CHAPTER 5

METHODOLOGICAL ISSUES

5.1 INTRODUCTION

The previous chapter formulated hypotheses in relation to the research problem. These hypotheses need to be tested with an appropriate choice of methodology. There are several caveats that must be borne in mind, particularly with the dating of financial liberalisation and the use of the appropriate measures of leverage. These problems provide research design challenges, especially with the issue of gradual financial liberalisation. Before testing the hypotheses, it is necessary to provide a methodological background that clarifies these issues.

5.1.1 Goal of this chapter

The goal of this chapter is five-fold; firstly, to identify the techniques used in the dating of financial liberalisation. Secondly, to recommend a suitable dating approach for financial liberalisation. Thirdly, to elaborate on the different measures of leverage used in the existing literature. Fourthly, to recommend the most appropriate measures of leverage for this study. Finally, to define the different variables to be used in the study.

5.1.2 Layout of this chapter

The rest of this chapter is organised as follows; Section 5.2 focuses on the dating and identification of the appropriate dates of financial liberalisation in South Africa. Section 5.3 identifies the measures of leverage and recommends the suitable measures for this study. Section 5.4 defines the variables used in the analysis. Section 5.5 concludes the chapter.

5.2 THE DATING PROBLEM

Chapter three of this study dealt briefly on the financial liberalisation dates used by different authors in various studies relating to financial liberalisation. This section addresses another aspect of the dating problem. This aspect emphasises on the challenges and techniques used in the dating of financial liberalisation.

5.2.1 Challenges in dating financial liberalisation

The establishment of an appropriate date provides a benchmark to work with in determining the effects of financial liberalisation on the capital structure of firms. In establishing the appropriate date, it is important to note that there are two aspects associated with the dating of financial liberalisation. These are regulatory and effective liberalisation dates respectively. Regulatory liberalisation occurs as a result of a policy decree by government. On the other hand, effective liberalisation is the actual liberalisation which results in market integration.

The main challenge regarding this is that the actual date of financial liberalisation may occur well after the regulatory date. Conversely, the actual date may occur before the regulatory date. Makina and Negash (2005b: 62) caution that structural breaks in stock market data can occur before the official liberalisation. This is because investors can circumvent controls through country funds or depositary receipts. Structural breaks may also occur before the official liberalisation date due to anticipation by investors that restrictions would eventually be removed.

Another intriguing aspect to the dating problem relates to the gradual nature of financial liberalisation. Studies that utilise the event study method rely on a given benchmark date. This is specifically effective when the cut-off date is known. It may thus not be appropriate when the liberalisation occurs in a series of gradual events or reforms.

To complicate the problem further, the process of financial liberalisation is usually accompanied by a series of multifaceted reforms. In the case of corporate

announcements, information is guarded and little is known about the particular announcement, thus making it easier to date the event of financial liberalisation. It becomes difficult to guard against liberalisations effected by government as information about the event is anticipated. The event study approach may therefore have limited statistical power to detect the true impact of the financial liberalisation.

5.2.2 The techniques used to date financial liberalisation

Henry (2000a: 533) lays out three specific guidelines that may be followed to establish the effective cut-off date. The first guideline is liberalisation by policy decree. The second guideline is the date of the establishment of the first country fund, and the third being an increase in the International Finance Corporation's (IFC) investability index by at least 10 percent. His study of twelve emerging economies utilises the policy decree approach, and in the absence of the first approach, the latter two alternatives are used.

Given the multifaceted nature of reforms, Bekaert, Harvey and Lundblad (2003: 55) acknowledge that the establishment of a cut-off date is purely a matter of judgement. The intuition behind this is that, firstly, the investment constraints that are prevalent in the pre-liberalisation regime may not be binding. Secondly, the implementation of regulatory changes is a gradual process. Thirdly, despite stock market integration, foreign investors are often subjected to liquidity costs associated with the shares in emerging markets.

Edison and Warnock (2003: 84) propose the use of the ratio of market capitalisation represented by the IFC Investable Indices to the market capitalisation represented by the IFC Global Indices. This ratio is argued to be more appropriate for emerging markets because it allows for the gradual integration and the inclusion of several liberalisation dates. Kaminsky and Schmukler (2008: 263) construct an index of financial liberalisation, which ranges from 1 (fully liberalised) to 3 (repression). They track this index over the period of financial reforms for a sample of emerging and mature markets.

