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Trade-off Theory of Optimal Capital Structure and Adjustment to Long-run Target:Evidence from Dynamic Panel Data

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Abstract: The main objective of this paper is to test the trade-off theory of capital structure in South Africa. Using dynamic panel model and Generalized Method of Moments (GMM) estimation technique, the results show that fixed asset has a significant positive relation with long-term debt. Similarly, fixed asset has a significant positive relation with total debt. Moreover, the study reveals that South African firms have long-run target debt, but the rate of adjustment to the long-run target debt is slow. Based on the findings, the study suggests that fixed asset is required as collateral to obtain long-term debt capital needed to finance profitable investment projects. Besides, the study suggests that costs of deviating from the optimal target debt ratio could be insignificant for South African firms. The paper contributes to capital structure research by testing trade-off theory in South Africa. In addition, the paper uses a better estimation technique, the Generalized Method of Moments.

Keywords: Capital structure, debt ratio, trade-off theory, Generalized Method of Moments, South Africa
JEL classification: G32

1. Introduction

Modern theory of capital structure began following the research work of Modigliani and Miller in 1958. Modigliani and Miller (1958) argued that capital structure is irrelevant to a firm's value. Subsequent researchers challenged their results explaining various conditions which could make capital structure decisions relevant.

Theoretical and empirical debate on capital structure remains inconclusive, suggesting that more studies need to be conducted in order to add clarity to the theoretical and empirical debate on capital structure. Most of the theoretical and empirical debates on capital structure have come from developed countries, but there has been very little contribution from Africa. It would be interesting to see more contributions to capital structure debate from Africa, as most of the predictions of capital structure theories can be tested in Africa where some degree of market imperfection exists. Specifically, in South Africa which is the focus country of this study, there are cases of firms going bankrupt which could be explained within the framework of the trade-off theory of capital structure. Thus, testing the trade-off theory in South Africa would provide more empirical evidence for one of the main theories of capital structure as well as add clarity to the ongoing capital structure debate from an African perspective.

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Theories explaining capital structure and variation of debt ratio across firms range from capital structure irrelevance proposed by Modigliani and Miller (1958) to various relevant theories. Trade-off theory is one of the main theories of capital structure that explains how firms make capital structure decisions in practice, but empirical evidence remains inconclusive (Flannery and Rangan 2006). After over fifty years of intense debate, researchers are yet to reach a consensus on a unifying theory that could comprehensively explain the many facts about how firms make capital structure decisions in the real world (Frank and Goyal 2008). This is not surprising because different theories emphasise different issues, making it challenging to establish a unifying theory of capital structure.

Myers (1984) initiated the concept of trade-off theory of capital structure where firms trade-off the benefits of debt against the costs of debt (bankruptcy costs). Specifically, the trade-off theory states that there exists an optimal debt ratio where the marginal benefit of debt equates marginal cost of debt. This trade-off theory implies that debt ratio exhibits target adjustment, so that any deviation from the target is gradually eliminated. Also, it is implied in trade-off theory that firms have a long run optimal debt ratio that is assumed to be a function of several firm-specific characteristics which vary overtime, over firms or over both time and firms (Frank and Goyal 2008).

An extensive body of empirical research has documented evidence supporting the trade-off theory predictions (Rajan and Zingales 1995; Bhaduri 2002; Frank and Goyal 2008; Eldomiaty and Ismail 2009). The bulk of this empirical research comes from developed countries with relatively little attention given to a country like South Africa. The limited available research conducted in South Africa focuses on static model specifications and mostly investigates the determinants of capital structure from a static point of view.

Trade-off theory is static, but firms in real world operate for many years, and in dynamic environments. Specifically, firms in South Africa operate in a dynamic economic and business environment as shown by the existence of rapid economic changes, and business cycles stages from 1945 to 2009 (Akinboade and Makina 2009). Since firms in South Africa operate in a dynamic economic and business environment, their capital structure decisions would be dynamic as well. To the best of our knowledge, no study has used the dynamic model to test the trade-off theory of capital structure in South Africa. Specifically, the purpose of this paper is to test the trade-off theory of capital structure on South African listed firms using dynamic model specifications. The rest of the paper is organised as follows: Section 2 sets out the literature review and hypotheses of the study. Section 3 describes the data, variables and methodology. Section 4 discusses the results while Section 5 highlights the robustness of the results. Section 6 summarises and concludes.

2. Literature Review

Modern theory of capital structure began following the research work of Modigliani and Miller in 1958. Modigliani and Miller (1958) argued that capital structure is irrelevant or independent of a firm's value. The capital structure irrelevant theory of Modigliani and Miller (1958) was criticised for ignoring taxes. They later developed another theory in 1963 which took into consideration corporate taxes. Consequently, Modigliani and Miller (1963) argued that in the presence of corporate taxes, capital structure becomes relevant because of tax savings of debt. Later, Miller (1977) argued that if personal tax is taken into

consideration, tax savings from corporate taxes are offset when personal tax is paid. Hence, capital structure remains irrelevant.

