2,189	382.730	691.791	2,364
$\bar{A}$	834.376	79,472	7,625	2,724	9,235	64,744
Weights	0.0084	0.7956	0.0763	0.0273	0. 0924	

Table 2: Moments of the Commercial & Services Segment

	Athi River Mining	Bamburi Cement	Crown Berger	EA Cables	EA Portland	Sector Moments
$\overline{D}/A$	0.3304	0.0087	0.0017	0.0760	0.2485	0.1348
$\overline{Inv}/A$	0.1820	0.0554	0.0631	0.0700	0.0401	0.0844
$\rho(D,I)$	0.9514	0.6548	-0.2935	0.4268	-0.0102	0.5580
$\rho(D,Inv)$	0.7560	0.1846	-0.1518	0.8568	-0.3126	0.2633
$\sigma(\frac{Inv}{A})$	0.1835	0.1491	0.1076	0.1097	0.1143	0.1471
$\overline{D}$	4,930	255.545	3.409	301.972	2,826	1,854
$\overline{Inv}$	2,716	1,629	128.679	278.264	456.396	1,539
$\overline{OI}$	1,236	5,963	195.061	522.911	872.006	3,341
$\bar{A}$	14,924	29,414	2,038	3,973	11,373	20,044
Weights	0.2418	0.4765	0.0330	0.0644	0.1843	

Table 3: Moments of the Construction & Allied Segment

The tables above constitute the moments used to conduct the simulation process. The moments are apportioned by the use of weights given to the various firms based on the average assets of the firms. Furthermore, Table 2 and Table 3 the values of Average Debt to Average Assets were in millions ('000,000).

The sector moments were computed using the formula:

$$\sum_{j=1}^{5}(\boldsymbol{Firm\ Moment_j} * \boldsymbol{Assigned\ Weight}) \quad (4)$$

4.3. Simulated method of moments

With the moments produced above, a set of subjective boundaries were set on the moments to allow for the generation to be constrained and fast. In this context I chose boundaries for the moments as follows:

	Upper Boundary	Lower Boundary
$\overline{D/A}$	1	-1
$\overline{Inv/A}$	1	-1
$\rho(D,I)$	1	-1
$\rho(D,Inv)$	1	-1
$\sigma(\frac{Inv}{A})$	1	-1
$\bar{D}$	27,000,000	61,000
$\overline{Inv}$	13,000,000	51,000
$\overline{OI}$	3,000,000	44,000
$\bar{A}$	80,000,000	834,000

Table 4: Boundary Values for the Commercial & Services Segment

	Upper Boundary	Lower Boundary
$\overline{D/A}$	1	-1
$\overline{Inv/A}$	1	-1
$\rho(D,I)$	1	-1
$\rho(D,Inv)$	1	-1
$\sigma(\frac{Inv}{A})$	1	-1
$\bar{D}$	5,000,000	255,000
$\overline{Inv}$	3,000,000	128,000
$\overline{OI}$	6,000,000	195,000
$\bar{A}$	30,000,000	2,000,000

Table 5: Boundary Values for the Construction & Allied Segment

In Table 4 and Table 5, the values of Average Debt to Average Assets are in thousands ('000).

From the boundaries established, the simulator was run to generate various values for the moments. Nine moments are generated in the SMM based on the theoretical justification that in this method we should have the same number of parameters as the number of moments present in the process. The simulation provided ten samples which were stored and presented in Table 6 and Table 7.