5.2.3 The dating approach used in South African studies

When the actual liberalisation date is not well known, time series analysis techniques such as the ones utilised by Bai, Lumsdaine and Stock (1998: 395) could be used to determine whether there was a structural break in the stock market data. Bekaert *et al.* (2002a: 203) follow this approach in order to determine the breaks of several proxies to the dependent variable. They conclude that endogenous break dates occur later than exogenous break dates, thus ruling out the possibility of expectations. However, Makina (2005: 77) argues that this was not the case in South Africa, as there was a great deal of expectations regarding financial liberalisation. In South Africa, five possible structural breaks could have occurred when the following events took place;

- Political liberalisation in 1990,
- The lifting of economic sanctions in 1992,
- The ushering in of democracy in 1994,
- The abolishing of the dual exchange rate in 1995, and
- The gradual exchange control relaxations of the late 1990s to early 2000s.

Brooks, Davidson and Faff (1997: 259) examine the impact of South African economic developments on stock market volatility and they use February 2, 1990, the date when the ANC was unbanned, as a benchmark date for financial liberalisation. The authors find a greater integration with the international equity markets in the period after 1990. This can be attributed to the market's anticipation for the effective liberalisation of the JSE. The study by Bekaert, Harvey and Lundbland (2001: 469) uses 1992, when most economic sanctions were lifted. This date is justified because the authors examine real economic effects of financial liberalisation. Fuchs-Schundeln and Funke (2003: 757) test the financial and macroeconomic implications of stock market liberalisation for 27 countries and they use March 1995 for South Africa, the official liberalisation date of the JSE.

Makina and Negash (2005b: 61) test for structural breaks in the cost of capital variables around the two dates provided by Fuchs-Schundeln and Funke (2003: 730) and Brooks *et al.* (1997: 255). They include 1992 as the third date in their analysis. This date was

formally proposed by Bekaert *et al*. (2001: 465). This date was chosen because by the end of 1992, most economic sanctions on South Africa were lifted. To detect structural breaks around the three dates, they utilise the Chow test and the Broken Trend Stationary (BTS) test formalised by Perron (1989: 1361). They confirm significant structural breaks in stock market data for February 1990 and December 1992. Ironically, no structural break is detected for March 1995, the official liberalisation date of the JSE. Makina and Negash (2005b: 61) conclude that political and economic policy concerns were significant determinants of stock market liberalisation compared to direct legal barriers. This finding suggests that there was much anticipation for the full opening of the JSE, following major political developments in the early 1990s.

Once the structural breaks are identified, the period before the break can be analysed separately from the period after the break. Makina and Negash (2005a: 150) identify the pre liberalisation regime as the period before February 1990 and the post liberalisation regime as the period after December 1992. The period in between February 1990 and December 1992 is considered as the window period.

Loots (2003: 218) examines whether trade and financial liberalisation benefits economic growth in emerging economies, particularly in South Africa. The study incorporates progressive dummy variables that capture the six main dates when exchange controls in South Africa were relaxed. These dates range from March 1995, when the dual exchange rate system was re abolished, to March 2001 when the limit to new investment for residents was increased. This limit was increased to R750 million for investments into Africa and R500m for investments into the rest of the world.

5.2.4 The dating approach followed in this study

The insights discussed in the preceding section serve as eye openers in the quest to solve the dating puzzle. However, the dating issue is somewhat unresolved, principally because a static and segmented model forms the basis for some of the studies discussed. Nonetheless, the dynamic nature of integration has been captured by other studies

thereby rendering the focus on a single break date to be less reliable. Hence, this study focuses on capturing some of the gradual aspects of financial liberalisation in South Africa.

From the discussion in Sections 3.5 and 5.2.2, it appears that the actual dates of financial liberalisation in South Africa lie between 1989 and 1996. From this observation, it follows that the choice of date is dependent on the nature of the study. This study focuses on the removal of restrictions on more than one sector of the economy. Hence, it is necessary to include several financial liberalisation dates.