For this to be true, they maintained that a number of non-realistic assumptions had to be fulfilled. This conclusion led to an interesting debate on internal versus external financing and stimulated further research in this area. Research has shown that the Modigliani and Miller theory seems to fail if bankruptcy, transaction, and agency costs are taken into consideration. Frank and Goyal (2003) argued that even though the Modigliani and Miller theory does not provide a realistic description of how firms should set up their capital structure, it provides a theoretical framework of understanding why capital structure decisions may be relevant. From the academic questions raised by Modigliani and Miller, theories such as the agency theory, the pecking order theory, and the trade-off theory of capital structure evolved.

According to the agency theory of capital structure, conflict between shareholders and managers would affect capital structure choice. Jensen and Meckling (1976) defined agency costs as the sum of (a) monitoring expenditure of the principal, (b) the bonding expenditure by the agent, and (c) the residual loss arising out of the agency relationship. The agency theory of capital structure is based on the argument that managers sometimes pursue their own objectives at the expense of shareholders. Jensen (1986) argued that optimal capital structure exists which is obtained by trading-off the agency cost of different types, thus influencing firm value. Jensen (1986) further argued that managers of low growth-high free cash flow firms are likely to waste cash resources by investing in unprofitable projects.

Since debt has to be paid back in cash with interest, the amount of free cash flow that could be wasted by the manager is reduced by using more debt. Therefore, debt is used as a monitoring device to discipline managers from engaging in empire building. More recent studies (Bhadari 2002; Arce 2007) found evidence supporting the applicability of agency theory.

Agency theory and trade-off theory are related because they both argue for the existence of an optimal debt ratio. The agency theory argues that between the increasing costs of debt on one hand and increasing costs of equity on the other hand, there exists an optimal capital structure that reduces total agency costs and maximises firm's value. Thus, it could be deduced that both the trade-off theory and agency theory explain why firms do not use 100 per cent debt compared to Modigliani and Miller's theory where 100 per cent debt usage is possible.

Pecking order theory is another theory that competes with trade-off theory of capital structure. Pecking order theory also explains why capital structure is important for firms. The theory suggests that firms prefer to use retained profits to finance new investments. It ranks retained profits at the top of the pecking-order, followed by debt and lastly external equity. In other words, pecking-order theory states that firms use a hierarchy of financing sources starting with retained profits, followed by debt; external equity is the last resort. The pecking order theory suggests that if external capital is needed, firms prefer to raise debt because of low information asymmetry associated with debt compared to external equity (Myers 1984; Myers and Majluf 1984). In the pecking order theory, there is no optimal debt ratio for firms compared to trade-off theory and agency theory where optimal debt ratio exists for firms.

Furthermore, the pecking order theory suggests that observed capital structure of firms reflect cumulative requirements for external capital. On one hand, profitable firms with slow growth prospects will have low debt ratio relative to the industry average where such firms operate while on the other hand, unprofitable firms in the same industry would end up having a relatively high debt ratio relative to their industry average (Iquiapaza *et al.* 2007). Thus, the level of profit determines if firms would require external capital.

Recently, Sen and Eda (2008) and Frank and Goyal (2008) found evidence that supported the pecking order theory (debt ratio is negatively related to profit). The main reason why the pecking order theory is interpreted as predicting negative relations between debt ratios and profit is that dividend payment is assumed to be sticky. Consequently, firms are left with the option of playing down debt which leads to a fall in debt ratio as profit increases. Conversely, Bharath *et al* (2009) found evidence against the pecking order theory.

Unlike the agency theory and trade-off theory where optimal debt ratio or optimal capital structure exists, there is no clearly defined optimal debt ratio in pecking order theory. Instead, firms make capital structure decisions based on source of capital which is least costly, that is, source of capital that is less sensitive to problems of information asymmetry following a pecking order starting from retained profit, followed by debt and finally equity issue.

2.1. Trade-off Theory of Capital Structure

Trade-off theory relating to debt entails offsetting the costs of debt against the benefits of debt. Modigliani and Miller (1963) introduced the tax benefit of debt and their theory implies 100 per cent use of debt. Later research work led to an optimal debt ratio given by the trade-off theory (Bradley *et al.* 1984). The first element usually considered as the cost of debt is financial distress costs or bankruptcy costs of debt. These costs also include the direct and indirect bankruptcy costs (Graham and Tucker 2006). The trade-off theory supports moderate use of debt by a tax paying firm.

The trade-off theory of capital structure argues that firms choose how much debt and how much equity to use by balancing the benefits and costs of debt. Despite various criticisms in the literature, the trade-off theory is well supported by both empirical and theoretical studies (Flannery and Rangan, 2006; Hennessy and Whited 2005; Titman and Tsyplakov 2007). Thus the trade-off theory remains one of the dominant theories of corporate capital structure.

