CHAPTER 4

DATA AND RESEARCH METHODOLOGY

This chapter is divided into two main sections i.e., data and research methodology. The section one, the data, lays out the data, the procedure of data collection and sampling criteria. The importance of research data is addressed in section 4.1.1, while section 4.1.2 presents the target population. The sampling criteria and sampled *shari'ah*-complaint companies are presented and explained in section 4.1.3. Section 4.1.4 offers data sources and data collection procedure and finally, section 4.1.5 details the study variables

4.1.1 The importance of Research Data

In this modern era of research, data are considered as an important component for conducting good research (Gujarati, 2004). The study employs secondary data presented on an annual basis and covering the period from 2010 to 2017, an eight-year study period, which includes 3 years before and 4 years after the changes in financial ratio benchmark of *shari'ah*-screening methodology adopted. The study is in attempt to analyse the impact of newly and revised financial ratio benchmark on *shari'ah*-compliant companies' performance before and after its adoption in November 2013. The year 2013 was when the revised financial ratio benchmark was introduced.

The main reason for selecting this particular study period was that the *Shari'ah* Advisory Council (SAC) of the Securities Commission Malaysia used to categorise the listed *shari'ah*-compliant companies into 13 economic sectors following similar format from 2010 until November 2018, when the SAC adopted new economic sector format, which contains changes in economic sector names and increased the number of economic sectors from 13 to 14 sectors, which affected the proportion of the number of companies in each sector.

The following section addresses the target population, the sampling criteria and the sources of data.

4.1.2 The Target Population

The target population of this study is the whole number of listed Malaysian *shari'ah*-compliant firms on the main market of Bursa Malaysia (BM), which meet the requirements of the sampling criteria. This is due to the fact that the Main Market is the home of well-established and largest companies in Malaysia. The BM contains two markets namely Main market and ACE Market. Both markets list *shari'ah* and non-*shari'ah*-compliant companies, which eventually make the total number of listed companies on Bursa Malaysia. Moreover, the SACSCM is vital *shari'ah* regulatory entity that produces two semi-annual reports in May and November of every year. The two semi-annual reports provide updates on the latest status of listed *shari'ah*-compliant companies, which particularly determines if there are de-listed or newly-listed *shari'ah* companies due to failure to meet the *shari'ah*-screening requirements. As such, the population of the current study is 686 *shari'a*-compliant companies, representing 76% of total traded companies on the Main Market of Bursa Malaysia as reported in Table 4.1 (Securities Commission Malaysia, 2017).

Table 4.1 summarises the number of economic sectors, the total number of companies (*shari'ah*-and non-*shari'ah*-compliant companies), the total *shari'ah*-

compliant companies and percentage of *shari'ah*-compliant companies according to the November 2017 report of Securities Commission Malaysia.

Table 4.1 The economic sectors, total number of companies and total *shari'ah*-compliant companies based on November 2017 report

S. No	Economic Sectors	Companies as Nov2017 report	*Shari'ah* Companies as Nov2017 report
1	Consumer products	129	105
2	Industrial products	235	193
3	Mining	1	Nil
4	Construction	49	46
5	Trading/Services	218	156
6	Properties	97	74
7	Plantations	41	32
8	Technology	87	75
9	Infrastructure	4	2
10	Finance	33	2
11	SPAC	3	Nil
12	Hotels	4	1
13	Closed-end fund	1	Nil
		902	686
Percentage of *shari'ah* companies to total number of companies			76%

Source: Securities Commission Malaysia Report (November, 2017)

According to the table, the BM categorised the listed companies into 13 economic sectors. However, the *shari'ah*-compliant companies are mainly concentrated in nine economic sectors, including consumer products, industrial products, construction, trading/services, properties, plantations, technology and infrastructure, while there is a low representation for *shari'ah*-compliant companies in sectors such as finance and hotel economic sectors.

4.1.3 Sampling Criteria and Sampled *Shari'ah*--complaint companies

This study covered the whole population of listed *shari'ah*-compliant companies on Main Market of BM, which meet the requirements as the sample of the study. Here, the list of the requirements is summarised:

Firstly, a *shari'ah*-compliant firm has to meet the two-tier quantitative approach, which uses the business activity benchmarks and the financial ratio benchmarks, in determining the *shari'ah* status of the listed securities of the *Shari'ah* Advisory Council of the Securities Commission Malaysia, which classifies companies into *shari'ah*- and non-*shari'ah*-compliant companies (Securities Commission Malaysia, 2017).