	$\overline{D}/A$	$\overline{Inv}/A$	$\rho(D,I)$	$\rho(D,Inv)$	$\sigma(\frac{Inv}{A})$	$\overline{D}$	$\overline{Inv}$	$\overline{OI}$	$\bar{A}$
SR 1	0.5050	0.5177	0.0354	0.6179	0.1847	7,674,900,512	6,078,891,176	1,973,904,265	46,249,637,275
SR 2	0.6547	0.8539	0.5984	-0.3577	0.6289	16,549,239,209	12,529,559,207	141,127,834	11,280,695,754
SR 3	0.6099	0.8815	0.7926	-0.1878	0.2992	18,215,641,863	3,975,544,264	1,805,811,757	45,957,323,591
SR 4	0.8178	0.1975	-0.4662	0.4294	0.8046	11,894,704,855	9,648,714,151	509,606,844	68,873,783,161
SR 5	0.0883	0.5600	-0.9531	-0.2769	0.2136	7,108,206,453	11,622,349,955	2,513,395,063	72,743,471,232
SR 6	0.2833	0.5891	0.4788	-0.3562	0.2662	24,197,510,095	1,579,529,967	823,722,939	22,196,865,032
SR 7	0.0166	0.6851	0.5924	0.2177	0.9303	5,217,695,437	5,711,991,558	1,048,807,170	31,823,119,706
SR 8	0.2451	0.6559	0.4027	0.8337	0.0676	15,586,456,377	10,782,421,471	1,100,819,502	69,987,176,626
SR 9	0.9273	0.4723	0.1768	-0.5688	0.9144	1,496,242,977	3,402,737,775	400,563,269	57,012,844,906

Table 6: Commercial & Services Moments Generated

	$\overline{D}/A$	$\overline{Inv}/A$	$\rho(D,I)$	$\rho(D,Inv)$	$\sigma(\frac{Inv}{A})$	$\overline{D}$	$\overline{Inv}$	$\overline{OI}$	$\bar{A}$
SR 1	0.8741	0.5653	-0.0708	0.4792	0.7239	131,956,475	396,396,251	5,714,441,211	12,525,383,234
SR 2	0.8049	0.5675	0.1858	-0.6899	0.0934	1,041,892,111	1,381,926,871	4,221,031,727	3,874,441,826
SR 3	0.6358	0.2503	-0.1065	-0.1802	0.0557	2,678,197,754	1,380,708,875	2,546,516,365	15,800,355,010
SR 4	0.9855	0.1893	0.4832	0.3776	0.5367	1,015,390,861	130,597,221	4,465,648,115	10,675,329,416
SR 5	0.0124	0.7468	0.7893	-0.2251	0.0507	3,303,698,849	1,510,009,178	5,256,486,755	17,953,994,723
SR 6	0.8497	0.5800	0.4312	0.1676	0.9361	79,141,111	950,380,200	509,272,602	11,793,666,706
SR 7	0.4461	0.8656	-0.0312	-0.4694	0.7057	2,914,200,246	761,905,980	2,932,264,876	21,601,055,671
SR 8	0.6800	0.7573	0.5902	-0.6511	0.1041	4,704,783,395	2,069,347,195	591,286,824	15,083,001,160
SR 9	0.93498	0.87950	0.54463	0.74968	0.87900	2,014,787,283	577,607,041	943,737,050	19,170,773,761

Table 7: Construction & Allied Moments Generated

The moments generated are then compared to the actual moments.

This comparison is then made as follows:

	Actual Moments	Simulated Moments	Variance	Standard Deviation
$\overline{D}/A$	0.2816	0.4609	0.0161	0.1268
$\overline{Inv}/A$	0.1392	0.6014	0.1069	0.3269
$\rho(D,I)$	-0.1791	0.1842	0.0660	0.2569
$\rho(D,Inv)$	0.5156	0.0390	0.1136	0.3370
$\sigma(\frac{Inv}{A})$	0.3283	0.4789	0.0113	0.1065
$\overline{D}$	21,283	11,993	43,153,167,626,019	6,569,107
$\overline{Inv}$	10,101	7,259	4,040,722,677,383	2,010,154
$\overline{OI}$	2,364	1,146	741,318,207,023	860.998
$\bar{A}$	64,744	47,347	151,334,087,324,303	12,301,792

Table 8: Commercial & Services Comparison

The values of Average Debt to Average Assets in all the columns were in millions ('000,000). Furthermore, the Simulated Moments were calculated as the average of the simulations that were done under Table 6.