The trade-off theory made some important predictions that are intuitively reasonable. First, an increase in costs of financial distress reduces the optimal debt level. Second, an increase in tax increases optimal debt level. Third, at the optimal capital structure, an increase in the marginal bondholder tax rate decreases the optimal debt level. However, the main challenge of the trade-off theory is that the optimal capital structure is unobservable and a proxy is needed (Frank and Goyal 2008). Earlier studies used historical mean of the actual debt ratio for a firm (Shyam-Sunder and Myers 1999). The use of historical mean of debt has the advantage of minimising the effects of temporal variations in time due to business cycles, floatation costs and firm's lagged adjustment towards their target debt ratio. Subsequent studies employed an alternative specification which is a rolling target debt ratio for each firm using only historical information and an adjustment process with lags of more than one year (Frank and Goyal 2008). Hui *et al.* (2006) improved on the limitations of

subsequent measures of target debt ratio by allowing for a time dependent target debt ratio which is assumed to be mean reverting. Nevertheless, the use of dynamic panel model and Generalised Method of Moments estimation technique (that control for unobservable firm specific effects and the endogeneity problem) used in this study will give a better estimate of the target debt ratio.

Furthermore, fixed asset is an important factor that supports the use of debt in the trade-off theory of capital structure. Firms with high levels of fixed asset are better positioned to provide collateral for debts. If the firm defaults on debt, their assets will be taken over but the firms may be in a position to avoid bankruptcy. It is believed that firms with high levels of fixed assets are less likely to default and are more likely to utilise debt (Loof 2003). Consequently, this results in a positive relation between fixed asset and debt. Other traditional factors that determine a firm's optimal debt ratio are profit, size, non debt tax shield and growth (Rajan and Zingales 1995; Frank and Goyal 2008). Recent research (Leary and Roberts 2005; Huang and Ritter 2007; Loffler and Maurer 2008) provide empirical evidence supporting the trade-off theory. The next section further highlights empirical evidence that supports and goes against the trade-off theory in developed and developing countries.

2.2: *Empirical Evidence on Trade-off Theory*

Most studies on developed countries (Rajan and Zingales 1995; Titman and Wessels 1988 among others) found positive relations between fixed assets and debt, but mixed results were mostly found for developing countries. For instance, Um (2001) and Wiwattanakantang (1999) reported a positive relation between fixed asset and debt in Korea and Thailand respectively. Conversely, the studies of Booth *et al.* (2001) in ten developing countries and Huang and Song (2005) in China found that fixed asset is negatively related to debt. However, it is argued that this relation depends on the type of debt. Similarly, Bevan and Danbolt (2002) found positive relations between fixed asset and long term debt in the UK. Moreover, Banerjee *et al.* (2000) used a set of explanatory variables to study optimal capital structure in the UK market. They found fixed assets to be positively related to debt ratio with all other variables carrying the expected signs.

The findings of the relation between debt ratios and fixed assets do not differ much across the developed countries reviewed. This indicates that capital structure in developed countries is affected by common factors. The result is not surprising because developed countries have institutional similarities. Conversely, developing countries have different legal and institutional traditions. Thus, the financial markets in developing countries would be different compared to financial markets in developed countries. Kunt and Maksimovic (1994) investigated the capital structure of the largest public firms in ten developing countries which included Africa. The countries covered were Zimbabwe, Jordan, India, Pakistan, Thailand, Malaysia, Mexico, Brazil, Turkey and Korea. Kunt and Maksimovic (1994) argued that despite the difference in the level of financial market development between the United States and the sample used in their study, the variables that explain capital structure in the United States also explain capital structure in developing countries. They found evidence supporting trade-off theory and agency theory in the sampled countries.

However, the results of Kunt and Maksimovic (1994) revealed that though fixed asset is among the main explanatory variables of capital structure, it was found to have a negative

relation with debt ratio which suggests that markets for long-term debt in developing countries do not function effectively.

Similarly, Booth *et al.* (2001) investigated if capital structure theory is applicable across developing countries with different institutional structures. They employed three measures of debt ratio namely, total debt ratio, long-term book debt ratio, and long-term market debt ratio. The study showed that fixed asset has a positive relation with long-term debt ratio, but is negatively related to total debt ratio. Booth *et al.* (2001) concluded that debt ratios in developing countries seem to be affected by similar variables identified in developed countries. Similarly, we expect variables that explain capital structure in developed countries to explain the capital structure of South African firms. Specifically, we expect fixed asset to be an important factor determining debt level in South Africa.

However, Booth *et al.* (2001) pointed out that the long-term debt ratios of developing countries are lower compared to developed countries. The findings of Booth *et al.* (2001) imply that the market for long term debt is not functioning effectively in developing countries. They argued that their results are consistent with results of Rajan and Zingales (1995). Although, the market for long term debt is not functioning properly in developing countries compared to the market for long term debt in developed countries as pointed out by Booth *et al.* (2001), South Africa is an exception because it has a well-functioning bond market (though newly introduced in 1999) which is comparable to that of developed countries. Thus the South Africa debt ratio may not differ much compared to the debt ratio in developed countries.

