Chapter 3: Research Methodology

3.1 Development of Hypotheses

The first theory that is tested in this study is agency (contracting) cost. Agency costs are represented by three proxies including growth opportunities, firm size and maturity matching. Based on this theory, high leverage provides an incentive for shareholders to reject profitable projects because creditors earn a large portion of returns. This is known as an underinvestment problem and it increases when growth opportunities increase. The underinvestment problem can be mitigated by shortening the maturity of debt so that it matures before an investment problem can be exercised (Barclay and Smith, 1995; Data and Iskandar-Datta, 2000; Guedes and Opler, 1996; Hart and Moore, 1990; Myers, 1977; Mitchell, 1993; Stulz, 1990; Titman, 1992). There are some studies that conclude that growth opportunities are insignificantly related to debt maturity (Heyman et al., 2008; Stohs and Mauer, 1996) and some studies that suggest positive relation between growth opportunities and debt maturity (Cai et al., 2008; Majumdar, 2010). The empirical prediction is that firms with more growth option in their investment opportunity sets employ a higher proportion of short-term debt in their capital structures.

The agency problems between stockholders and bondholders may be particularly severe for small firms. The reason is that managers in small firms on average own larger proportion of the equity and also small firm's collateralizable assets

are small relative to their future investment opportunities. It is suggested that to avoid these conflicts, smaller firms take resource to short-term debt (Barclay and Smith, 1995; Barnea et al., 1980; Cai et al., 2008; Chittenden et al., 1996; Guedes and Opler, 1996; Heyman et al., 2008; Majumdar, 2010; Ozkan, 2002; Pettit and Singer, 1985; Smith and Warner, 1979; Stohs and Mauer, 1996; Titman and Wessels, 1988; Whited, 1992). As short-term debt is suggested to reduce agency costs, a positive relation between firm size and debt maturity is to be expected.

The immunization hypothesis suggests that firms match the maturity of their liabilities to the maturity of their assets. The firm faces a reinvestment decision at the end of an asset's life. So it can reestablish the appropriate investment incentive if it issues debt that matures at this time. Firm faces problems if the maturity of its debt is shorter or longer than the maturity of its assets. It's found that firms employ short-term debt to finance current assets. Although Majumdar (2010) finds no support for maturity matching in the Indian context but this theory is supported by many studies (Barnea et al., 1980; Cai et al., 2008; Demirguuc-Kunt and Maksimovic, 1999; Graham and Harvey, 2001; Guedes and Opler, 1996; Hart and Moore, 1995; Heyman et al., 2008; Morris, 1976; Myers, 1977; Ozkan, 2002; Stephan et al., 2010; Stohs and Mauer (1996). The empirical implication is therefore that debt maturity is positively related to asset maturity.

The second theory that is examined in this study is signaling and liquidity risk which is represented by three proxies including firm's quality, liquidity, and

leverage. Based on this theory, rational investors use the firm's debt maturity structure to infer private information held by insiders. Under the condition of asymmetric information, maturity structure of debt can be used to signal information regarding the quality of the firm. Therefore high quality firms may choose to signal their quality by issuing short-term debt because of high transaction cost associated with short-term debt, excessive required default risk premium associated with long-term debt and the ability to renegotiate debt contracts while issuing short-term debt (Data and Iskandar-Datta, 2000; Diamond, 1991; Flannery, 1986; Majumdar, 2010; Mitchell, 1991; Stephan et al., 2010; Stohs and Mauer, 1996; Titman, 1992). Some studies find little support for firms using debt maturity to signal their quality (Antoniou et al., 2006; Barclay and Smith, 1995; Cai et al., 2008). Based on these findings, a negative relationship between firm quality and debt maturity is expected.

Liquidity risk and liquidity constraints are important issues for firms with large amount of debt. When firms issue long-term bonds, the management may shift to riskier projects over time. So risk of lenders is increased and firms with higher liquidity will be able to raise long-term debt (Antoniou et al., 2006; Budina et al., 2000; Cai et al., 2008; Mauer, 1996; Myers and Rajan, 1998). According to the this argument the empirical prediction is that in case of high leverage, liquidity risk (inverse measure to current ratio) has negative impact on debt maturity.