Secondly, each *shari'ah*-compliant firm must be reported consistently in the list of *shari'ah*-compliant companies in every semi-annual report conducted by the SAC during the selected study period from 2010 to 2017. Therefore, if a *shari'ah*-compliant firm is delisted from only one of the SAC's semi-annual reports within the study period due to failure to meet the *shari'ah*-compliant requirements, that particular firm will be disqualified from inclusion in the sample list and thus, it will be dropped.

Finally, the study also excludes all *shari'ah*-compliant financial institutions such as Islamic banks and corporations from its sample list. This is in line with what major prior empirical studies did (Ebaid, 2009; Sheikh & Wang, 2013; Dawar, 2014). This is because financial institutions adopt different capital regulatory policies such as regulatory safety net, deposit insurance, and supervision, which make their capital structure different from those of non-financial *shari'ah*-complaint companies (Berger et al., 1995).

Due to the sampling criteria, the number of economic sectors of the current study dropped from nine to eight industries, while its target population dropped from 686 companies to 683 *shari'ah* companies. The following Table 4.2 presents the number of economic sectors and the consistently-reported *shari'ah* companies, which are the sampled *shari'ah*-compliant companies of the study.

Table 4.2 The net economic sectors and the sampled *shari'ah* companies for each sector

S. No	Economic sectors	***Shari'ah* firms- November 2017 report**	**Consistently *shari'ah*firms**	**Percentage of consistently *shari'ah* firms**
1	Consumer products	105	58	55%
2	Industrial products	193	102	53%
3	Construction	46	25	54%
4	Trading/Services	156	60	38%
5	Properties	74	20	27%
6	Plantations	32	25	78%
7	Technology	75	13	17%
8	Infrastructure (IPC)	2	2	100%
	Total *shari'ah* firms	683	305	45%

Source: The semi-annually reports of Securities Commission Malaysia

The table 4.2 reveals that the net sampled *shari'ah*-compliant companies represent 45% of total listed *shari'ah* companies on the Main Market of Bursa Malaysia according the November 2017 *Shari'ah* Advisory Council report. In addition, the following Table 4.3 displays the historical data of total *shari'ah*-complaint companies, consistently-listed on the Main Market of Bursa Malaysia and percentage of consistently- listed *shari'ah* companies out of the total *shari'ah*-complaint companies during the selected period.

Table 4.3 Historical data of total *shari'ah*-compliant companies and total consistently-reported *shari'ah* companies

SAC's Semi-annual Reports	**2010**		**2011**		**2012**		**2013**		**2014**		**2015**		**2016**		**2017**	
	May	**Nov**	**May**	**Nov**	**May**	**Nov**	**May**	**Nov**	**May**	**Nov**	**May**	**Nov**	**May**	**Nov**	**May**	**Nov**
No. of *shari'ah* firms	847	846	847	839	825	817	801	653	665	673	674	667	669	672	676	686
Consistently-listed*shari'ah* firms	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305
Source:	The semi-annually reports of Securities Commission Malaysia															

4.1.4 Data Sources and Data Collection Procedure

The database provides historical data of private and government entities. The data play a vital role in modern research. This study utilises three different databases, namely, Datastream database, Bursa Malaysia Website, Securities Commission Malaysia Website.

Firstly, the study adopts Datastream database. It is a global database, which provides huge data in finance, economics and other fields. More importantly, Datastream provides the data in a ready form, which is easy to download and run for analysis. It is the main source for most of this study's variables.

However, one of the shortcomings of Datastream database is that the database does not differentiate the proportion of interest-bearing debt from Islamic debt, instead, it puts all together under either long-term or short-term borrowing or loan category in the liability side of the balance sheet. The separation between both types of debt is a crucial to achieve the aims of the current study, which examines the effect of interest-bearing debt and Islamic debt financing on *shari'ah*-compliant companies' performance. This is the main reason that motivated the study to utilize the audited annual reports of *shari'ah*-compliant companies as a source of debt data.

