Empirical Investigation of Debt-Maturity Structure: Evidence from Pakistan

ATTAULLAH SHAH and SHAHID ALI KHAN

1. INTRODUCTION

Capital structure theories suggest many ways in which firms can adjust overtime to the target debt ratio in order to optimise the cost of capital and maximise the wealth of shareholders. In doing so, a firm can use different mixes of equity, debt, and hybrid securities. These areas of capital structure have already been extensively researched—both theoretically and empirically [e.g., Hatfield, *et al.* (1994); Haris and Raviv (1991); Lewis and Sappington (1995); Miao (2005)]. Recent developments in corporate finance research show that the optimal capital structure decision is not limited only to choosing what percentage of debt or equity should be used, but the decision also has to involve the choice of short-term or long-term debt [Leland and Toft (1996); Myers (1977); Yi (2005)].

In developed markets, firms can easily choose between short or long-term debts as per their requirements of optimal debt maturity structure. They are not constrained by the availability of either type of debt as the banking industry and capital markets are both developed and competitive. Unfortunately, firms operating in developing countries are not that lucky. Because of less developed capital markets and instable interest rates, firms in developing countries usually find it difficult to use long-term debt. Besides these obvious reasons, we need to know empirically what factors influence the debt maturity choice in developing countries like Pakistan.

As far as we know, there is no formal study to empirically examine the determinants of debt-maturity structure of Pakistani firms. In a study on determinants of capital structure of Pakistani listed firms, Shah and Hijazi (2004) report greater percentage of short-term debt in the total debt of the listed firms. Similarly, Booth, *et al.* (2001) and Demiriguc-Kunt and Maksimovic (1999) document higher percentage of short-term debt in developing countries. How higher is the percentage of the short-term debt in Pakistani listed firms and what are the determinants of debt maturity structure in Pakistan? This study aims to answer these questions.

This study contributes to the empirical literature by presenting evidence for the first time on how listed firms in Pakistan make their choices between long-term and short-term debt. The empirical literature is rich on capital structure decisions but not on

Attaullah Shah <attaullah.shah@imsciences.edu.pk> is Assistant Professor, Institute of Management Sciences, Peshawar. Shahid Ali Khan, Faculty Member, Institute of Management Sciences, Peshawar.

debt-maturity decisions. This study contributes to the empirical literature by presenting evidence for the first time on how listed firms in Pakistan make their choices between long-term and short-term debt. The empirical literature is rich on capital structure decisions but not on debt-maturity decisions. There is a need to add empirical evidence to the literature on the debt-maturity choices not only from the methodological standpoint but also from the view of including detailed analysis of large data sets of individual countries, especially from developing ones. In this regard, the study contributes to empirical literature by using all relevant models of dynamic panel data. Tools like Generalised Methods of Moments (GMM) rarely have been used in debt-maturity research. Ozkan (2000) is one notable study that used GMM for the first time in debt-maturity research. The assumption that firms swiftly change the maturity structures of their debts may not hold true in situations where costs of adjustments are higher. If this assumption does not hold true, then the use of a static model will not be appropriate. Our results justify the use of dynamic models in the debt-maturity research because firms included in the sample find it costly to adjust instantly to their target debt-maturity structure, which causes delays in the adjustment process.

The paper is organised as follows. Section one introduces the paper. Section 2 presents a summary of literature related to debt maturity-structure. Section 3 describes the data and discusses the dependent and explanatory variables. Section 4 presents various specification choices of the potential model for our analysis. Results from alternative specifications are presented in Section 5. Section 6 concludes the paper.

2. RELATED LITERATURE

The basic objective behind any capital structure decision is to optimise the cost of capital. Corporate finance literature suggests that maturity of debt can play a significant role in lowering the cost associated with debt financing. Four underlying theories explain why a firm will have a specific debt-maturity structure. These theories are the agency cost theory, the signaling and liquidity risk theory, the maturity matching and the tax-based model.

Myers (1977) says that a firm may pass up some profitable investment opportunities in the presence of risky debt. This is known as an under-investment problem. But if the maturity of debt is short, such problems will not arise as the firm will pay the debt before the growth option expires. This suggests that if a firm has more growth opportunities, it will have more short-term debt. Consistent with the above, Barclay, *et al.* (2003), Guedes and Opler (1996) and Varouj, *et al.* (2005) all find an inverse relationship between the proxy for growth opportunities and corporate debt-maturity.

Myers (1977) suggests another solutions to the under-investment problem. He proposes to match the maturity of a firm's debts to that of its assets. The maturity matching ensures that debt payments correspond to the fall in the value of existing assets. It means that maturity of assets should be matched with the maturity of debt. With a different argument, Stohs and Mauer (1996) also recommend maturity matching. They say that when a firm has longer maturity of assets as compared to the maturity of its debts, the cash flow from its assets will not be sufficient to meet the debt obligation. Demirguc-Kunt and

Maksimovic (1999) add another aspect of asset maturity in relation to debt maturity. They suggest that fixed assets facilitate borrowing by serving as collateral.

