Chapter 4: Research Results

This section examines the empirical relationship between the firm's debt maturity structure and its characteristics based on the theoretical predictions presented in the previous section.

4.1 Summary Statistics

Table 4.1 shows the summary statistics for the sample firms.

Table 4.1
Descriptive Statistics

	Debt Maturity	Growth	Size	Asset Maturity	Quality	Liquidity Risk	Leverage	Effective Tax
Mean	0.278016	1.201771	19.60386	14.83102	0.005036	0.677811	0.396652	0.144535
Median	0.230643	0.935800	19.41215	11.50748	0.008594	0.536916	0.384683	0.174197
Maximum	0.911333	9.269700	24.61537	88.49558	0.626600	9.560229	0.966448	0.972838
Minimum	0.000000	0.232000	14.98219	0.117300	-0.773091	0.000499	0.005680	-0.972340
Std. Dev.	0.221240	0.947597	1.537983	11.76029	0.095387	0.735761	0.205736	0.216037
Skewness	0.753018	4.002527	0.432774	2.916116	-1.283443	6.045486	0.240476	-0.917694
Kurtosis	2.671122	24.15179	3.057076	14.06943	19.02100	57.12795	2.332209	7.803499

As shown in table 4.1 the mean value for debt maturity is 0.2780, which implies that short-term debt is popular among Malaysian firms. This figure is lower than the debt maturity of firms operating in developed countries (Antoniou et al., 2006; Barclay and Smith, 1995). Based on Antoniou et al. (2006), the average long-term debt ratio is 59% in France, 53% in Germany and 46% in UK. The reasons could be the underdeveloped debt markets in Malaysia or using the banks as the

main sources of financing for firms. The average of growth is 1.20 which is higher than the median of 0.9358. These figures suggest that the sample of this study includes some high-growth firms and the maximum growth of 9.2697 shows this fact. This figure is quite low compared to the figure that was obtained by Cai et al. (2008) in China. The growth variable for Chinese firms takes the average value of 2.38. The reason could be the preference of Chinese firms to get equity financing and immature bond market (Huang and Song, 2006).

The average of liquidity risk is 0.6778 implying that Malaysian firms do not seem to have a liquidity problem in the short-term. The mean of leverage is 39.66% (median is 38.47%). The mean value for tax is 0.1445 implying that the effective tax burden is not very high in Malaysia. The corporate tax rate for domestic firms is currently 25% which shows the Malaysian firm's tendency to be granted more options and incentives to reduce their tax levy or maybe only a part of the firms have chargeable earnings. There are cross-country differences for each of these variables because of substantial variations in the tradition and practices of corporate financial systems in different countries.

4.2 Analyses of Measures

4.2.1 Muticollinearity

A high degree of correlation amongst the explanatory variables is called multicollinearity problem. Perfect multicollinearity exists when there is exact linear relationship between two or more explanatory variables while imperfect multicollinearity exists when two or more explanatory variables are approximately linearly related. Muticollinearity may cause several problems. Since two or more of the explanatory variables are significantly related, it becomes difficult to precisely identify the separate effects of the multicollinear variables. It is likely to make large errors in estimation. There is a higher probability of obtaining a beta hat that is dramatically different from the true beta. Multicollinearity increases the likelihood of obtaining an unexpected sign for a coefficient. Standard errors may be overestimated and t-values depressed. A symptom may be high R^2 but low t-values. Examining the correlation matrix of explanatory variables helps to find multicollinearity problem. Table 4.2 shows the correlation among the dependent and independent variables.