Secondly, the study applies Securities Commission Malaysia's semi-annual reports as a source of data. It is a regulatory framework's entity, which provides *shari'ah* guidelines towards *shari'ah*-compliant products and services in Malaysia. The *Shari'ah* Advisory Council has produced updated semi-annual reports in May and November of each year since its establishment in 1997. The annual report addresses the latest status of listed companies in BM. This consequently assists the study to list companies that fulfill the key sampling requirements mainly to check whether the firm is reported constantly in the *shari'ah*-compliant companies' list during the study period.

Finally, the study also uses Bursa Malaysia's website to obtain the annual audited reports of the listed *shari'ah* companies on BM, which is the main source of the separated historical data of interest-bearing debt and Islamic debt. Moreover, the Bursa Malaysia website is a platform that contains and publishes the audited annual reports of the listed companies. Bursa Malaysia categorizes the listed companies into *shari'ah* and *non-shari'ah* companies by labeling the remark (S) on the name of the firm, which indicates the firm is a *shar'ah*-complaint firm, but if there is no such (S) against the firm's name, it is an indication of a non-*shari'ah*-complaint firm.

Technically, in terms of getting the separated debt data, the study refers to the balance sheet/financial position statement for each firm to obtain the separated interest-bearing debt from Islamic debt data. However, looking at a balance sheet statement of any firm does not provide full details because companies invariably do not separate the two types of debt at this stage and instead, put both either under short-term or long-term borrowing or loan category in the liability side of the balance sheet statement of a *shari'ah*-compliant firm. However, it is important to note that on the balance sheet page, there are various notices offering numbers for certain items in the balance sheet statement and then, the researcher has to follow the provided notices in the balance sheet, which leads to the financial note section. This section then provides more details about the noted item in the balance sheet statement, including the borrowing and loan items, which are crucial to determine the proportion of interest-bearing debt from Islamic debts' figures.

By following these types of notices, the study has managed to collect the separated interest-bearing debt data and Islamic debt data. This alone can be considered as one of the remarkable contributions of the current study.

The following Table 4.4 summarises the commonly-used Islamic debt instruments in the financial note section of *shari'ah*-compliant companies' annual reports, which in part assists the study to collect separated interest-bearing debt data from Islamic debt data.

Table 4.4 Summary of the common Islamic debt financing Instruments

No. Items	**Short-term Islamic debt financing instruments**	**Long-term Islamic debt financing instruments**
1	*Sukuk Ijarah* MTN	*Bai'Bithaman Ajil* Facility
2	*Bai' Bithaman Ajil*	*Bai' Bithaman Ajil* Islamic Debt Securities
3	Islamic Financing	*Murabahah* medium term notes
4	Islamic facility	Islamic Financing
5	Sukuk Ijarah Bonds	Islamic Securities (*Sukuk*)
6	*Al-Istisna* Bonds/*Sukuk* Medium Term	*Sukuk Musyarakah* Medium Term Notes
7	Islamic Debt Securities	*Sukuk Murabahah*/Islamic Medium Term

Source: Audited Annual reports of *shari'ah*-compliant companies

4.1.5 Study Variables

The study employs three types of variables, namely, dependent, independent, and control variables. This is partly to facilitate the study in achieving its objectives, which are to assess the impact of total Islamic leverage and interest-bearing debt and Islamic debt ratios on the consistently listed *shari'ah*-compliant companies' performance and to investigate further the optimal level of total Islamic leverage for consistently listed *shari'ah*-compliant companies.

4.1.5.1 Dependent Variables

The study adopts accounting-based performance measurements as a dependent variable. The study particularly employs ROE and ROA following the previous empirical studies (Brooks, 2016, Brealey, Myers & Marcus, 2018, Damodaran, 1997, Usman & Yakubu, 2019, Dalci, 2018, and Moussa, 2019). This is because, the study attempts to concentrate solely on the accounting performance analysis in order to measure the effects of interest-bearing debt ratios and Islamic debt ratios on consistently listed *shari'ah*-compliant companies' performance in Malaysia.