In India, a developing country, Bhaduri (2002) found fixed assets to play an important role in determining the optimal debt ratio of Indian firms. Besides, he reported that large sized Indian firms depend more on long-term debt. Similarly, Huang and Song (2005) examined capital structure determinants in the Chinese market and found that long-term debt ratio, total debt ratio and total liability ratio are positively related to fixed assets. The findings of Huang and Song (2005) are consistent with the findings of Chen (2004). Thus, it could be deduced that firms in India and China follow the trade-off theory since fixed asset is found to be positively related to debt ratios in both countries.

Recently, working on Central and Eastern European countries, Delcoure (2007) found a positive relation between a firm's debt ratios and fixed asset. In addition, a negative relation between debt ratios and profit was found. Delcoure (2007) concluded that the pecking order theory and trade-off theory explain the capital structure puzzle in developing countries that constituted the sample in their study.

Previous studies reviewed have shown that despite differences in the level of financial market development between developed and developing countries including countries in Africa, capital structure in developing countries is affected by similar factors affecting capital structure in developed countries (Rajan and Zingales 1995; Kunt and Maksimovic 1994; Booth *et al.* 2001). Nevertheless, more studies need to be conducted on developing countries in Africa to confirm the findings of Booth *et al.* (2001) and Kunt and Maksimovic (1994). This study departs from past studies in several ways. First, the study tests trade-off theory in South Africa which has received little attention in the literature. Second, the study uses a better estimation technique which is the dynamic panel and Generalized Method of Moments (GMM) that effectively control for the influence of unobservable firm-specific

effects and endogenous problem and is able to give consistent estimators that are robust to serial correlations and heteroskedasticity problems.

2.3 Hypothesis

The model of Hui *et al.* (2006) incorporated a time-dependent target debt ratio and obtained a better estimate supporting the trade-off theory. Similarly, Duffie *et al.* (2007) and Loffler and Maurer (2008) came to the same conclusion that incorporating the dynamics of debt ratio into capital structure research significantly improves the regression results. Salawu (2007) and Delcour (2007) found evidence that fixed asset is positively related to debt ratios. Similarly, Omet (2006), and Rajan and Zingales (1995) found evidence that fixed asset is positively related to debt ratios. Conversely, Baner (2004) and Daskalakis and Psillaki (2007) found evidence that fixed asset is negatively related to debt ratios. Achy (2009) found the relation between fixed asset and long term debt to be unclear.

In summary, most of the empirical evidence found conflicting results. The inconsistencies in findings of past researchers suggest the need for further studies in this area. We therefore hypothesised in H_1 form that:

(1) There is a significant relation between fixed asset and long term debt ratio.

(2) There is a significant relation between fixed asset and total debt ratio.

3. Data and Methodology

The sample consists of South African firms listed on the Johannesburg Stock Exchange (JSE). The data sources for the analysis were from Bloomberg data base. To derive the final sample, we imposed some restrictions. First, we used the 100 largest listed firms on the Johannesburg Stock Exchange with complete data, and having non missing relevant variables from 2004 to 2009. Second, financial firms were excluded because their financial statements differed significantly from that of non financial listed firms. Third, regulated firms were also excluded because their debt ratio was usually higher than other non financial firms (Rajan and Zingales 1995).

Past researchers (Rajan and Zingales 1995; Ozkan, 2001; Frank and Goyal 2008; Eldomiaty and Ismail 2009) used balance sheet and income statement data to conduct capital structure research. Similarly, we used balance sheet and income statement data to test the trade-off theory of capital structure. In addition, as a robustness check, we used two measures of debt ratio, namely long term debt ratio and total debt ratio.

The period of 2004 to 2009 was chosen because South Africa experienced an average per capital GDP growth rate of 5% (IMF 2009). In addition, there was no noticeable systemic shock in the chosen period that could significantly bias the results.

3.1 Empirical Model

In order to estimate the dynamic model consistently from balanced panel data, fixed effect panel and Generalized Method of Moments (GMM) were used. The use of fixed effect panel model and GMM was thought to be more appropriate for conducting this study. On one hand, panel data improves the efficiency of econometric estimates and provides more flexibility in controlling for endogeneity (Baltagi 2005). On the other hand, GMM is used to estimate parameters of interest because it maximises an objective function that includes

moment restrictions that the correlation between the residuals and lagged explanatory variable is zero (Nunkoo and Boateng 2010).

In addition, GMM reduces the effect of reverse causality. It is possible that observed relations between debt and explanatory variables reflect the effect of debt on the explanatory variable rather than vice versa. Thus, the use of GMM mitigates this reverse causality problem by allowing for the lagged value of the dependent variable to be included as one of the regressors in the dynamic model specification.

Specifically, the study used the two-step GMM in first difference, the approach of Arellano and Bond (1991). This approach eliminates the influence of unobservable firm-specific effects, and uses instruments that are uncorrelated with the error term. The GMM estimation technique has been used by recent researchers to conduct capital structure research in developed countries (Ozkan 2001; Flannery and Rangan 2006; Frank and Goyal 2003; Nunkoo and Boateng 2010).