Table 4.2
Correlation Matrix

Correlation Probability	Debt Maturity	Growth	Size	Asset Maturity	Quality	Liquidity Risk	Leverage	Effective Tax
Debt Maturity	1.000000							

Growth	-0.028282	1.000000						
	0.3082	---						
Size	0.334985	0.042179	1.000000					
	0.0000	0.1285	---					
Asset Maturity	0.341534	-0.084982	0.312439	1.000000				
	0.0000	0.0022	0.0000	---				
Quality	-0.004745	0.076485	0.041557	0.008973	1.000000			
	0.8643	0.0058	0.1342	0.7465	---			
Liquidity Risk	-0.027713	-0.043500	0.111292	0.076259	0.019416	1.000000		
	0.3181	0.1170	0.0001	0.0059	0.4843	---		
Leverage	0.181025	0.004927	0.287574	0.107556	0.040040	0.432565	1.000000	
	0.0000	0.8591	0.0000	0.0001	0.1491	0.0000	---	
Effective Tax	0.029443	0.038202	0.111515	0.056587	0.091336	-0.095300	-0.123880	1.000000
	0.2888	0.1686	0.0001	0.0414	0.0010	0.0006	0.0000	---

As shown in the table above the signs of correlation coefficients between debt maturity and proposed firm characteristics are as predicted by theory. Debt maturity is positively and significantly associated with size, asset maturity and leverage with correlation coefficients of 0.335, 0.341 and 0.181 respectively (all the correlations statistically significant at the 1% level). Effective tax rate and debt maturity are positively and insignificantly associated with each other. The negative coefficients of growth, quality and liquidity risk, though insignificant, are consistent with the theory prediction. As shown in correlation matrix, the correlation coefficients of independent variables are not high which implies that

there is not strong correlation among explanatory variables and the model is free of multicollinearity problem.

The other alternative to detect multicollinearity problem is using auxiliary regressions which regress each explanatory variable on the remaining explanatory variables. The R^2 will show how strongly each variable is collinear with the other explanatory variables. By using the R^2 the variance inflation factor of each variable is obtained:

Variance Inflation Factor (VIF) = 1 / (1 – R^2)

The variance inflation factors measure how much the variances of the estimated regression coefficients are inflated as compared to when the predictor variables are not linearly related. Table 4.3 shows the R^2 of each independent variable regression on the remaining independent variables and their variance inflation factors.

Table 4.3
Variance Inflation Factor

Dependent Variable	R^2	VIF	Prob (F-Stat)
Growth	0.020890	1.021336	0.000125
Size	0.183316	1.224464	0.000000
Asset Maturity	0.109543	1.123019	0.000000
Firm's Quality	0.016587	1.016867	0.001395
Liquidity Risk	0.191979	1.237592	0.000000
Leverage	0.259335	1.350138	0.000000
Effestive Tax Rate	0.050783	1.053501	0.000000

If VIF > 5 then serious multicollinearity problem exists. Based on the results there is no multicollinearity problem in this model and sample firms. The computer outputs are provided in Appendix B.

4.2.2 Fixed Effect Testing

As mentioned in section 3.5 panel data techniques allow control for heterogeneity while time series and cross-section studies do not control for this heterogeneity and as a result the estimation could be biased. EViews provide the option to test the significance of the effects because panel data suggest that firms are heterogeneous. In this test which is called “Redundant Fixed Effects – Likelihood Ratio” the unrestricted specification is a two-way fixed effect estimator. EViews will test the joint significance of each effect separately as well as the joint significance of all of the effects.

For doing this test, the regression is estimated using fixed effects for both cross-section and period. Then the Likelihood Ratio test is done and results are displayed as below:

Table 4.4
Redundant Fixed Effects Tests
Test cross-section and period fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	10.386715	(259,1029)	0.0000
Cross-section Chi-square	1670.383238	259	0.0000
Period F	2.722086	(4,1029)	0.0284
Period Chi-square	13.683654	4	0.0084
Cross-Section/Period F	10.271140	(263,1029)	0.0000
Cross-Section/Period Chi-square	1674.275018	263	0.0000

This table includes three sets. The first test consists of two tests. The F-test evaluates the significance of cross-section effects using sums of squares and the Chi-square test evaluates the same effects using likelihood function. The two statistic values (10.38 and 1670.38) and associated p-values strongly reject the null that cross-section effects are redundant. The next two sets which evaluate the significance of the period dummies also strongly reject the null hypothesis of no period effects. The third set evaluates the joint significance of all of the effects. Based on the results the restricted model in which there is only a single intercept is rejected. As a result the Likelihood Ratio test shows that both firm and time effects are present in the data. The computer output is provided in Appendix C.