4.1.5.2 Independent Variables (IVs)

The study uses seven debt proxies namely short-term interest-bearing debt, long-term interest-bearing debt, total interest-bearing debt, short-term Islamic debt, long-term Islamic debt, total Islamic debt and total Islamic leverage, which contains both types of debt ratios (Sheikh & Wang, 2013; Ebaid, 2009; AND Salim & Yadav, 2012). This is partly to meet the specific characteristics of this study's sample requirements and its objectives, which are to investigate separately the effect of interest-bearing debt ratios and total Islamic debt ratios on the performance of consistently listed *shari'ah*-compliant companies and to examine further the optimal Islamic leverage level for consistently listed *shari'ah*-

compliant companies on the Main Market of Bursa Malaysia. Table 4.5 below presents the DV and IVs of this study.

Table 4.5: Summary of Dependent and Independent variable Names, Symbols, Definitions, References and Expected Signs

D. Variables	**Symbols**	**Definition**	**Sources**	**Expected Sign**
Return on equity	ROE	Net income to total equity. It is computed as Income before tax for the fiscal year divided by the total equity.	Thomson Reuters EIKON with Datastream	Dependent
Return on assets	ROA	Net income to total assets. It is computed as income before tax for the fiscal year divided by the average total assets for the same period.	Thomson Reuters EIKON with Datastream	Dependent
Short-term interest-bearing debt	STIBD	Short-term interest-bearing debt to total assets	Self-Constructed	+
Long- term interest-bearing debt	LTIBD	Long- term interest-bearing debt to total assets	Self-Constructed	+
Total interest-bearing debt	TIBD	Total interest-bearing debt to total assets	Self-Constructed	+
Short-term Islamic debt	STID	Short-term Islamic debt to total assets	Self-Constructed	+
Long-term Islamic debt	LTID	Long-term Islamic debt to total assets	Self-Constructed	+
Total Islamic debt	TID	Total Islamic debt to total assets	Self-Constructed	+
Total Islamic leverage	TIL	Total debt (interest-bearing debt + Islamic debt) to total assets	Self-Constructed	+

4.1.5.3 Control Variables (CVs)

The study applies some control variables (CVs) namely account payable, current ratio, assets turnover, growth, firm size and time dummies. The time dummy measures the impact of time effects on the performance of consistently listed *shari'ah*-compliant companies.

Table 4.6 provides a summary of CVs, symbols, definitions, references and their expected signs.

Table 4.6 Reports of control variable names, symbols, definitions, references and expected sign

Variable	**Symbol**	**Variable Definition**	**Reference**	**Exp. Sign**
Account Payable	AP	The ratio of accounts payable to total assets	Yazdanfar and Öhman (2015)	+
Current ratio	CR	Current assets to current liabilities.	Mishra and Dasgupta (2019), Khasawneh and A. Dasouqi (2017), Haron (2016) and Dawar (2014)	+
Asset Turnover	AT	The amount of revenue generated for each unit of assets. It is computed as primary revenue for the fiscal year divided by the average total assets for the same period.	Thomson Reuters EIKON with Datastream	+
Growth	Grwth	Percentage change in sales	Ahmed and Afza (2019), Chakrabarti and Chakrabarti (2019), Dalci (2018) and Moussa (2019).	+/-
Firm size	LSIZE	Natural Logarithm of total assets	Vieira (2017), Tarus and Ayabei (2016) Haron (2016)	+
Time dummies		It has a value of 1 for after 2013 and 2 for before 2013	Yazdanfar and Öhman. (2015) and Asimakopoulos et al., 2009)	+/-
Year dummies	T-DMIES	It has a value from 1 to 8 representing number of study years	Yazdanfar and Öhman. (2015) and Asimakopoulos et al., 2009)	+/-

4.2 Research Methodology

The aim of this section is to develop a method, which measures the effects of total Islamic leverage and interest-bearing debt ratios and Islamic debt ratios on consistently listed *shari'ah*-compliant companies' performance and it also examines further the optimal level of total Islamic leverage in debt-equity structure of consistently listed *shari'ah*-compliant companies at which a firm can maximize its performance.

Section 4.2.1 presents the advantage of panel data analysis, while panel data analysis procedures are discussed in Section 4.2.2. Section 4.2.3 reports types of panel data models. Test of hypothesis, specification tests and serial correlation are discussed in Section 4.2.4. Section 4.2.5 presents the regression threshold model. Section 4.2.6 reports the applied software for data analysis. Finally, Section 4.2.7 provides the chapter summary.