In order to test the trade-off theory on South African listed firms, we used the framework of Ozkan (2001) with slight modifications. Ozkan specified a dynamic panel model to investigate the empirical determinants of target capital structure and adjustment process towards a long run target. Similarly, we specified a dynamic panel model to test the trade-off theory of capital structure. However, Ozkan (2001) used profit, size, liquidity and non debt tax shield as explanatory variables in their dynamic capital structure model. Conversely, this study used fixed assets as the main explanatory variable, while profit, size, growth, and non debt tax shield were used as control variables. Besides, Ozkan (2001) conducted his study on the United Kingdom while our study is on South Africa.

Specifically, the study specifies the following models:

$$LD_{it} = \lambda_i LD_{it-1} + \beta_1 + \beta_2 FA_{it} + \beta_3 Profit_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} + \beta_6 NDTS_{it} + \eta_i + \eta_t + \mu_{it}. \quad \text{Model 1}$$

$$TD_{it} = \lambda_i TD_{it-1} + \beta_1 + \beta_2 FA_{it} + \beta_3 Profit_{it} + \beta_4 Size_{it} + \beta_5 Growth_{it} + \beta_6 NDTS_{it} + \eta_i + \eta_t + \mu_{it}. \quad \text{Model 2}$$

where subscripts i and t represent firm and time period respectively. Models 1 and 2 are estimated using GMM estimation technique (GMM in first difference) that controls for unobservable firm-specific effects and endogenous problems and are better able to give consistent estimators that are robust to heteroskedasticity and serial correlation problems. The study uses two measures of debt ratio as proxy namely, ratio of long term debt to total assets, and ratio of total debt to total assets. Profit is measured as ratio of profit before interest and tax (PBIT) to total assets; fixed asset is measured as ratio of fixed assets to total assets; size is measured as log of total assets; growth is measured as change in total assets; and NDTS is measured as ratio of depreciation to total assets. The main independent variable and control variables in both equations are proxies commonly used in the literature. Specifically, the main independent variable is fixed assets, while the control variables are profit, size, growth and non debt tax shield. The study uses book value of debt because it is less subjected to fluctuations compared to market value of debt.

4. Empirical Results

As can be seen from the entire firm level variable in Table 1, the mean is higher than the median. Thus the data is characterised by positive skewness. The correlation matrix is

Table 1. Summary of descriptive statistics

	LD	TD	PROFIT	FA	SIZE	NDTS	GROWTH
Mean	13.09217	20.21592	12.36913	53.29025	3.577250	4.092792	17.85371
Median	9.590000	17.85000	9.945000	52.44000	3.640000	3.295000	13.72500
Maximum	84.79000	84.79000	65.64000	98.54000	5.510000	23.85000	88.37000
Minimum	0.190000	0.410000	0.160000	0.620000	1.540000	0.100000	1.050000
Std. Dev.	12.59395	14.39039	9.393929	22.22590	0.810432	3.381084	14.99370
Skewness	2.406474	1.293772	2.150577	0.009714	-0.075197	2.956027	1.733577
Kurtosis	11.62921	5.721957	9.623396	2.167435	2.622838	15.17071	6.901008
Jarque-Bera	976.2772	141.0444	623.6930	6.935412	1.648700	1830.787	272.3902
Probability	0.000000	0.000000	0.000000	0.031188	0.438520	0.000000	0.000000
Sum	3142.120	4851.820	2968.590	12789.66	858.5400	982.2700	4284.890
Sum Sq. Dev.	37907.22	49492.90	21090.77	118063.8	156.9752	2732.184	53729.85
Observations	600	600	600	600	600	600	600

Note: Long term debt (LD) is the ratio of long term debt to total assets; Total debt (TD) is ratio of total debt to total assets; Fixed assets (FA) is ratio of fixed assets to total assets; Profit is the ratio of profit before interest and tax to total assets; Size is the log of total assets; growth is change in total assets; and Non debt tax shield (NDTS) is the ratio of depreciation to total assets.

Table 2. Correlation coefficients

	LD	TD	PROFIT	FA	SIZE	NDTS	GROWTH
LD	1.000000	0.837685	-0.098345	0.484548	0.142443	-0.221945	0.055990
TD	0.837685	1.000000	-0.196763	0.414741	0.238403	-0.190477	0.064273
PROFIT	-0.098345	-0.19676	1.000000	-0.022918	-0.131470	-0.070089	0.102346
FA	0.484548	0.414741	-0.022918	1.000000	0.067392	0.394119	-0.143415
SIZE	0.142443	0.238403	-0.131470	0.067392	1.000000	0.057015	-0.005710
NDTS	-0.221945	-0.190477	-0.070089	0.394119	0.057015	1.000000	-0.131867
GROWTH	0.055990	0.064273	0.102346	-0.143415	-0.005710	-0.131867	1.000000