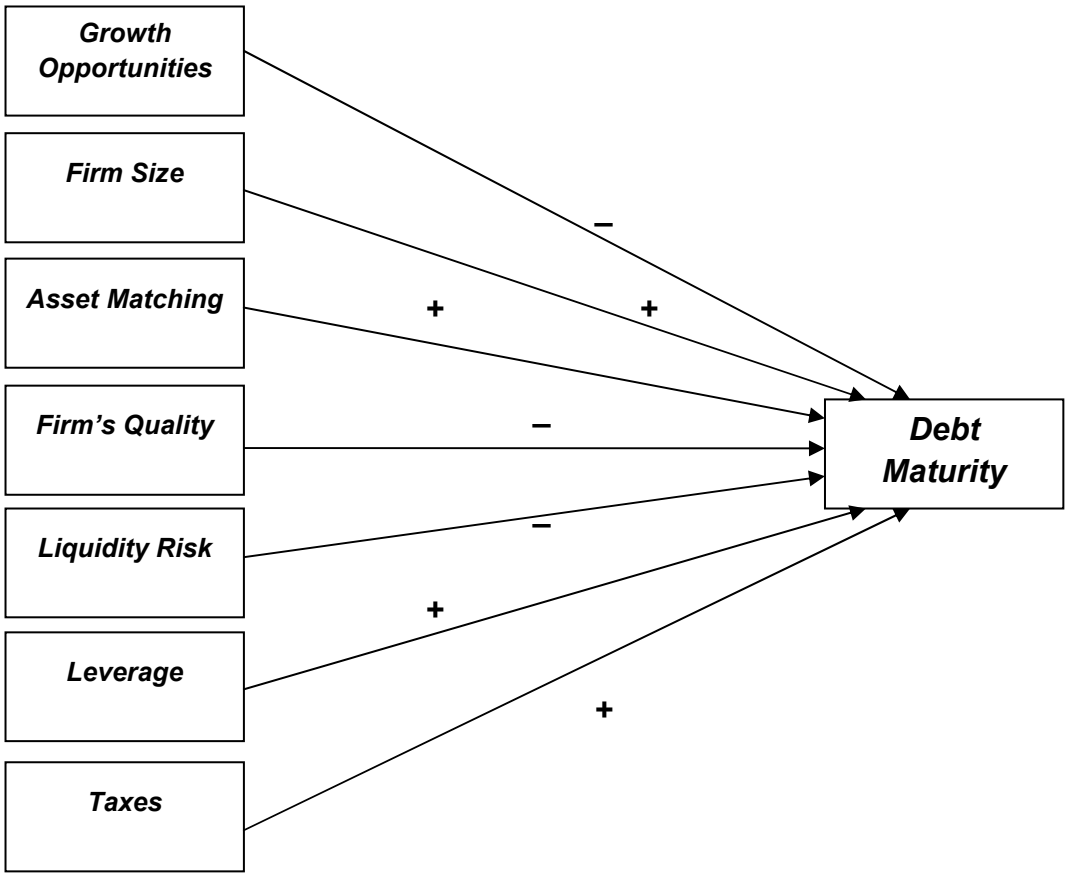
There are two arguments regarding the relationship between leverage and debt maturity. Some studies show that firms with higher leverage in their capital

structure choose longer maturity to delay their exposure to bankruptcy (Antoniou et al., 2006; Leland and Toft, 1996; Majumdar, 2010; Morris, 1992). Another argument emphasis on negative relation between the two because underinvestment problem can be mitigated by reducing leverage as well as shortening the maturity of debt (Dennis et al., 2000; Heyman et al., 2008). Therefore the nature of relation between leverage and debt maturity is expected to be positive.

It is argued that if the term structure of interest rate or yield curve is upward sloping, firms prefer long-term debt that raises the firm value because tax shield value of long-term debt is accelerated by increasing the proportion of debt payment (Brick and Ravid, 1985). So it is concluded that the benefits of the tax shield depend on the term structure of interest rate. The results of studies are mixed regarding the relation of the two. Kane et al. (1985) and Stohs and Mauer (1996) find a negative relation between tax and debt maturity. The positive association of tax with debt maturity is found by some studies too (Antoniou et al., 2006; Guedes and Opler, 1996; Stephan et al., 2010). Finally, it is argued by most of the studies that taxation has no effect on debt maturity decisions (Barclay and Smith, 1995; Cai et al., 2008; Lewis, 1990; Majumdar, 2010; Ozkan, 2002; Smith and Stulz, 1985). The positive relation is expected between debt maturity and effective tax rate.