4.2.1 Advantage of panel data analysis

Econometric analysis is the most used method in economic and finance studies (Lei, 2006). Three forms of data are involved in econometric analysis, namely, cross-sectional, time-series and panel data. The panel data analysis is considered the most suitable approach for this study, which examines the repeated cross-section of observations for *shari'ah*-compliant companies over a period from 2010 to 2017.

Here are some benefits of using panel data. First, panel data models are able to consider a higher level of heterogeneity that characterises individuals, regions, firms, etc. over time (Hsiao, 2003, and Lei, 2006). This is achieved by utilising one-way or two-way analysis for controlling the individual- and time-invariant variables whereas a time-series study or a cross-sectional study is unable to do so. As such, time-series and cross-sectional studies not controlling this heterogeneity are at risk of obtaining biased results (Baltagi, 2005, and Lei, 2006).

Second, panel data give more informative data, are more variable, with less collinearity among the variables, offer greater freedom and higher efficiency (Baltagi, 2005). Time-series studies invariably suffer from multicollinearity. For instance, Baltagi and Levin (1992) studied the demand for cigarettes in the USA for 46 states from 1962-1992, and reported high collinearity between price and income in the aggregate time series for the USA. This is less likely with a panel across American states since the cross-sectional dimension adds a substantial variability with the addition of more informative data on price and income. Therefore, the changes in the data can be separated into differences between states of varying sizes and characteristics, and variances within states. The former variation is typically more significant. With more informative data, it is possible achieve more reliable parameter approximations. Besides, through the combination of time-series of cross-sectional observations, panel data can considerably increase the number of observations.

Third, panel data can offer higher detection rates and measuring effects that are not observable in pure cross-sectional data (Hsiao, 2003). A clear example of this is provided by Ben-Porath (1973): Assume that in a cross-section of married women, 50% are working. There are at least two clear explanations for this: either each woman in a homogeneous population has a 50% chance of work in any one year or 50% of women in a heterogeneous population always work and 50% never work. The policy implications differ depending on which phenomenon is correct. In the first case, there is significant labour market turnover among married women; in the second instance no turnover exists the availability of individual labour force histories over time can facilitate the discrimination between these two clear explanations. As such, causal effects can be better perceived from panel data analysis (Lei, 2006).

Finally, it is possible to use panel data, under certain assumptions, to derive consistent estimators when omitted variables are present (Wooldridge, 2002). These omitted or unobserved variables are normally included in the error term when employing cross-sectional data. If there is correlation of the omitted or unobservable variables with DVs, then Ordinary Least Squares (OLS) will give biased estimates (Lei, 2006). This is a recurrent issue encountered by researchers who merely possess cross-sectional data. Should panel data on individuals be accessible to over time, the issue could be addressed.

However, there is a technical issue in relation to the usage of panel data, which is the selection of a suitable model within the three panel models due to the level of homogeneity of the intercept and slope coefficients and the degree to which any individual cross-sectional effects have a correlation with the explanatory variables (EVs) (Song & Witt, 2000, and (Lei, 2006). To solve over this problem, this is a testable assumption that will be the focus of the following section.

4.2.2 Panel Data Analysis Procedures

This Sub-section introduces and discusses the approaches in panel data analysis, one-way Vs. two-way Error Component Model. A panel data regression is different from a regular time-series or cross-sectional regression as it has a double subscript on its variables (Baltagi, 2005) and (Lei, 2006). This can be presented from the classical linear regression model (4.1):

$$Y_{it} = \alpha + X'_{it}\beta + \mu_{it} \quad (4.1)$$

where:

i denotes the cross-sectional dimension, e. g., regions, countries, companies, and t also time-series dimension, namely, years, and quarters.

α = a scalar,

ß = K×1vector and

X'_{it} = the itth observation on K explanatory variables.

μ_{it} = the disturbance term (Lei, 2006).

The majority of the panel data applications utilise a one-way error component model for the disturbance, with

$$\mu_{it} = \mu_i + V_{it} \quad (4.2)$$

where:

V_{it} = the remainder disturbance.

μ_i = time-invariant, accounting for any individual-specific effect that is excluded from the regression. In this case we could think of it as the individual's unobservable ability.

The remainder disturbance V_{it} varies with individuals and time and can be thought of as the usual disturbance in the regression (Lei, 2006).