The regime dummy variable technique is used to determine structural breaks in the coefficients during the period of financial liberalisation. These techniques are applied for 1993 and 1995. It is assumed that the removal of sanctions by the end of 1992 could have initiated a structural break in regression parameters in the following year; hence, 1993 is chosen as a possible break date. The year 1995 is also chosen because of the opening up of the JSE to allow inward and outward investment.

Although Makina and Negash (2005b: 61) fail to detect a structural break in the cost of equity capital data, it is advisable to test for structural breaks for firm determinants of capital structure around this date. This is mainly because the political and economic events leading to the opening of the JSE in 1995 could have affected corporate financial policy.

The year 1993 is used as a possible date for the lifting of international sanctions. Dummy variables are used to capture the effects of the lifting of international sanctions on the capital structure variables. The value of one is used for the year 1993 going forward and zero otherwise. Domestic financial sector liberalisation is captured through the identification of post-apartheid deregulation of reserve requirements. It is not necessary to include the dates for the deregulation of interest rate and credit ceilings, because these reforms were mainly implemented prior to the 1985 debt standstill. This study examines the period after the 1985 debt standstill.

There are three notable dates associated with the decrease in reserve requirements. These are February 1991, when the basic requirement on short term liabilities was lowered from 5 percent to 4 percent. In April 1993, a subsequent decrease to 3 percent was effected and in April 1998 when the requirements were simplified to include a 2.5 percent rate on total liabilities[10].

The date of stock market liberalisation is identified as 1995, the year the JSE was officially liberalised. To capture the effects of stock market liberalisation, a dummy that takes on the value of one is used for the period from 1995 going forward and zero otherwise. The years 1995, 1997 and 1998 are used to estimate the impact of capital account liberalisation on firm capital structure.[11] These dates represent the years when exchange controls were relaxed. Following Loots (2003: 218) a progressive dummy variable is created. This variable takes on the value of zero for the period before 1995, and increases by 0.5 for each subsequent exchange control relaxation.

The individual firm's access to international markets is also captured by the use of dummy variables. These variables take on the value of 1 for firms that have participated in international equity issues and zero otherwise. Therefore each firm that participated in international equity issues is considered in the regression model.

5.3 THE LEVERAGE MEASUREMENT PROBLEM

The use of the appropriate measure of leverage has been a contentious issue. On this note, Green *et al*. (2003: 247) identify four key issues that have been the subject of debate. Firstly, whether to use aggregate sector accounts or individual firm balance sheet data. Secondly, whether to use firm balance sheet data or flow of funds data. Thirdly, whether to use book or market values of leverage ratios. Finally, if the flow of funds approach is used, the question is whether to use gross or net flows.

[10] See Nel (2000: 71) for a detailed discussion on the minimum reserve requirements
[11] For a detailed discussion on these dates, see section 1.3.3

5.3.1 The objective of the analysis

Rajan and Zingales (1995: 1427) advise that the appropriate measure of leverage depends on the objective of the analysis. For example, if the objective is to study the maturity structure of debt, the ratio of short term debt to total debt may be more suitable. If the objective is to assess firms' reliance on internal funds, the appropriate measure would be the ratio of retained earnings to total liabilities.

Corbett and Jenkinson (1996: 76) argue that the flow of funds approach is more suitable than balance sheet data for international comparisons. The plausible explanation for this argument is that the flow of funds data addresses how financial markets have performed in funding investments. In light of this argument, Cobham and Subramaniam (1998: 1036) observe that international comparisons have utilised the flow of funds approach.

Because this study focuses on a single country (South Africa), the use of balance sheet data is adequate. Analysis of data at the firm level provides reliable insights, which may not be captured at the aggregate level. Schmukler and Vesperoni (2001: 4) contend that balance sheet data allow inter firm comparisons within the same macro economic framework. This micro analysis can help explain how individual firms' access to international equity markets affects their capital structure. Schmukler and Vesperoni (2006: 185) further advise that if markets are segmented, financial liberalisation may open opportunities only for some firms. The changes in capital structure for firms with and without access to international markets may not be captured effectively by a market level analysis.