The agency model suggests that smaller firms have higher agency costs because the potential conflict of risk shifting and claim dilution between shareholder and bondholders is more severe in these firms [Smith and Warner (1979)]. This agency cost can be controlled with short-term debt Barnea, *et al.* (1980). Moreover, the information asymmetry problem is severe with small firms, as they find it costly to produce and distribute information about themselves [Pettit and Singer (1985)]. Because of information asymmetry, their access to capital market for long-term debt remains limited. The large fixed cost of flotation of fixed securities relative to the small size of the firm is another impediment that stops small firms approaching the capital market [Easterwood and Kadapakkam (1994)]. Examining the maturity of firm's liabilities in thirty developed and developing countries during 1980-1991, Demirguc-Kunt and Maksimovic (1999) find that large firms have higher long-term debt ratios as compared to that of small firms.

The signalling model suggests that firms generate signals to the outside world about their credit quality or their cash flows when they use a specific type of financing option. [Flannery (1986)] says debt maturity can reduce the costs of information asymmetry between firm managers and investors. He theoretically proves that if bond market investors cannot isolate good firms from bad ones, good firms will consider their long-term debt to be under-priced and will, therefore, issue short-term debt. Conversely in the same circumstances, bad firms will sell over-priced bonds. Flannery (1986) further argues that debt maturity serves as a signalling device. Short-term financing subjects a firm to more frequent monitoring; hence only good-quality firms will be more willing than bad-quality firms to use short-term debt. Highlighting the relevance of transaction costs of debt, Mitchell (1991) argues that low quality firms have no option but to use long-term debt because they will find it difficult to roll over short-term debt as it would subject them to transaction costs which may not the case for high-quality firm. Furthermore, financially strong firms can use more of short-term debt as they are better equipped to face refinancing risk and the interest risk of short-term debt [Jun and Jen (2003)]. Guedes and Opler (1996) find empirical support for the above argument and report that financially sound firms use more short-term nonconvertible debt as compared to firms that have low credit ratings. Goswami, *et al.* (1995) adds another aspect of temporal distribution of information asymmetry. They say that a firm issues long-term debt when information asymmetry is related to uncertainty of long-term cash flows. However, firm will issue short-term debt when informational asymmetry is randomly distributed across short and long-term debt.

Tax-based model, suggested by Brick and Ravid (1985), states that after adjusting for the default risk, a firm will preferably make use of long-term debt when the interest rate is expected to slope upward, because long-term debt will reduce the estimated tax expenses. The basic assumption of their model was that the leverage decision is made before the debt maturity decision. Lewis (1990) says that taxes will not impact a firm's value when optimal capital structure and debt maturity structure are determined at the same time. Kane, *et al.* (1985), using dynamic model, predict that optimal debt maturity will increase when contracting costs increase, the benefits of tax-shields decreases, and the volatility of firm worth decreases.

3. DATA AND METHODOLOGY

Data

Data for the study has been taken from "Balance Sheet Analysis of Joint Stock Companies Listed on the Karachi Stock Exchange (1999-2004)", a publication of Statistics Department of State Bank of Pakistan. The book contains six years data of balance sheets and income statements of non-financial firms.

For our analysis, we first selected firms for which data was available in all six years. Second, care was taken not to include public utility firms, because they are regulated differently. There were many firms with negative equity. All such firms were excluded from the analysis, as capital structure and debt-maturity structure decisions in these firms are influenced by the financial constraints they face. Similarly, firms that had accumulated-losses in all six years were excluded. All outliers with 3 standard deviations from the mean value were removed. Initially, we included all six years in our analysis. However, the construction of some variables required calculation of yearly change, and because of this, the year 1999 was dropped. Resultantly, we were left with a panel of 266 firms and five years.

Dependent and Independent Variables

Dependent Variable

Empirically, several proxies have been used for debt-maturity. For example, some studies have used the ratio of liabilities maturing in (i) 5 years (ii) 1 year to total liabilities [(Ozkan (2000)]. Others have used the ratio of debt maturing in more than 3 years to total debt [Barclay and Smith (1995); Varouj, *et al.* (2005). Our data source i.e., the Balance Sheet Analysis book published by the State Bank of Pakistan does not provide data on different maturities of debt. Given this limitation, our measure of debt-maturity, denoted by DEMA, is as follows:

$$DEMA = \frac{Debt\ Maturing\ in\ more\ than\ one\ year}{Total\ debt}$$

Independent Variables

Growth

Following the under-investment hypothesis, we expect a negative relation between growth and debt-maturity. To measure growth, either market-value or book-value based approach can be used. Though many research studies on debt maturity structure use market-to-book ratio, we use the proxy of annual percentage increase in total assets for growth. The reason for this is that our data comes from the years 1999 to 2004. The Karachi Stock Exchange experienced a boom in 2002 and onward where share prices for a majority of companies increased dramatically. If we use market-value based proxy it will unnecessarily indicate that the listed companies experienced abnormal growth in 2002 and onward. In comparison, the book-value approach provides a consistent measure of growth.