Otherwise, the error term can be treated with two-way error components disturbances:

$$\mu_{it} = \mu_i + \lambda_i + V_{it} \quad (4.3)$$

where:

μ_i and $\mu_{it}$are defined the same as in (4.2).

λ_i = the unobservable time effect.

Here λ_i is individual-invariant and it accounts for any time-specific effect that is excluded from the regression.

4.2.3 Types of Panel Data Models

In principle, "a panel data model can be estimated in three ways, depending on whether the individual cross-sectional effects are considered to be constant, fixed or random." These are explained in the following section.

4.2.3.1 Pooled OLS

Replace 4.1 with 4.2, we get:

$$Y_{it} = \alpha + \mu_i + X'_{it}\beta + V_{it} \quad (4.4)$$

Or in the case of two-way error component model, we get:

$$Y_{it} = \alpha + \mu_i + \lambda_i + X'_{it}\beta + V_{it} \quad (4.5)$$

Assume the term $\alpha + \mu_i$ in (4.4) or $\alpha + \mu_i + \lambda_i$in (4.5) is constant; there is neither significant individual nor significant time effects. OLS offers consistent and efficient estimates of the homogenous intercept and slope.

As such, this model is invariably referred to as “the pooled OLS” (POLS). The attraction of the POLS model is in its ease of estimation and interpretation as it is possible to pool all of the data and run an OLS regression model (Lei, 2006).

On the other hand, the unit-specific effects are the same in POLS, which is highly restrictive and typically unrealistic. Hsiao (2003: 20) cautioned that "unless both cross-sectional and time-series analyses of covariance indicate the acceptance of homogeneity of regression coefficients, unconditional pooling (i.e., a single least-squares regression using all observations of cross-sectional units through time) may lead to serious bias".

4.2.3.2 Fixed Effects Model

If μ_i in model (4.4) or $\mu_i + \lambda_i$ in model (4.5) differs based on the cross-sectional unit but is assumed to be fixed parameters to be estimated, the disturbance term V_{it} is independent and similarly spread; and the X'_{it} are assumed to be independent of the V_{it} for all i and t, it is called “the fixed effects” (FE) model or “least square dummy variable” (LSDV) model (Lei, 2006).

The construction of the FE model is based on the assumption that variances across units can be captured in differences in the constant term (Greene, 2003). Each μ_i or $\mu_i + \lambda_i$ is designed as an unknown parameter to be estimated. Under such circumstances, OLS estimation of the model will produce biased estimators. However, according to Lee (2006), “This issue can be addressed by either first-differencing the variables or, differencing them by cross-sectional-specific means.”

Baltagi (2005) maintained that “The FE model is an appropriate specification if we are focusing on a specific set of N firms or regions and our inference is restricted to the behaviour of these sets of firms or regions”. “Inference in this case,” stated Lee (2006) “is conditional on the particular firms or regions that are observed”.

Lee (2006) explains: “The benefit of fixed effects inference is that there is no need to assume that the effects are independent of X_{it}. It allows the unobserved individual effects to be correlated with the included variables. The drawbacks are that the FE model suffers from a large loss of degree of freedom as we are estimating (N-1) extra parameters, and too many dummies may aggravate the problem of multicollinearity among the regressors”. Besides, the researcher says: “In addition, this FE estimator cannot estimate the effect of any time-invariant variable like location. These time-invariant variables are wiped out by the deviations from means transformation”.

4.2.3.3 Random Effects (RE) Model

Different from the fixed effects model, where inferences depend on the particular cross-sectional units sampled, a substitute method is the RE model. Based on the RE assumptions, μ_i or $\mu_i + \lambda_i$ has no correlation with X_{it}. Therefore, OLS is asymptotically unbiased but suffers from inefficiency in comparison with feasible generalised least squares (FGLS) (Lei, 2006).

According to Hsiao (2003), “the RE model is an appropriate specification if n, cross-sectional units are randomly drawn from a large population. Furthermore, it can be shown that a random effects specification implies homoscedastic disturbances variance, VAR (μ_{it}) = $\sigma_\mu + \sigma_V$ for all i, t, and serial correlation only for disturbances of the same cross-sectional unit".