The broadest measure of leverage is the ratio of total liabilities to total assets. Rajan and Zingales (1995: 1428) caution that this ratio may overstate leverage, simply because the amount for total liabilities includes accounts payables, which may be used for transactions rather than financing purposes. Again, the appropriate measures of leverage depend on the object of the study. In this study, several measures of leverage are studied, principally because the study explores the effect of financial liberalisation on capital structure in a broad sense. Following Bhaduri's (2002: 418) argument that different measures of

leverage may respond differently to the reform process, the behaviour of various combinations of leverage ratios should be examined. This argument is cemented by Bevan and Danbolt (2002: 159) who contend for a detailed examination of most forms of corporate debt.

5.3.2 Book versus market value ratios

Having established the appropriate measures of leverage, it is important to draw a distinction between the use of book and market values as reliable measures of leverage. Corporate finance literature advocates the use of market values in determining the capital structure of firms. The question is whether market values provide an accurate measure of the firm's financial position as compared to book values. The determination of market value ratios may require several calculations which in some instances may be onerous. Bowman (1980: 245) argues that many debt instruments are quoted at variable interest rates, subject to restrictions and conditions. One of the conditions is the requirement of compensating balances in a non interest bearing account. The possible solution would be to raise the effective interest rate above the stated rate. Such reinstatements can be onerous.

Another problem arises when the debt is convertible. The quoted price on the convertible debt may not be the market value of the debt. This is because the quoted price consists of the portion of the market price which is attributable to debt, and the portion attributed to equity. Weil, Segall and Green (1968: 445) and West and Largay (1972: 1156) attempt to address this problem by isolating the market value of the debt from the quoted price. Bowman (1980: 247) argues that this is not necessary because most convertible bonds have no ascertainable market value. Furthermore, if the market value could be determined, the difference would be marginal.

Prasad *et al*. (2001: 44) justify the use of book value measures because market values are subject to a number of "... factors orthogonal to the firm. Consequently, any changes in the leverage ratio when using the market values may not reflect any underlying alteration within the firm ..." Where market values are obtained, Bowman (1980: 242) demonstrates

that these two measures are highly correlated; hence the misspecification of using the book values is probably insignificant. An inspection of the correlations reported in Table 7.3, in Section 7.2, shows that the book and market values of leverage for South African data are highly correlated. For example, the correlation between the book and market value of the debt to equity ratio is 0.78 and the correlation between the book and market value measures of the total debt ratio is 0.79.

Marsh (1982: 131), Boyle and Eckhold (1997: 429) and Hovakimian, Opler and Titman (2001: 5) use both the book and market values of leverage ratios to model capital structure. Both methods yield similar results.

5.3.3 The measures used in this study

Having the preceding caveats in mind, this study considers the effect of financial liberalisation on the book values of leverage ratios. However *quasi* market value measures of leverage are used for comparison purposes. In this case, book value measures are scaled by market values of equity. Table 5.1 provides a summary of how leverage ratios have been defined in some of the notable studies on capital structure.

Table 5.1: Definitions of leverage

Definition	Reference
Total debt ratio	
$\frac{\text{Short term debt} + \text{Long term debt (Book value)}}{\text{Total assets (Quasi market values)}}$	Rajan and Zingales (1995: 1427)
$\frac{\text{Total debt (Book value)}}{\text{Total assets (Book values)}}$	Wald (1999: 164)
$\frac{\text{Total liabilities (Book value)}}{\text{Total liabilities + networth (Quasi market values)}}$	Booth *et al*. (2001: 89)
$\frac{\text{Total debt (Book value)}}{\text{Total assets (Book value)}}$	Ozkan (2001: 185)
Short term debt ratio	
$\frac{\text{Short term debt (Book Value)}}{\text{Quasi market value of equity}}$	Titman and Wessels (1988: 16)
$\frac{\text{Short term debt (book value)}}{\text{Book value of equity}}$	Schmukler and Vesperoni (2006: 189)
$\frac{\text{Short term debt (Book value)}}{\text{Total assets (Book value)}}$	Gwatidzo and Ojah (2009: 5)
Long term debt ratio	
$\frac{\text{Long term debt (Book value)}}{\text{Market value equity + Book value debt}}$	Bradley *et al.* (1984: 869)
$\frac{\text{Long term debt (Book value)}}{\text{Quasi market value of equity}}$	Titman and Wessels (1988: 16)
$\frac{\text{Long term debt (Book value)}}{\text{Total assets (Book value)}}$	MacKie-Mason (1990: 1491)
$\frac{\text{Long term debt (Book value)}}{\text{Book value of equity}}$	Schmukler and Vesperoni (2006: 189)

5.4 VARIABLE DEFINITION

Despite the complex nature of financial liberalisation, the broad measurement of its impact on capital structure is fairly straight forward. This entails a regression of the debt ratio on a constant, a set of control variables and several macroeconomic and firm dummies. Hence, this section defines each of the aforementioned variables.