Size

Agency theory suggests that agency costs are higher for small firms. These costs can be controlled with the help of short-term financing. This suggests positive relationship between size firm and maturity structure of debt. The same positive relationship is suggested by information asymmetry hypothesis. Furthermore, fixed flotation costs of long-term securities make access to capital market difficult for small firms that again suggest a positive relationship between maturity of debt and size of the firm. Our proxy for the size of firm is the natural log of total asset.

Asset Maturity

Stohs and Mauer (1996) say when a firm has longer maturity of assets than the maturity of its debt, the cash flow from its assets will not be sufficient to meet the debt obligation. On the other hand, if a firm finances its short-term assets with longer maturity debt, then the funds will remain useless in periods of low activity. This suggests that asset maturity has a positive relationship with debt maturity. We use two proxies for assets' maturity; (a) Assmat, which is obtained by dividing net fixed assets on annual depreciation charge and (b) Oppcycle, which is a ratio of net sales to net fixed assets. The first proxy will capture the maturity of fixed assets, and the second proxy, as argued by Demirguc-Kunt and Maksimovic (1999) is a descriptor of the firm's operating cycle. It captures the yearly fluctuations in operational activities. A high ratio of Oppcycle will show that the firm may need short-term financing to support sales.

Firm Quality

Information asymmetry that may exist between managers and investors usually results in under pricing of long-term securities. In order to reduce this cost of information asymmetry, Flannery (1986) argue that good firms will prefer to issue short-term debt. Furthermore, only good quality firms will be willing to subject themselves to frequent monitoring that comes after short-term financing. This suggests an inverse relationship between debt maturity and firm quality. Following Barclay and Smith (1995), we use abnormal future earning as a proxy of a firm's quality. It is assumed that a higher-quality firm will have positive future abnormal profit. Abnormal profit can be defined as follows:

$$Quality = \frac{Earning_{t+1} - Earning_t}{Earning_t}$$

Tax Rate

In model developed by Kane, *et al.* (1985), an optimal mix of long-term and short-term debt is determined by a trade-off that exists between three factors. These factors are bankruptcy costs, floatation costs of debt, and the benefits of tax-shields. They argue that debt-maturity increases with floatation costs and decreases with tax-shield benefits of debt. Our measure of tax rate is as follows:

$$\text{Tax Rate} = \frac{Annual\ Tax\ Expense}{Taxable\ Income}$$

Table 1 summarises the independent variables, their measures, and expected relationship with the dependent variable DEMA. Table 2 shows descriptive statistics for variables which are included in our analysis. Further, Table 3 shows means of independent variable grouped by industries.

Table 1

Independent Variables and Their Relationship with Dependent Variable

Variables	Measure	Expected Sign
Growth	%age change in assets	Negative
Size	Log of assets	Positive
Assmat	Fixed assets/depreciation	Positive
Opcycle	Sales/fixed assets	Negative
Firm Quality	Earnings in $[(t+1)-t]/t$	Negative
Tax	Tax charge/taxable income	Negative

Table 2

Descriptive Statistics of Selected Variables

Variables	Observations	Mean	Std. Dev.	Min	Max
DEMA	1330	0.21	0.21	0.00	0.91
Growth	1330	0.12	0.25	–0.70	2.32
Assmat	1330	12.72	7.88	0.00	53.49
Size	1330	6.76	1.46	1.63	11.08
Quality	1330	0.31	3.00	–30.00	26.33
Opcycle	1330	3.97	4.72	0.01	36.70
Tax	1330	0.27	1.19	0.00	29.00

Table 3

Means of Selected Variables by Industries

	Textile	Chemical	Engineering	Sugar	Paper	Cement	Power	Misc.
DEMA	0.25	0.15	0.11	0.14	0.15	0.40	0.23	0.16
Growth	0.14	0.10	0.14	0.13	0.10	0.06	0.06	0.08
Assmat	12.86	11.33	11.05	14.83	9.42	17.24	11.09	14.43
Size	6.76	6.78	6.43	6.51	5.83	7.62	8.08	5.99
Quality	0.46	0.23	0.24	–0.41	–0.06	0.98	0.03	0.53
Opcycle	2.55	5.74	7.09	2.56	6.57	1.38	6.24	6.62
Tax	0.19	0.25	0.40	0.69	0.23	0.16	0.17	0.18