4.2.3 Hausman Test for Correlated Random Effects

The random effects assumption is that the random effects are uncorrelated with the explanatory variables. EViews provides the Hausman test to compare the fixed and random effects. To perform the Hausman test, the regression is first estimated using random effects specification. Then the "Correlated Random Effects – Hausman Test" is used and the results are as below:

Table 4.5
Correlated Random Effects - Hausman Test
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	20.160585	7	0.0052

The statistic provides strong evidence to reject the null hypothesis that there is no misspecification. So the random effects specification is rejected in favour of fixed effects. As a result fixed effect specifications are preferred to other models to determine the firm specific determinants of debt maturity. The computer output is provided in Appendix D.

4.3 Testing of Hypotheses

Table 4.6 shows the results of panel regression using fixed effects for cross section and period relating debt maturity to the relevant firm characteristics:

Table 4.6
Dependent Variable: Debt Maturity
Method: Panel Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.622861	0.312373	-1.993962	0.0464
Growth	-0.011103	0.007766	-1.429645	0.1531
Size	0.040993	0.016034	2.556665	**0.0107**
Asset Maturity	0.002880	0.000611	4.712296	**0.0000**
Quality	-0.062757	0.037762	-1.661912	**0.0968**
Liquidity Risk	-0.088573	0.008280	-10.69703	**0.0000**
Leverage	0.323881	0.044538	7.272001	**0.0000**
Effective Tax Rate	-0.001490	0.019441	-0.076666	0.9389

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	***0.778584***	Mean dependent var	0.278016
Adjusted R-squared	0.720486	S.D. dependent var	0.221240
S.E. of regression	0.116967	Akaike info criterion	-1.270699
Sum squared resid	14.07809	Schwarz criterion	-0.192928
Log likelihood	1096.955	Hannan-Quinn criter.	-0.866316
F-statistic	13.40133	Durbin-Watson stat	1.679779
Prob(F-statistic)	***0.000000***		

The first column shows lists of independent variables and the next columns show the observed coefficients, the value of standard error of the estimates, the t-Statistics and their probability, respectively. The explanatory power of the model (R^2) and the result of the F-test are shown in the second part of the table.

The first hypothesis indicating that high growth firms borrow on the short-term is not confirmed. The result of growth opportunities does not support Myres' (1977) proposition that firms with high growth opportunities tend to use more short-term debt but this irrelevance of market-to-book ratio for debt maturity decisions was reported by Billet et al. (2007), Kim et al. (1995), Scherr and Hulburt (2001) and Stohs and Mauer (1996) for the U.S firms, and by Cai et al. (1999) for Japanese firms. Although the observed relation is negative, it is statistically insignificant which suggest that underinvestment problem does not affect corporate debt maturity in the Malaysian context and shows that overinvestment problem is of more concern in which firms tend to use long-term debt to control managers' incentives to invest in negative NPV projects (Hart and Moore, 1995). The findings are in line with Chan-Lau's (2001) argument that bank-oriented systems mitigating the shareholders-managers conflicts and also reduce the under-investment problem.

Hypothesis 2 proposes a positive relation between debt maturity and size which is confirmed. The relation between debt maturity and size is consistent with the Barclay and Smith (1995), Ortez-Molina and Penas (2006), Smith and Warner (1979), Stohs and Mauer (1996) observations. They argue that agency issues

are less pronounced in larger firms compared to smaller firms. The positive relation between the two is statistically significant at 5% showing that larger firms have more long-term debt than smaller firms. This is in line with the findings of Titman and Wessels (1988) who claimed that larger firms might have better access to financial markets to raise long-term debt and better support a higher proportion of long-term debt while as Whited (1992) argued small firms rely more on bank debt with shorter maturity than public debt. The other factors that are important to support this notion are affordable transaction costs, lower informational asymmetries, reputational consideration, and weak incentive problems in larger firms.