From this table we see that the simulated moments try to match up to the actual moments albeit a significantly large variance. From the actual and simulated moments we see that Debt and Investment are correlated positively. This is different from the previous studies like (Odit & Chittoo, 2008) and (Aivazian, Ge, & Qiu, 2005) which found a negative relation between the two. The possibility of this positive relationship may be based on the type of segment under analysis. This is because most companies that make this segment choose to borrow so as to make their investments because of the high initial capital for their investment. For example, Kenya Airways had to borrow first to invest in the purchase of new aeroplanes.

	Actual Moments	Simulated Moments	Variance	Standard Deviation
$\bar{D}/A$	0.1348	0.6259	0.1206	0.3473
$\overline{Inv}/A$	0.0844	0.5916	0.1287	0.3587
$\rho(D,I)$	0.5580	0.3531	0.0210	0.1449
$\rho(D,Inv)$	0.2633	0.0013	0.0343	0.1853
$\sigma(\frac{Inv}{A})$	0.1471	0.4953	0.0606	0.2462
$\bar{D}$	1,854	2,190	56,453,176,587	237.598
$\overline{Inv}$	1,539	1,007	141,686,712,618	376.412
$\overline{OI}$	3,341	2,958	73,476,159,394	271.064
$\bar{A}$	20,044	13,158	23,708,253,199,556	4,869,112

Table 9 : Construction & Allied Comparison

The values of Average Debt to Average Assets in the Actual Moments, Simulated Moments and Standard Deviation columns are in thousands ('000). However, the values of the same in the Variance column are in millions ('000,000). Furthermore, the Simulated Moments were calculated as the average of the simulations that were done under Table 7.

Similar to the previous table, we can also observe that the simulated moments try to match up to the actual moments albeit a significantly large variance. From the actual and simulated moments we also see that Debt and Investment are correlated positively. This is also different from the previous studies which found a negative relation between the two. The possibility of this positive relationship is also based on the type of segment under analysis. This is because most companies that make this segment also choose to borrow so as to make their investments because of the high initial capital for their investment. For example, ARM had to borrow first to invest in the construction of a new factory.

It is however not possible to draw up conclusive conclusions from this data. Limitations of the study will explain this.

5. Conclusion and Recommendations

5.1. Conclusion

From the analysis it is not conclusive to say that debt and investment have a positive relationship as highlighted by the limitations that were faced. However, from the nature of the segments and the companies that comprised the same, it is possible to conclude that indeed debt and investment have a positive relationship.

5.2. Policy recommendations

With this information in mind, firms can know what happens to their investments and other factors when they choose to take up debt. They can then make informed decisions and move forward accordingly.

5.3. Suggestions for further studies

This study has added on to previous studies that had been done albeit with different results. This then contributes to the pool of information on this subject matter.

Given this study, it would be interesting to find out the relationship between debt and investment in the Kenyan context with a greater sample of data. This would be in relation to the different sectors and the fundamentals of the different sectors.

5.4. Limitations of the study

The key limitation of this study was the sample size selected. A total of 10 companies are used that only make up two segments of the NSE. In contrast to this, Odit & Chittoo (2008) used all the listed companies in Mauritius. Their sample size enabled them to make conclusive conclusions on the relationship between debt and investment. The sample size was also a cause of the significantly large variance between the actual and simulated moments.

Data constraints were also a problem. Even within the segments it was rather difficult to obtain information on all the companies. This limited the scope of the research in its entirety. The use of a rather small study window (10 years) was also a challenge to come to any conclusive stand point.

The selective nature of the boundary selection made the analysis lose some of the objectivity that it was out to observe. Lastly, with no high growth companies, the analysis was rather incomplete.

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