4. MODEL SPECIFICATION

Studying phenomenon like capital structure or debt maturity structure where a choice has to be made between two options, one has to make certain assumptions about the way the choice is made. In case of debt maturity structure, available options are whether (i) to use debt of short maturity (ii) or to use debt of long maturity. If firms can

instantly switch between these options and there are no costs of switching over or adjustments to reach the target debt maturity structure, we can adopt static model for analysis. However, if firms experience delays in the process of adjustments then the use of static model will be inappropriate. As reported by Antoniou, *et al.* (2006) and Ozkan (2000), firms do experience delays in the process of adjustment which implies that their actual debt maturity structure may not be the desired debt maturity structure. This is why we prefer to use partial adjustment model:

$$DEMA_{it} = \alpha DEMA_{i,t-1} + \sum_{k=1}^{k} \beta_k X_{it} + \lambda_i + \lambda_t + e_{it} \qquad \dots \qquad \dots \qquad \dots \qquad (1)$$

$DEMA_{it}$ is debt maturity ratio of firm i in time t. X_{it} represents various independent variables as discussed in the previous section. λ_i is a dummy variable that capture firm specific effects that do not change over time. λ_i is dummy variable for year specific effects that do not change across firms like macroeconomic factors. e_{it} is the normal error term that is assumed to be serially uncorrelated with zero mean.

As shown in Bond (2002), the individual effects (λ_i) are assumed to be stochastic. If so, these effects will be correlated with the lagged dependent variable $DEMA_{i,t-1}$. In such a case the OLS estimator of α and β_k are inconsistent and the estimator of α are biased upward because the lagged variable $DEMA_{i,t-1}$ is positively correlated with the error term defined as ($\lambda_i + e_{it}$). Within Group estimator can remove this inconsistency by transforming the variables such that observations are expressed as deviations from group means. The transformation removes the individual effects λ_i. However, such transformation invites a correlation between the error term $\dfrac{-ei_{t-1}}{T-1}$ and the lagged dependent variable $\dfrac{-DEMA_{it-1}}{T-1}$ and the resultant estimate of α is heavily biased downward. [Bond (2002)] says that OLS and the Within Group estimates are biased in opposite directions and help in evaluating a candidate consistent estimate that will lie between the two. Instead of using the Within Group estimate, the firm specific effects can be removed with taking the first difference of the Equation (1).

$$\Delta DEMA_{it} = \alpha \Delta DEMA_{i,t-1} + \sum_{k=1}^{k} \beta_k \Delta X_{it} + \Delta \lambda_t + \Delta e_{it} \qquad \dots \qquad \dots \qquad (2)$$

However, in the above model too, the error terms Δe_{it} are correlated through terms $DEMA_{i,t-1}$ and $e_{i,t-1}$. To overcome this weakness, Anderson and Hsiao (1982) developed a model (AH 2SLS) where $\Delta DEMA_{i,t-2}$ or $DEMA_{i,t-2}$ are used as instruments for the first difference of the lagged dependent variable. The instruments are correlated with $DEMA_{i,t-1}$ but uncorrelated with Δe_{it}. However, AH 2SLS method does not use all possible moment conditions. Further precision in the estimates can be obtained through a method of Generalised Methods of Moments (GMM), a technique suggested by Arrelano and Bond (1991). Under this method, all available moments can be used by using the orthogonality conditions which are present between the lagged values of dependent

variable and error terms. Arrelano and Bond (1991) GMM is also called difference GMM. However, Blundell and Bond (2000) demonstrate that the difference GMM value is biased downward in the presence of finite sample bias which is expected when the series is highly persistent. They suggest that one should examine the time series properties of each series when using GMM estimator for dynamic panel data models. After investigation if the individual series turn out to be persistent, then instruments available in first differences tend to be less powerful. In contrast, system GMM which was introduced by Arellano and Bover (1995) and late on extended by Blundell and Bond (1998) significantly smaller finite sample bias and works with a good deal of precision when estimating autoregressive parameters in persistent series. In our case, after investigation we found that the variables Size, Assmat, and Oppcycle showed persistence.[1] Therefore, we report the results of system GMM technique alongside the results of OLS, Within Group regression, Anderson Hsiao 2SLS, and difference GMM.

5. RESULTS

Table 4 presents five alternative estimation procedures starting from a basic OLS in levels, the Within Group (WG), Anderson - Hsiao 2SLS regression, difference GMM and finally system GMM. The first two columns of the table show names of the selected variables and hypothesized signs. In rest of the columns, coefficients and p-values are reported under each specification method. The heteroskedasticity robust standard errors are reported in parenthesis below each coefficient value. In all models there are 266