The benefit of random-effects inference is that the fixed number of parameters, from which efficient estimation approaches can be obtained. The drawback is that there is a need to specifically assume the pattern of correlation (or no correlation) between the effects and the included EVs (Hsiao, 2003, and Lei, 2006).

4.2.4 Tests of Hypotheses

Following the presentation of the three types of panel data models, the next sub-section introduces and discusses the specification tests.

4.2.4.1 Poolability Test

Chow F test can be done to differentiate the POLS and FE models. Breusch and Pagan LM Test also can be utilised to differentiate POLS and RE models.

Chow F Test can be used to test the joint significance of the included fixed effects parameters. Under the null hypothesis of equality, the efficient estimator is POLS. Based on Greene (2003), the Chow F ratio used for this test is:

$$F(n-1, nT-n-K) = \frac{(R2_{FE} - R2_{POLS})/(n-1)}{(1-R2_{FE})/(nT-n-K)}$$

where" $R2_{FE}$ and $R2_{POLS}$ are the residual sums of squares of the FE and POLS models, respectively, (n-1) and (nT-n-k) are the degrees of freedom, the total number of observations are NT. If the calculated value of F is smaller than the critical value, the null hypothesis of equality is accepted. Rejecting the null hypothesis is in favour of either individual specific effect (i. e., Ho: μ_1 = μ_2= ... μ_{N-1}= 0) or time-period effect (i. e. Ho: λ_1= λ_{2i}=... = λ_{N-1}= 0) (Lei, 2006).

With regard to the random error component model, Breusch and Pagan (1980) created a Lagrange multiplier (LM) test for testing Ho: $\sigma 2_{\mu}$ =0 or Ho: $\sigma 2_{\lambda}$=0 for one-way or two-way model. Under the null hypothesis LM is disseminated as chi-squared with one degree of freedom. Accepting the null hypothesis implies that the classical regression model with a single constant term is suitable for the data and the model, i.e., the model can be estimated by POLS. Rejection of the null hypothesis, then, is favourable for the RE model. On the other hand, even under such circumstances, it still cannot be concluded that the model has random effects due to the existence of another competing model, i.e., FE (Lei, 2006).

4.2.4.2 Specification Tests

Normally, a Hausman test is used for testing between RE and FE (Hausman, 1978). Let $\beta^\wedge{}_{FE}$ and V ($\beta^\wedge{}_{FE}$) signify the FE estimator and its covariance matrix and likewise for the RE estimator, $\beta^\wedge{}_{RE}$E with V ($\beta^\wedge{}_{RE}$). If the RE model is correct, $\beta^\wedge{}_{RE}$ shows consistency and efficiency, thus V ($\beta^\wedge{}_{FE}$) >V ($\beta^\wedge{}_{RE}$). Let q =$\beta^\wedge{}_{FE}$-$\beta^\wedge{}_{RE}$. Under the null hypothesis, it follows that cov (=$\beta^\wedge{}_{FE}$-$\beta^\wedge{}_{RE}$)=0. This is because if $\beta^\wedge{}_{RE}$is efficient it is not possible to reduce its variance and, if it is correlated with =$\beta^\wedge{}_{FE}$, which can be used to reduce its variance. The variance of the difference is:

$V(q^\wedge = V(\beta^\wedge FE) - V(\beta^\wedge RE)$ (4.7)

According to Lei (2006), "If the individual effects are not random but correlated with the X_{it} then the RE estimates are inconsistent, however, the FE estimates remain consistent, because the FE model admits any degree of correlation between α_i and X_{it}".

The Hausman test statistic is:

$H = q'[V(q')]^{-1}q \sim \chi^2(\mathrm{K})$ (4.8)

The Hausman test scrutinises if there is substantial correlation between the unobserved individual-specific random effects and the regressors. Under the null hypothesis, that μ_i or λ_t is not correlated with X_{it}, the Hausman test statistic is disseminated asymptotically as chi-squared with K degree of freedom.

The RE and FE models show consistency but the RE model is more efficient. If the computed value exceeds the critical value, this indicates that the RE model lacks inconsistency and the FE model would be the model preferred (Lei, 2006).

However, there are two concerns pertaining to the Hausman test. Firstly, the results of the test could be biased in small samples (Baltagi, 2005), and consequently, it is a possibility that the RE with the differences between the RE and FE estimates being practically small could be statistically rejected. Then, a characteristic response is to conclude the random effects assumptions hold and to focus on the RE estimates (Wooldridge, 2002).