Note: Long term debt (LD) is the ratio of long term debt to total assets; Total debt (TD) is ratio of total debt to total assets; Fixed assets (FA) is ratio of fixed assets to total assets; Profit is the ratio of profit before interest and tax to total assets; Size is the log of total assets; growth is change in total assets; and Non debt tax shield (NDTS) is the ratio of depreciation to total assets.

reported in Table 2. The low correlation among the variables indicates that there is no multicollinearity problem in the data. We specified two dynamic models. Long term debt ratio is the dependent variable in Model 1, while total debt ratio is the dependent variable in Model 2. GMM (in first difference) estimation technique eliminated unobservable firm-specific effects. All variables except the lagged dependent variable were treated as exogenous. Two-step GMM estimates were used because it is heteroskedasticity consistent if based on two-step estimates.

Table 3. Trade-off theory results of Generalized Method of Moment Estimates (GMM in First Difference)

Dependent Variable	Long Term Debt			Total Debt		
Independent Variables	GMM (First Difference)			GMM (First Difference)		
LD_{it-1} / TD_{it-1}	0.797***	(15.09)	[0.0000]	0.832***	(5.049)	[0.0000]
Profit	-0.096*	(-1.90)	[0.0587]	-0.578***	(-3.151)	[0.0020]
Fixed assets	0.087*	(1.87)	[0.0632]	0.329**	(2.156)	[0.0327]
Size	10.131**	(2.04)	[0.0160]	19.04**	(2.324)	[0.0215]
Growth	0.075**	(2.50)	[0.0134]	0.125	(1.209)	[0.2284]
Ndts	-0.046	(-0.70)	[0.4819]	-0.339	(-0.358)	[0.7207]
2nd order serial correlation (p-value)	0.8701	0.3548				
Hansen Test (p-value)	0.35	0.96				

Notes: Fixed asset is the main independent variable. Profits, Size, Growth and NDTS are as defined in Table 1.

Numbers in parentheses after the coefficients are White's (1980) heteroskedasticity constant *t*-statistics. The numbers in brackets are p-values. The model is estimated using Dynamic Panel program used by Arellano and Bond (1991).

*, **, and *** indicate that the coefficient is significant at 10%, 5% and 1% respectively.

2nd order serial correlation in first difference, which is distributed as N (0, 1) under the null of no serial correlation in the residuals. Hansen (1982) test under the null of instrument validity. Check The Hansen test statistics is chi-square (x^2) distributed with degrees of freedom calculated as the difference between the number of instruments and the number of regressors. $D_{i,t-2}$, $Profit_{i,t-2}$, $fixed\ Asset_{i,t-2}$, $Size_{i,t-2}$, $Growth_{i,t-2}$, $NDTS_{i,t-2}$ *are* used as instruments.

Furthermore, to confirm the applicability of GMM estimation technique, two tests statistics are reported namely: second order serial correlation in the residuals test, and Hansen test of instruments validity. The results indicate there is absence of second order serial correlation in both models. Moreover, the Hansen(1982) tests of instrument validity show that the instruments used are valid instruments for both models. Hence, we would proceed with the interpretation of the GMM results.

The estimated coefficients are significant and have the expected sign. Fixed asset is positively related to long term debt ratio. Similarly, fixed asset is positively related to total debt ratio. Moreover, the coefficients of lagged dependent variables in both models indicate that South African firms' adjust back to their long-run target debt level. The evidence of a positive relation between fixed asset and debt ratios suggest that South Africa firms are required to give collateral before long term debt could be obtained. Specifically, the result implies that South African firms use fixed assets as collateral when negotiating borrowing, especially long term borrowing. In addition, the positive relation between debt and fixed assets may suggest that collaterals (fixed assets) help in mitigating information asymmetry problems between firms and banks because firms with more fixed assets could easily obtain long term debt capital even if some information is undisclosed to the banks. Also, the trade-off theory implies that South African firms have target debt ratio and they make efforts to adjust to their long-run target debt ratio. However, the adjustment rate (which is calculated as 1-λ x 100) is slow as indicated by the lagged coefficient of long term debt ratio (20.3%)

and lagged coefficient of total debt ratio (16.8%). The slow adjustment rates suggest that the cost of deviating from the target debt ratio may be insignificant for South African firms. The results of this study are consistent with the findings of Rajan and Zingales (1995) and Delcour (2007) who found evidence in support of the trade-off theory. The result is also consistent with findings of Ozkan (2001), Flannery and Rangan (2006) and Nunkoo and Boateng (2010) who found evidence that firms adjust to long-run target debt ratio. Conversely, the result is inconsistent with findings of Baner (2004), Booth *et al.* (2001) and Huang and Song (2005) who found evidence against the trade-off theory.