Table 4

OLS in Level, Within Group, AH 2SLS, GMM Difference and System GMM

Variables	Predic- ted Sign	OLS		Within Group		AH 2SLS		GMM Difference		GMM System	
		Coeff:	p-values	Coeff:	p-values	Coeff:	p-values	Coeff:	p-values	Coeff:	p-values
$DEMA_{t-1}$	+	0.7010	0.00	0.1076	0.00	0.6847	0.00	0.4739	0.000	0.5871	0.00
		(.029)		(.037)		(.129)		(.077)		(.076)	
Growth	–	0.0528	0.01	0.0019	0.92	0.0301	0.31	0.0213	0.350	0.0202	0.35
		(.02)		(.018)		(.03)		(.023)		(.021)	
Assmat	+	0.0025	0.00	0.0043	0.00	0.0051	0.00	0.0063	0.032	0.0060	0.00
		(.001)		(.001)		(.002)		(.003)		(.002)	
Size	+	0.0088	0.00	0.0761	0.00	–0.0088	0.79	0.1184	0.129	0.0304	0.04
		(.003)		(.023)		(.033)		(.078)		(.015)	
Quality	–	–0.0015	0.28	0.0011	0.47	0.0017	0.38	0.0026	0.254	0.0017	0.47
		(.001)		(.001)		(.002)		(.002)		(.002)	
Opcycle	–	–0.0034	0.00	–0.0042	0.00	–.0013	0.63	0.0002	0.939	–0.0035	0.03
		(.001)		(.002)		(.003)		(.003)		(.002)	
Tax	–	–0.0040	0.01	0.001	0.71	–0.0106	0.00	–0.0092	0.000	–0.0074	0.00
		(.002)		(.002)		(.002)		(.002)		(.001)	
No. of Firms		266		266		266		266		266	
No. of Obs		1,330		1,330		1,330		1,330		1,330	
Wald (joint)		2175(7)	0.00	32.12(7)	0.00	5.25(9)	0.00	60.98(7)	0.00	478(10)	0.00
Wald (time)		10.97(3)	0.01	5.857	0.11	4.96(2)	0.01	9.94(3)	0.02	11.99(3)	0.01
Sargan Test		–		–		–		31.59(37)	0.72	54.94(56)	0.52
Difference	Sargan	–		–		–		–			0.22
AR(1)		–0.27	0.79	(3.84)	0.00	–4.76	0.00	–4.7600	0.00	–6.1600	0.00
AR(2)		0.33	0.74	–6.6800	0.00	1.080	0.28	0.3600	0.72	0.9100	0.36

[1]Regressing each variable on its one period lagged values yielded the coefficient values of 0.8099 for size, 0.6547 for Assmat, 0.7693 for Opcycle, .0150 for Quality, .0396 for Tax, and 0.0835 for Growth.

firms and 1330 observations, however, usable observations vary according to estimation method. We use Sargan test of overidentifying restrictions to check the validity of instruments set. The null hypothesis of the test is that there is no correlation between instruments and the error term. AR(1) and AR(2) test whether first and second order serial correlation in the residuals exist or not. All models have time dummies to capture the effect of macro-economic shocks. The joint significance of these dummies is tested by Wald test. All GMM models were estimated using xtabond2 command written by Roodman (2006) for Stata.

In OLS estimation, the lagged dependent variable $DEMA_{i,t-1}$ is treated as exogenous and firm fixed effects are not captured. As discussed in the previous section, the dependent variable which is lagged one period is correlated with the error term and the resultant coefficient is biased upward. The WG estimator purges the fixed effects by transforming the observations as deviation from group means. However, this estimator too is biased but now in opposite direction of OLS. The OLS and the WG coefficients of the dependent variable $DEMAi_{,t-1}$ are 0.7010 and 0.1076 respectively. The AH difference regression gives α value 0.6847 that is in between the OLS and WG.

Estimating the regression with GMM technique, we first need to account for the problem of endogeneity and exogeneity of the explanatory variables because the valid set of instruments depends upon the relationship between the transformed error term e_{it} and explanatory variables X_{it}. Following the approach of Blundell, *et al.* (1992), we examine the possibility whether the X_{it} variables are predetermined with respect to e_{it}. If a specific explanatory variable x_{it} is correlated with Δe_{it} and the e_{it} is serially uncorrelated, then adding instrument dated t–1 will cause the estimate of the coefficient of x variable to fall. Similarly, the possibility of strict exogeneity of X_{it} variables with respect to e_{is} can be examined by including present as well as lagged values dated t–1, t–2, and earlier of X_{it} variable in the instruments set. Again if the coefficient estimates of the X variables fall, then the variable cannot be considered as exogenous. As a result of this procedure, we found that the variables Opcycle and Tax were exogenous and including present as well as lagged values of them to the instrument set gave desirable results. For other explanatory variables, instrument set dated t–1 was found to give better coefficient estimates and efficient standard errors, suggesting no measurement errors in them. However, they were not strictly exogenous. For the lagged dependent variable $DEMA_{i, t-1}$, instruments dated t–2 and earlier were found valid and efficient. The Sargan test of overidentifying restriction clearly accepts the validity of the instruments in both of the GMM models. The AR(1) test indicates that there is first order serial correlation in the residuals, however, AR(2) test provides evidence that second order serial correlation is absent. The difference Sargan test accepts the validity of the additional level instruments at any conventional level in the system GMM estimation.