Hypothesis 3, which proposes that firms match the maturity of their debt to that of their assets, is confirmed as the association between debt maturity and asset maturity is positive and statistically significant at 1% level. This result might support the notion that firms match the maturity of their debt to maturity of their assets to avoid problems such as not having enough cash on hand to pay their obligation when due, which might occur when debt maturity is less than the asset maturity or not earning cash flow from assets while the firm has remaining debt obligations to pay, which might happen if debt maturity is larger than the asset maturity. The result of this study is consistent with the findings of Stohs and Mauer (1996). It seems that Malaysian firms are heavily subscribed to the matching principle like in the United States (Guedes and Opler, 1996) and Western Europe (Antoniou et al. 2006).

The forth hypothesis is supported at 10% significance level. The relation between firm quality and debt maturity is in line with Flannery (1986) who claimed that high quality firms would choose more of short-term debt assuming that high quality firms can afford the cost of rolling over short-term debt. The negative relation between debt maturity and quality is significant at 10% level.

The coefficient of liquidity is negative and significant at 1% level which confirms the hypothesis 5. The results indicate that firms with less current liabilities borrow more on long-term basis. Based on Antoniou et al. (2006) and Morris (1992) lenders are concerned about the long-term prospects of their borrowers and put some requirements on such loan covenants. As a result, having good liquidity for Malaysian firms is an important factor to borrow long-term debt.

As has been reported in Leland and Toft (1996) and Morris (1992), the relation between debt maturity and leverage is positive implying that the debt maturity increases with firm leverage. The result supports the hypothesis 6 and shows that their relation is significant at 1% level. The firms with higher debt may borrow on the longer term to ensure that they had earned enough money to repay the creditors. The result supports the view that high leveraged firms attempt to control for costs of financial distress and bankruptcy risk by lengthening their debt maturity.

As shown by results, debt maturity and effective tax rate are unrelated (statistically insignificant) to each other in the Malaysian context and so the

hypothesis 7 is not approved. The reason may be the illiquid and underdeveloped nature of debt market in Malaysia or the relatively low effective tax rates in Malaysia which could cause effective tax rates not to exert any significant influence on the debt maturity choice. The result is consistent with the findings of Dennis et al. (2000) and Guedes and Opler (1996) who reported insignificant tax coefficient. Overall, in recent studies on debt maturity structure of the firms in different countries the effective tax rate has not played any significant role. Lewis (1990) argues that if optimal leverage ratio and debt maturity structure are chosen simultaneously, then taxes do not affect optimal debt maturity.

The explanatory power of the model (R^2) is relatively high indicating that 77.85% of the changes and variation in debt maturity structure of the Malaysian firms is explained by the firm specific characteristics while the rest of this portion is accounted by market and country characteristics. The result of the F-test shows that the firm specific determinants collectively explain the changes in debt maturity structure of the Malaysian firms.

4.4 Summary of Research Results

The results of the estimation demonstrate that all variables appear to be significant for debt maturity choice except growth and effective tax rate. Based on the regression result, two out of three variables that are defined to be the proxies for agency cost are significant while all three variables for signalling and liquidity

theory are supported to determine the debt maturity structure of Malaysian firms. Among the agency cost variables, size and asset maturity are significant at 5% and 1% level respectively implying that larger firms use more long-term debt than smaller firms in the Malaysian context because of their access to debt market and firms tend to match the maturity of their debt to that of their assets to avoid different problems regarding the payment to creditors. There is no evidence to support using short-term debt to mitigate agency problem due to the bank control over Malaysian firms.

Signalling and liquidity variables are all significant at 10%, 1% and 1% respectively. In case of firm's quality the result shows that high quality firms tend to signal their quality to creditors by using more short-term debt while creditors and lenders have great attention to liquidity conditions of the firms and this factor affects their decisions to lend on long-term basis. Regarding the leverage in the Malaysian context, firms with high leverage ratio tend to borrow long term debt to avoid cost of financial distress and bankruptcy risk. The relation of effective tax rate and debt maturity choice is strongly insignificant and the reason might be the relatively low effective tax rate or underdeveloped debt market in Malaysia. The firm specific characteristics accounts for 77.85% of variations in debt maturity structure and their explanatory power is significant at 1% level.