5. Robustness of the Results

We conducted a number of tests to examine the robustness of the results. First, we performed second order serial correlation tests because the Generalized Method of Moments (GMM) gives consistent estimates if there is absence of second order serial correlation in the error terms. The test results show that there is absence of second order serial correlation in the error terms. Thus GMM is appropriate for estimating the parameters of interest. Second, we performed Hansen test of instruments validity because the GMM estimation gives consistent estimates if valid instruments are used. The Hansen test results confirm that instruments used are valid. In other words, the instruments used are uncorrelated with the error terms. Besides, we specified two dynamic panel models and used two different proxies as dependent variable to find out if similar results could be obtained. Indeed, similar results were found. The trade-off theory is supported in the two dynamic panel models specified.

6. Summary and Conclusion

In this paper we have tested the trade-off theory on listed firms in South Africa. The findings suggest that South African firms adhere to the trade-off theory because fixed asset is significant and positively related to long term debt. Similarly, fixed asset is significant and positively related to total debt. Specifically, firms with more fixed assets would have more debt in their capital structure. The positive relation between fixed asset and long term debt as well as the positive relation between fixed asset and total debt suggest that firms in South Africa are required to pledge fixed asset as collateral to obtain long-term debt capital from banks. In addition, the positive relation between fixed asset and long term debt as well as total debt implies that collaterals (fixed asset) help in mitigating information asymmetry problems because firms with more fixed assets could obtain long term capital from banks even if some information is undisclosed to the banks. Moreover, the study reveals that South African firms have long-run target debt ratio, but the adjustment rate is low. This implies that firms that are under or over leveraged slowly adjust back to their long-run target debt ratio. The reason for this slow adjustment could be that the costs of deviating from the target debt ratio may be insignificant for South African firms. In general, this study shows that empirical evidence on trade-off theory found in developed countries is also applicable to South Africa, despite the institutional differences that exist between them.

The paper contributes to empirical research on capital structure in two ways. First, the paper represents one of the limited available studies that empirically test the trade-off theory of capital structure in South Africa. Second, the study employs dynamic panel model and Generalized Method of Moments (GMM in first difference) estimation technique that effectively controls for unobservable firm-specific effects and endogenous problems.

Unobservable firm-specific effects were eliminated through first differencing technique while endogenous problems were addressed by using more efficient instruments.

References

Achy, L. 2009. Corporate capital structure choices in MENA: empirical evidence from non listed firms in Morocco. *East Development Journal* 1(2): 255–273.

Akinboade, O.A and D. Makina. 2009. Econometric analysis of bank lending and business cycles in South Africa. *Applied Economics* 42: 3803–3811.

Arce, D. G. 2007. Is agency theory self-activating. *Economic Inquiry* 45 (4): 708–720.

Arellano, M. and S. Bond. 1991. Some test of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies* 58: 277–297.

Baltagi, B.H. 2005. *Econometric Analysis of Panel Data*. West Sussex: John Wiley and Sons.

Baner, P. 2004. Capital structure of listed companies in Visegrad countries. Research seminar paper presented at *Seminar for Comparative Economics*, LMU, Munich.

Banerjee, S., A. Heshmati and C. Wihlborg. 2000. The Dynamics of Capital Structure. SSE/ EFI Working Paper Series in *Economics and Finance* 333: 1–20.

Bevan, A. and J. Danbolt. 2002. Capital structure and its determinants in the UK – a decomposition analysis. *Applied Financial Economics* 12(3): 159–170.

Bevan, A. and J. Danbolt. 2002. Testing for inconsistencies in the estimation of UK capital structure Iquiapaza determinants. *Applied Financial Economics* 14(1): 55–66.

Bhaduri, S. 2002. Determinants of corporate borrowing: some evidence from the Indian corporate sector. *Journal of Economics and Finance* 26: 200–215.

Bharath, S.T., P. Pasquariello and G. Wu. 2009. Does asymmetric information drive capital structure decisions? *Review of Financial Studies*, RFS advance access. From *F:// cspeckingorder22.mht* [Accessed 18 September/2009].

Booth, L., V. Aivazian, A. Demirguc-Kunt and V. Maksimovic. 2001. Capital structures in developing countries. *Journal of Finance* 56(1): 87–130.

Bradley, M., G. Jarrell and E. Kim. 1984. On the existence of an optimal capital structure: theory and evidence. *Journal of Finance* 39 (3): 857–78.

Chen, J. (2004). Determinants of capital structure of Chinese-listed companies. *Journal of Business Research* 57(12): 1341–1351.

Daskalakis, N. and M. Psillaki. 2007. Do country or firm factors explain capital structure? Evidence from SMEs in France and Greece. *Applied Financial Economics* 18(2): 87–97.

Delcoure, N. 2007. The determinants of capital structure in transitional economies. *Journal of International Review of Economics and Finance* 16: 400–415.

Duffie, D., L. Saita and K. Wang 2007. Multi period corporate default prediction with stochastic covariates. *Journal of Financial Economics* 83(3): 635–65.

Eldomiaty, T.I and M.A. Ismail. 2009 Modeling capital structure decisions in a transition market: empirical analysis of firms in Egypt. Review *of Quantitative Financial Accounting* 32: 211–233.