3.1.1 Theoretical Framework

Based on the literature review, the theoretical framework of the study is provided below:



3.1.2 Hypotheses

Based on the theoretical framework, the following hypotheses are formulated for empirical testing in the context of Malaysian firms:

H1: Debt Maturity is negatively related to growth opportunities.

H2: Debt maturity is positively related to firm size.

H3: Debt maturity is positively related to asset maturity.

H4: Debt maturity is negatively related to firm's quality.

H5: Debt maturity is negatively related to liquidity risk.

H6: Debt maturity is positively related to leverage.

H7: Debt maturity is positively related to tax.

3.2 Selections of Measures

3.2.1 Debt Maturity

In this study, the dependent variable is debt maturity which is defined as the ratio of long-term debt to total debt (Antoniou et al., 2006; Barclay and Smith, 1995; Cai et al., 2008; Heyman et al., 2008; Majumdar, 2010; Scherr and Hulburt, 2001; Stephan, 2010). There is no universal definition for short- or long-term debt. Some studies consider long-term debt as debt with a maturity of more than one year that reflects the result of debt decisions in the past (Antoniou et al.,

2006; Cai et al., 2008; Heyman et al., 2008; Majumdar, 2010; Scherr and Hulburt, 2001; Stephan, 2010) while others define it as debt with a maturity of more than three years (Barclay and Smith, 1995) and five years (Schiantarelli and Sembenelli, 1997). The results are qualitatively similar but the first definition is appropriate for firms operating in underdeveloped financial environment (Bloomberg defines long-term debt as any debt that is due one year from the date of balance sheet reporting). Data availability is also important in choosing the definition.

Long-term debt is calculated as total debt minus short-term debt and current portion of long-term debt. The short-term debt and current portion of long-term debt is the portion of debt payable within one year. Debt maturity ratio is defined as long-term debt divided by total debt in order to separate the debt maturity decision from the leverage decision. The debt maturity decision is more carefully focused by examining long-term debt as a fraction of total debt:

Debt maturity = Long-Term Debt / Total Debt

Three main theories of the determinants of debt maturity structure are tested in this study and where appropriate, more than one variable is used to represent different dimensions of a theory because of limitations and comparability problems associated with accounting information.

3.2.2 Growth Opportunities

Regarding growth opportunities, studies on listed firms generally use Tobin's Q as a proxy for growth opportunities. For non-listed firms, past growth in total assets and the ratio of capital expenditures over total assets is usually used as a proxy for growth. The firm's balance sheet does not include intangible assets like growth options. The firm's market value in relation to its book value is thus increased by more growth options. Smith and Watts (1992) and Graver (1993) find that the market to book ratio (Tobin's Q) is significantly associated with the firm's policy choices. So the ratio of the market value of the firm's assets to their book value is employed in this study as a proxy for growth options. The market value of the firm's assets is estimated as the book value of total assets minus the book value of equity plus the market value of equity (Antoniou et al., 2006; Barclay and Smith, 1995; Cai et al., 2008; Heyman et al., 2008; Ozkan, 2002):

Growth = (Book Value of Total Assets – Book Value of Equity + Market Value of Equity) / Book Value of Total Assets

3.2.3 Firm Size

Firm size is measured by the natural logarithm of total assets (Antoniou et al., 2006; Cai et al., 2008; Heyman et al., 2008; Stephan et al., 2010):

Firm Size = LN (Total Assets)

3.2.4 Asset Maturity

Following Stohs and Mauer's (1996) method, asset maturity is measured by the ratio of net property, plant and equipment to annual depreciation expense (Antoniou et al., 2006; Cai et al., 2008; Majumdar, 2010; Ozkan, 2002; Stephan, 2010):

Asset Maturity = Net Property, Plant and Equipment / Annual Depreciation

3.2.5 Firm's Quality

To estimate quality empirically, the firm's abnormal future earnings is used where higher-quality (undervalued) firms are assumed to have higher future abnormal earnings and lower-quality (over-valued) firms are assumed to have lower future abnormal earnings (Barclay and Smith, 1995). The abnormal earnings are defined as follow (Majumdar, 2010):

Abnormal Earnings = [EBIT (t+1) – EBIT (t)] / Total Assets (t)

3.2.6 Liquidity Risk

The ratio of the firm's current assets to current liabilities (current ratio) characterizes firm riskiness. Moreover, current ratio is usually treated as an indicator of liquidity constraints and/or an adverse measure to liquidity risk, which is interacted with the firm's debt to total assets ratio, leverage.