Further precision is obtained with the GMM technique which gives the α value below the value under OLS and AH 2SLS estimation, but well above the Within Group estimator. The difference GMM gives α value of 0.4739; however, system GMM produces a higher value of 0.5871 for α. The difference GMM estimates of coefficients for other variables too are barely higher than the Within Group estimates. This observation provides some evidence of finite sample bias associated with weak instruments in the presence of persistent series. For this reason, the system GMM results are our preferred results.

In all of the above models, the α value is positive and significant. The adjustment coefficient, $\gamma = (1-\alpha)$, is close to 0.5. It means that there is adjustment process and firms face difficulty in instantly adjusting toward their target debt maturity structure. Because of the problems associated with OLS, WG, and AH regressions as discussed previously, we mainly focus on GMM models for our analysis. All the explanatory variables have the predicted signs in all models except the Growth and Quality variables; however, they are insignificant in almost all models.

The variable Growth is insignificant at any conventional level in all models except in OLS. The finding suggests that growth (measured by annual percentage increase in total assets) does not have any impact on the debt maturity decision. Our results do not conform to the under-investment hypothesis of Myers (1977) that growing firms will shorten the maturity of debt so as to avoid an under-investment problem. Our finding is also in contrast to the finding of Barclay and Smith (1995); Varouj, *et al*. (2005) Majority of the previous research studies on debt maturity structure have used market-to-book value of equity as a proxy for growth; however, we use the proxy of annual percentage increase in total assets. One may suspect that our proxy for Growth does not effectively represent growth opportunities; be that as it may, a similar insignificant relationship is reported by Stohs and Mauer (1996), though they use the proxy of market-to-book ratio (MV/BV) for growth.

Though the Growth variable does not support the prediction of agency cost hypothesis, our Size variable does support the agency cost hypothesis, given by Barnea, *et al.* (1980), that small firms have more agency problems and will use more short-term debt to lower the costs of these problems. The Size variable is positively related to maturity structure and is significant in all models except in AH 2SLS and difference GMM. The level of significance is 1 percent in OLS and Within Group regressions and 5 percent in system GMM. The coefficient value of 0.0304 suggests that Size is the most significant determinant of debt maturity structure in Pakistan. As the size of a firm increases, the percentage of long-term debt to total debt also increases. Besides the agency cost hypothesis, our results confirm to the argument by Pettit and Singer (1985) that information asymmetry problem is severe with small firms as they find it costly to produce and distribute information about themselves. Information asymmetry makes their access to capital market difficult for long-term debt. The large fixed flotation cost of long-term securities is another impediment that stops small firms approaching capital market.

The variable Assmat has the predicted sign and is significant in all models at 1 percent level with the exception of difference GMM where it is significant at 5 percent level. In term of importance, Assmat has the second largest coefficient of 0.006 after the Size variable. On other hand, the other proxy for maturity matching (Opcycle) has also the expected negative sign and is significant at 5 percent level in system GMM and at 1 percent level in OLS and WG regressions. Both of the proxies for maturity matching show that the maturity of debt varies with the maturity of firms' assets. A firm uses more short-term debt when sales and production activities pace up. However, the proportion of long-term debt increases when the percentage of assets with longer lives increases. The significance of Assmat and Opcycle lend unambiguous support to maturity matching hypothesis.

The Quality variable as measured by the proxy of abnormal profit has neither the expected sign nor statistically significant coefficient in any model. This finding is strictly in contrast to signalling hypothesis presented by Flannery (1986) that short-term debt serves as a signalling device when information asymmetry between firm's managers and investors with respect to quality of the firm is higher.

Finally, Consistent with the tax-based hypothesis, the coefficient estimate on the variable Tax is negative and significant in all models except in Within Group. The level of significance is 1 percent in all models. This shows that corporate tax rate does have an influence the maturity structure of debt.

Robustness of the Results

In order to test the robustness of the results, we estimate the relationship between the dependent variable DEMA and the six explanatory variables with static panel data models. Specifically, we apply pooled regression model, fixed-effects model and cross-sectional model. Table 5 summarises the regressions' output for these models. The first two columns show the names of variables and their hypothesised signs respectively. The last three columns report the results for pooled, fixed-effects and cross-sectional regressions respectively. Standard errors are reported in the parentheses below the coefficient values. The alternative estimations under static panel data models substantiate the main findings of our prior estimations under dynamic panel data models. The Growth variable is still statistically insignificant in all of the three models whereas the Quality variable has the expected negative sign but is insignificant in the first two models. Assmat, Size and Opcycle are highly significant and have the expected signs in all of the three models. The Tax variable shows inconsistency in the static models. Though it has the expected sign, it is insignificant in the fixed-effects model and cross-sectional model. Overall, the static models are in agreement with the results of our prior estimations under dynamic panel data models.