The second concern is that the Hausman test relies on the difference between two separately estimated covariance matrices being positive definite. In practice, the difference is not always positive 'definite, which can vary significantly cause distortion to the estimation of the Hausman test. This issue can be addressed by using the Mundlak model. Mundlak (1978) described the random-effects formulation as he claimed that it neglected the correlation that could exist between unobserved individual effects and the EVs. There also appears to be justification to believe that in several circumstances that unobserved individual effects and the EVs are in fact correlated. Mundlak (1978) maintained that to ignore this correlation could results in biased estimation. In light of this idea, he described a model known as the "Mundlak model"as shown below:

$$Y_{it} = \alpha + \beta\chi_{it} + A\bar{X}_i + \mu_i + V_{it}$$

The Mundlak model is also an error component model, similar in form as model (4.1), but adds the variable $A\bar{X}_i$, which is the mean of EVs and only varies over individuals. A simple F test of the significance of the means can be carried out following the Mundlak model. If the test is significant, excluding mean value may yield a biased estimation. Thus, the importance of the test favours FE model over RE model as RE model estimations can lack consistency (Lei, 2006).

4.2.4.3 Serial Correlation Test

Serial correlation is a critical assumption that has an association with disturbance term in the error component model. When the assumption is breached, the estimations of the regression coefficients remain unbiased and consistent, but lack efficiency (Drukker, 2003, and Baltagi, 2005). This can be prevented by running Wooldridge's test for serial correlation, which is very appealing as it does not require many assumptions and offers ease of implementation (Drukker, 2003).

4.2.5 Threshold regression

This sub-section addresses the optimal level of total Islamic leverage ratio at which the *shar'iah* firm may maximise its performance level, which is the third objective of this study. As stated in chapter two, the TOT states that "companies seek a debt level that balances the tax advantages of additional debt against the cost of possible financial distress" (Myers, 2001). This is to achieve the optimal debt-equity ratio, at which the benefits of debt against financial distress costs are balanced (Myers, 1984).

Thus, this study examines whether there is a threshold ratio at which a *shar'iah* firm may maximise its performance. Therefore, this study applies threshold regression model. The threshold regression models have witnessed a rapid growth since Tong and Lim and Tong' papers in 1980 and 1983. It is a linear regression. It is designed to allow coefficients to differ across regions (Wang, 2015). Those regions are identified by a threshold variable being above or below a threshold value. This study uses total Islamic leverage as threshold variable to capture the relationship between total Islamic leverage and *shar'iah*-compliant companies' performance. Thus, the study formulates two single threshold models with two regions:

Model 1: Return on equity and total Islamic leverage:

$$ROE_t = \beta + Z_t\delta_1 + \varepsilon_t \text{ if } TIL_t \leq \gamma$$

$$ROE_t = \beta + Z_t\delta_2 + \varepsilon_t \text{ if } TIL_t > \gamma$$

Model 2: Return on assets and total Islamic leverage:

$$ROA_t = \beta + Z_t\delta_1 + \varepsilon_t \text{ if } TIL_t \leq \gamma$$

$$ROA_t = \beta + Z_t\delta_2 + \varepsilon_t \text{ if } TIL_t > \gamma$$

where: ROE_t and ROA_t are the dependent variables, β is $K \times 1$ vector of region-invariant parameters, while, Z_t represents the independent variables namely total Islamic leverage, account payable, current ratio, asset turnover, growth and firm size. TIL_t is threshold variable and it is one of the IVs; ε_t is the error and β, $\delta_1$and δ_2 are coefficients.

4.2.6 The adopted software for data analysis

The thesis applies Stata 16 software as the main data analysis tool. It is adopted to produce the descriptive statistics, specification tests and threshold regression. Xtreg is the major command to run the panel data analysis namely pooled OLS, random and the fixed effects models.

4.2.7 Chapter Summary

This chapter was divided into two sections. Section 4.1 discussed the study sample and sampling criteria, the sources of data and the general procedure followed for data collection and study variables. Section 4.2 presented research methods, namely, panel data analysis and hypotheses, specification, and serial correlation tests, threshold regression model and software of analysis.