The liquidity risk is calculated as follow (Antoniou et al., 2006; Stephan et al., 2010):

Liquidity Risk = 1 / Current Ratio

3.2.7 Leverage

The ratio of book value of debt to book value of total assets is measured as a proxy for leverage variable (Antoniou et al., 2006; Majumdar, 2010):

Leverage = Total Debt / Total Assets

3.2.8 Effective Tax Rate

The tax shield advantage and debt maturity are inversely related. So firms prefer to issue long-term debt if the effective tax rate is low (Kane et al., 1985). Effective tax rate, which is tax shield variable, is measured with the ratio of tax paid to taxable income (Antoniou, 2006; Cai et al., 2008; Majumdar, 2010; Ozkan, 2002; Stephan et al., 2010):

Effective Tax Rate = Tax Paid / Taxable Income

3.3 Sampling Design

While sampling helps to estimate population parameters, there may be identifiable subgroups of elements within the population that may be expected to have different parameters on a variable of interest to the researcher. Data will therefore have to be collected in a manner that would help the assessment of

needs at each subgroup level in the population. The unit of analysis then would be at the group level and the sampling design that is used in this study is stratified random sampling.

Stratified random sampling, as its name implies, involves a process of stratification or segregation, followed by random selection of subjects from each stratum. The population is first divided into mutually exclusive groups that are relevant, appropriate, and meaningful in the context of the study. Tracing the differences in the parameters of the subgroups within a population would not have been possible without the stratified random sampling procedure. Stratification is an efficient research sampling design; that is, it provides more information with a given sample size.

In this study, the subjects drawn from each stratum are proportionate to the number of elements in the stratum (Proportionate Stratified Random Sampling). Once the population has been stratified in some meaningful way, a sample of members from each stratum is drawn using a systematic sampling procedure. In systematic sampling, there is a need to calculate sampling fraction that is the proportion of the total population that is needed to be selected:

Sampling Fraction = Actual Sample Size / Total Population = 1 / n

The systematic sampling design involves drawing every *n*th element in each stratum starting with a randomly chosen element between 1 and n. This sampling design is more efficient than the simple random sampling design because, for the

same sample size, each important segment of the population is better represented, and more valuable and differentiated information is obtained with respect to each group (Saundres et al., 2009; Sekaran, 2006).

3.4 Data Collection Procedure

The sample of firms and the financial data used in the study is obtained from Bloomberg database for the time period 2005-2009. Total number of firms that are listed in Bursa Malaysia (KLSE) is 968. Firms which operate in the government sector and in the financial sector such as banks, insurance companies and investment trusts and also firms operate in the utility sector such as companies providing a public service such as electricity, gas and telephone are excluded from the population. Financial and regulated firms are excluded because decisions concerning capital and maturity structure could be affected by other factors due to capital requirements and also their debt-like securities are not strictly comparable to those issued by non-financial firms. Based on the Smith (1986), governmental firms are also excluded because managers in these firms have less discretion concerning investments than do managers in non-governmental firms. The remaining number of firms is 821.

Based on the Bloomberg Industry Classification System (BICS), which is the most suitable classification for Malaysian Securities as it has named all tickers, there are 8 sectors including basic materials, communications, consumer cyclical, consumer non-cyclical, diversified, enrgy, industrial and technology.

Base on the table in research methodology book (Saunders et al., 2009, p. 219) the appropriate sample size for population size of 821 is approximately 263 at the 95% confidence level. So, 32% of members from each sector are included in the sample (263 / 821 = 0.32). That is, members represented in the sample from each sector will be proportionate to the total number of elements in the respective population. Table 3.1 shows the proportionate stratified random sampling used in this study:

Table 3.1
Population and Sample

Sector	Number of Firms	Proportionate Sampling (32% of the Firms)
Basic Materials	73	23
Communications	36	12
Consumer Cyclical	137	44
Consumer Non-Cyclical	159	51
Diversified	25	8
Energy	23	7
Industrial	300	96
Technology	68	22
Total	**821**	**263**

Systematic sampling is used to select firms from each sector. The sampling fraction is 1/3 (32%). So it is needed to select every third firms on the list of firms from each category. To start within each sector a one-digit random number

between 0 and 2 is selected. Once the first firm is determined, the sampling continues by selecting every third firms from sampling frame.