Table 5

Regression Output of Pooled, Fixed-Effect and Cross Sectional Models

Variables	Predicted Sign	Pooled Coeff.	p-value	Fixed-effects Coeff.	p-value	Cross Section Coeff.	p-value
Growth	–	0.0014 (.0203)	0.945	0.0005 (.0174)	0.974	0.0175 (.0539)	0.746
Assmat	+	0.0074 (.0008)	0.000	0.0039 (.0009)	0.000	0.0065 (.0016)	0.000
Size	+	0.0222 (.0034)	0.000	0.0953 (.0194)	0.000	0.0150 (.0087)	0.084
Quality	–	–0.0019 (.0015)	0.225	–0.0013 (.0011)	0.244	–0.0059 (.0029)	0.039
Opcycle	–	–0.0135 (.0009)	0.000	–0.0063 (.002)	0.002	–0.0182 (.0029)	0.000
Tax	–	–0.0078 (.0038)	0.044	–0.0006 (.0029)	0.818	–0.0109 (.0094)	0.248

6. CONCLUSION

In this study we examine the empirical determinants of debt maturity structure for a sample of 266 firms in non-financial sector over the period 2000 to 2004 by using

several variants of dynamic panel data models. Our study on debt maturity structure is a first one in Pakistan and hence contributes to literature by providing evidence from a developing country. To examine the dynamic nature of debt maturity structure, we start our analysis with a partial adjustment model using OLS estimation ignoring the individual effects. Going a step forward with the model, individual effects are purged out with Within Group (WG) estimation. To account for the endogeneity problem, GMM estimation is used next and precision in the estimates is obtained with the proper set of instruments.

To test the relevant theories of debt maturity structure suggested in the literature, we examine the effect of six explanatory variables on long-term debt ratio which is calculated as a ratio of debt maturing in more than year divided by total debt. These theories include agency cost theory, signalling and liquidity risk theory, the maturity matching hypothesis, information asymmetry hypothesis, and tax hypothesis. We find mixed support for the agency cost hypothesis. Our results show that smaller firms use more short-term debt; however, there is no evidence that growing firms use more of short-term debt as predicted by Myers (1977) that debt maturity is inversely related to proxies for growth options in firms' investment opportunity sets. The significance of Size variable also substantiates the information asymmetry hypothesis that information asymmetry is greater with small firms and hence they find it costly to approach capital market for long-term debt. We find unambiguous support for maturity matching hypothesis. Our results show that the long-lived assets are positively correlated with debt maturity structure. On the other hand, the yearly ups and downs in operating activities cause the short term financing to rise and fall accordingly. The signalling hypothesis suggested by Flannery (1986) is not supported by our results. Flannery (1986) had argued that good quality firms will use more short-term debt in order to generate positive signals to the outside world. Our proxy for firm quality is insignificant in any model. Finally we find support for the tax-based hypothesis. The coefficient of the Tax variable is negative and significant in almost all models.

REFERENCES

Anderson, T. W. and C. Hsiao (1982) Formulation and Estimation of Dynamic Models Using Panel Data. *Journal of Econometrics* 18, 47–82.

Antoniou, A., Y. Guney and K. Paudyal (2006) The Determinants of Debt Maturity Structure: Evidence from France, Germany and the UK. *European Financial Management* 12: 2,161–194.

Arrelano, M. and S. Bond (1991) Some Tests of Specification for Panel Data: Monte Carlo Evidence and An Application to Employment Equations. *The Review of Economics Studies* 58, 277–297.

Arslan, O. and M. B. Karan (2006) Ownership and Control Structure as Determinants of Corporate Debt Maturity: A Panel Study of an Emerging Market. *Corporate Governance* 14:4, 312–324.

Barclay, M. J., L. M. Marx, and Jr. C. W. Smith (2003) The Joint Determinant of Leverage and Debt Maturity. *Journal of Corporate Finance* 9, 149–167.

Barclay, M. J. and C. W. Smith Jr. (1995) The Maturity Structure of Corporate Debt. *The Journal of Finance* 50:2, 609–631.

Barnea, A., R. A. Haugen and L. W. Senbet (1980) A Rationale for Debt Maturity Structure and Call Provisions in the Agency Theoretic Framework. *The Journal of Finance* 35:5, 1223–1234.

Bond, S. (2002) Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice. (Cemmap Working Paper, UCL CWP09/02).

Booth, L., V. Aivazian and A. Demirguc-Kunt (2001) Capital Structure in Developing Countries. *Journal of Finance* 56, 87–130.

Brick, I. and S. A. Ravid (1985) On the Relevance of Debt Maturity Structure. *Journal of Finance* 40, 1423–1437.