Flannery, M.J and K.P. Rangan. 2006. Partial adjustment toward target capital structures. *Journal of Financial Economics* 79: 469–506.

Frank, M.Z and V.K. Goyal. 2009. Capital structure decisions : which factors are reliably important? *Financial Management*. 38(1): 1–37.

Frank, M. Z. and V.K. Goyal. 2003. Testing the pecking order theory of capital structure. *Journal of Financial Economics* 67: 217.

Frank M.Z and V. K. Goyal. 2008. Trade-off and pecking order theories of debt. *Handbook of Corporate Finance. Empirical Corporate Finance*. 2: 1–82.

Graham, J.R. and A.L. Tucker. 2006. Tax shelters and corporate debt policy. *Journal of Financial Economics* 81: 563–594.

Hansen, L P. 1982. Large sample properties of Generalised Method of Moments estimators. *Econometrica* 50: 1029–1054.

Hennessy, C.A. and T.M. Whited. 2005. Debt dynamics. *Journal of Finance* 60: 1129–65.

Huang, R. and J.R. Ritter. 2007. Testing Theories of Capital Structure and Estimating the Speed of Adjustment. Working Paper. Kennesaw State University and University of Florida.

Huang, S. G. and F.M. Song. 2005. The determinants of capital structure: evidence from China. *China Economic Review* 1–23.

Hui, C.H., C.F. Lo and. M.X. Huang. 2006. Are corporate target leverage ratios times dependent? *International Review of Financial Analysis* 15: 220–36.

IMF Country Report 2009. South Africa: Financial System Stability Assessment, Including Report on Observance of Standards and Codes on the Securities. Regulation, No.08/ 349.

Iquiapaza, R.A, A.A. Souza and H.F. Amaral. 2007. Capital structure and financing decision: new test of pecking order theory. *Social Science Research Network* 7: 1–15

Jensen, M. C., and W. Meckling. 1976.Theory of the firm: managerial behavior, agency costs, and capital structure. *Journal of Financial Economics* 3: 305–360.

Jensen, M. 1986. Agency cost free cash flow, corporate finance, and takeovers. *American Economic Review* 76 (2): 323–329.

Kunt, A. and V. Maksimovic. 1994. Capital Structure in Developing Countries: Evidence from Ten countries. Working Paper, the World Bank, Policy Research Paper, No. 1320.

Leary, M.T and M. Roberts. 2005. Do firms rebalance their capital structure? *Journal of Finance* 60(6) : 2575–2619.

Loffer, G. and A. Maurer. 2008. Incorporating the Dynamics of Leverage into Default Prediction. Working paper, University of Ulm.

Loof, H. (2004). Dynamic optimal capital structure and technical change. *Structural Change and Economics Dynamics* 15: 449–468.

Modigliani, F. and M.H. Miller. 1958. The cost of capital, corporate finance and the theory of investment. *American Economic Review* 48: 261–297.

Modigliani, F. and M.H. Miller. 1963. Corporate income taxes and the cost of capital: a correction. *American Economic Review* 53: 433–443.

Miller H. M. 1977. Debt and taxes. *Journal of Finance* 32: 261–275.

Myers, S.C. 1984.Corporate finance and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13: 187–221.

Myers S. C. and N.S. Majluf. 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13: 187–221.

Nunkoo, P.K. and A. Boateng. 2010. The empirical determinants of target capital structure and adjustment to long-run target: evidence from Canadian firms. *Applied Economics Letters* 17: 983–990.

Omet, G. 2006. Ownership structure and capital structure: evidence from the Jordanian capital market. *Corporate Ownership Control* 13: 99–107.

Ozkan, A. 2001. Determinants of capital structure and adjustment to long run target: evidence from UK company panel data. *Journal of Business Finance and Accounting* 28(1&2): 176–198.

Rajan, R. and L. Zingales. 1995. What do we know about capital structure? Some evidence from international data. *Journal of Finance* 50:1421–1460.

Salawu, R.O. 2007. An empirical analysis of the capital structure of selected quoted companies in Nigeria. *International Journal of Applied Economics* 1: 16-28.

Sen, M. and O. Eda. 2008. Testing of pecking-order theory in Istanbul Stock Exchange Market. *International Research Journal of Finance and Economics* 21:1450–2887.

Shyam-Sunder, L and S.C. Myers. 1999. Testing static trade-off against pecking order models of capital structure. *Journal of Financial Economics* 51: 219–244.

Titman, S. and S. Tsyplakov. 2007. A dynamic model of optimal capital structure. *Review of Finance*. 11: 401-451.

Titman, S. and R. Wessels. 1988. The determinants of capital structure choice. *Journal of Finance* 43(1): 1-19.

Um, T. (2001). Determination of capital structure and prediction of bankruptcy in Korea, PhD thesis, Cornell University.

White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48 (14): 817–836.

Wiwattanakaantang, Y.1999. An empirical study on the determinants of capital structure of Thai firms. *Pacific Basin Finance Journal* 7: 371–403.