The companies that do not have complete data are ignored which means those firms which have any missing observations for any variable in the model during the period dropped. Some of the observations related to debt maturity, asset maturity, leverage, and tax variables are either outliers or inconsistent figures, which are deleted from data set. Outliers are filtered in the following way: the percentage of long-term debt over total debt and the leverage ratio could not exceed 100%. The tax variable also could not exceed 1. This procedure eliminates 3 firms. Thus, a sample of 1300 firm-year observations for 260 firms in the period from 2005 to 2009 is obtained. The panel data set is presented in Appendix A.

3.5 Data Analysis Techniques

A panel regression model is used in this study to analyze data because the present data included observations of firms over five years. By combining data in two dimensions, a cross-sectional dimension reflecting the differences between individual firms and a time series dimension reflecting changes within the firm over time, panel data gives more data variation, less collinearity among explanatory variables, more degrees of freedom and more efficiency and minimizes the bias that might result if individual observations are aggregated into broad aggregates. Panel data is better suited than cross-sectional data for

studying the dynamics of change because it can take explicit account of individual. It is also better at detecting and measuring effects that cannot be observed in either cross-section or time-series data.

The simplest way to allow each firm to have its own intercept is to create a set of dummy (binary) variables, one for each firm, and include them as regressors. However if there are a lot of groups (firms) then it becomes very tedious to create all the dummy variables needed. The time dummy coefficients can allow the regression function to shift over time to capture changes in technology, government regulation, tax policy, external influences (wars…), etc. By allowing for dummy variables, panel data reduces the risk of obtaining biased results.

Panel data models also accommodate the effects of missing or unobserved variables. This study controls for unobservable firm heterogeneity by using panel data. The estimation results could be biased when time series and cross-section studies are used because they do not control for this heterogeneity. Cornwall et al. (1990), Kumbhakar (1990) and Baltagi and Griffin (1998) all provide strong evidence of the technical efficiency of panel data models in studying economic behaviour.

The study investigates the role of firm-specific characteristics in determining debt maturity decisions of Malaysian firms by estimating the following panel regression:

$$\text{Debt Maturity} = \alpha + \beta_1(\text{Company Growth})_{it} + \beta_2(\text{Size})_{it} + \beta_3(\text{Asset Maturity})_{it} + \beta_4(\text{Quality})_{it} + \beta_5(\text{Liquidity Risk})_{it} + \beta_6(\text{Leverage})_{it} + \beta_7(\text{Effective Tax Rate})_{it} + v_i + v_t + \varepsilon_{it}$$

where subscript i shows firm i, subscript t shows the year t and β_is are the unknown parameters of interest. v_i represents time-invariant unobservable firm-specific effects, such as reputation and capital intensity; and v_t represents time-specific effects such as interest rates and demand shocks and the ε_{it} denotes the error term.

The consideration of a firm-specific time-invariant effect is allowed using panel data analysis. The analysis can be run by either a fixed-effects model or a random-effects model. Before testing the hypotheses using the above panel data, the Likelihood Ratio and the Hausman specification test is carried out to examine whether the difference between the estimators generated by random-effects regression and the estimators generated by fixed-effects regression approximates zero under then null hypothesis that the random-effects estimates are efficient and consistent, and fixed-effects estimates are inefficient to find out a suitable panel data method for the estimation of the model.

Green (2003) indicates that an important point to decide which technique is more efficient is to examine whether there are unobserved variables, and whether these unobserved variables are correlated with the observed regressors of the model. If the regression equation includes all variables, then common OLS method is appropriate. If the equation does not include all variables, and the unobserved variables are correlated with the observed variables, the best method is fixed effects. If the equation does not include all variables but the unobserved variables are not correlated with the included variables, then random effects is preferred. If H_0 (random-effects) is rejected, the conclusion is that random-effects is not appropriate because the random effects are probably correlated with one or more explanatory variables. The test has a Wald test form, and is usually reported in Chi^2 form with k-1 degrees of freedom (k is the number of explanatory variables). The statistical significance and the sign of coefficients are used to analyze the hypotheses formulated and F-statistic and its significance and R^2 value are used to judge its relevance and sufficiency.