Datta, S., M. Iskandar-Datta and K. Raman (2005) Managerial Stock Ownership and the Maturity Structure of Corporate Debt. *The Journal of Finance* 60: 5, 2333–2350.

Demirguc-Kunt, A. and V. Maksimovic (1999) Institutions, Financial Markets, and Firm Debt Maturity. *Journal of Financial Economics* 54:3, 295–336.

Demiriguc-Kunt, A. and V. Maksimovic (1999) Institutions, Financial Markets, and Firm Debt Maturity. *Journal of Financial Economics* 54:3, 295–295.

Easterwood, J. C. and P. R. Kadapakkam (1994) Agency Conflicts, Issue Costs, and Debt Maturity. *Quarterly Journal of Business and Economics* 33:3, 69–80.

Flannery, M. J. (1986) Asymmetric Information and Risky Debt Maturity Choice. *Journal of Finance* 41:1, 19–37.

Gay, B. Hatfield, T. Louis, W. Cheng, and Wallace N. Davidson (1994) The Determination of Optimal Capital Structure: The Effect of Firm and Industry Debt Ratios on Market Value. *Journal of Financial and Strategic Decisions* 7:3, 1–14.

Goswami, G., T. H. Noe, and M. Rebello (1995) Debt Financing under Asymmetric Information. *Journal of Finance* 50:2, 633–659.

Guedes, J. and T. Opler (1996) The Determinants of the Maturity of Corporate Debt Issues. *The Journal of Finance* 51:5, 1809–1833.

Hayakawa, K. (2005) Small Sample Bias Properties of the System GMM Estimator in Dynamic Panel Data Models. Institute of Economic Research, Hitotsubashi University. (Hi-Stat Discussion Paper Series d05-82).

Jun, S. G. and F. C. Jen (2003) Trade-off Model of Debt Maturity Structure. *Review of Quantitative Finance and Accounting* 20, 5–34.

Kane, A., A. J. Marcus, and R. L. McDonald (1985) Debt Policy and the Rate of Return Premium to Leverage. *Journal of Finance and Quantitative Analysis* 20, 479–499.

Leland, H. E. and K. B. Toft (1996) Optimal Capital Structure, Endogenous Bankruptcy, and the Term Structure of Credit Spreads. *The Journal of Finance* 51:3, 987–1019.

Lewis , C. (1990) A Multi-Period Theory of Corporate Financial Policy under Taxation. *Journal of Finance and Quantitative Analysis* 25, 25–43.

Lewis, T. R. and D. E. M. Sappington (1995) Optimal Capital Structure in Agency Relationships. *The Rand Journal of Economics* 26: 3, 343–361

Maria-Teresa, M. (2005) Debt Maturity and the Characteristics of Ownership Structure: An Empirical Investigation of UK Firms. Department of Economics, University of York. (Discussion Papers 05/29).

Miao, J. (2005) Optimal Capital Structure and Industry Dynamics. *The Journal of Finance* 60: 6, 2621–2659.

Milton Haris, A. R. (1991) The Theory of Capital Structure. *Journal of Finance* 40:1, 297–355.

Mitchell, K. (1991) The Call, Sinking Fund and Term to Maturity Features of Corporate Bonds: An Empirical Investigation. *Journal of Financial and Quantitative Analysis* 26, 201–221.

Myers, S. C. (1977) Determinants of Corporate Borrowings. *Journal of Financial Economics* 17, 147–176.

Ozkan, A. (2000) An Empirical Analysis of Corporate Debt Maturity Structure. *European Financial Management* 6:2, 197–212

Pettit, R. R. and R. F. Singer (1985) Small Business Finance: A Research Agenda. *Financial Management* 14, 47–60.

Roodman, D. (2006) How to Do Xtabond2: An Introduction to "Difference" and "System" GMM in Stata. Centre for Global Development. (Working Paper).

Shah, A. and T. Hijazi (2004) The Determinants of Capital Structure of Stock Exchange-Listed Non-Financial Firms in Pakistan. *The Pakistan Development Review* 43:4, 605–618.

Smith, C. W. J. and J. B. Warner (1979) On Financial Contracting: An Analysis of Bond Covenants. *Journal of Financial Economics* 7, 117–161.

Stohs, M. H. and D. C. Mauer (1996) The Determinants of Corporate Debt Maturity Structure. *The Journal of Business* 20:3, 279–312.

Titman, S. and R. Wessels (1988) The Determinants of Capital Structure Choice. *Journal of Finance* 43, 1–19.

Varouj, A. A., G. Ying, and Q. Jiaping (2005) Debt Maturity Structure and Firm Investment. *Financial Management* 34:4.

Yi, J. (2005) A Study on Debt Maturity Structure. *The Journal of American Academy of Business, Cambridge* 7: 2, 277–285.