5.4.1 Dependent variables

- **Total debt to total assets (TD/TA)**

Since the objective of this research is exploratory, it is important to start with the broadest measure of leverage, which is the ratio of *total debt to total assets* calculated as book value of total interest bearing loans + redeemable preference shares (if applicable) + convertible loans (if applicable) divided by the book value of total assets. This ratio is also commonly referred to as the total debt ratio. An increase in the ratio may indicate higher risk, meaning that the firm may not be able to generate enough earnings to service the debt. The market value of the total debt ratio is calculated as total interest bearing debt divided by total assets – book value equity + market value equity.

- **Debt to equity (TD/E)**

The ratio of *debt to equity*, commonly referred to as the *debt-equity* ratio, measures the evolution of debt relative to equity. It is computed as the book value of total interest bearing debt divided by the book value of equity[12]. An increase in this ratio indicates that firms are relying more on interest bearing debt compared to equity.

- **Retained earnings to total liabilities (RE/TL)**

The ratio of *retained earnings to total liabilities* measures the importance of internally generated funds. It is defined as the ratio of retained earnings plus depreciation to the

[12] The book value of equity is calculated as book equity + minority interests (if applicable). The market value of equity is calculated as the market capitalisation at print out date.

book value of total liabilities. An increase in this ratio indicates that firms are relying more on retained earnings to finance investment.

- **Short term debt to total debt (STD/TA)**

The ratio of *short term debt to total debt* measures the maturity structure of debt. It is calculated as book value of short term interest bearing loans divided by the book value of total assets. An increase in this ratio may indicate that firms' maturity structure of debt has decreased. In other words, firms are relying more on short term debt.

5.4.2 Independent variables

The independent variables consist mainly of a series of macroeconomic and firm level control and dummy variables. The control variables identified are firm specific characteristics. The dummy variables are used to capture the lifting of international sanctions, stock market, financial sector and capital account liberalisation. An additional dummy variable is used to capture the effect of firms' access to international equity markets.

- **Control variables**

The challenge in the econometric approach is to be reasonably sure that the process of financial liberalisation is isolated from other confounding events. Bekeart and Harvey (2003: 5) acknowledge that existing economic models are not adequate to capture the whole process of liberalisation. Bearing this caveat in mind, the study considers firm level controls as confounding firm specific effects that need to be isolated.

Corporate finance literature advocates for several firm specific characteristics that may affect the choice of capital structure[13]. Rajan and Zingales (1995: 1451) argue that there are four main factors that have consistently shown to be correlated with leverage. These

[13] These factors have been discussed in detail in section 2.4. See Gupta (1969: 526), Marsh (1982: 121), Rajan and Zingales (1995: 1422), Booth *et al*. (2001:), Schmukler and Vesperoni (2006: 190), and Eriotis *et al*. (2007: 329)

are size, asset tangibility, profitability and growth prospects. This study therefore focuses only on these four factors to control for firm specific characteristics.

Size

Corporate finance theory postulates that larger firms are in a better position to assume more debt compared to smaller firms[14]. Bearing this prediction in mind, it is expected that firm size will be positively related to leverage.

Empirical work on capital structure has utilised several reliable proxies for size. These are the natural logarithm of sales, net fixed assets, total assets and capital stock. Table 5.2 summarises the proxies used for size from selected influential studies on capital structure. Marsh (1982: 132) uses log of capital employed, but further experimented with log of total assets and equity market capitalisation. All these three approaches yielded similar results. Titman and Wessels (1988: 6) observe that the use of the natural logarithm of total assets and total sales do not affect the parameter estimates of their structural model.

A closer investigation of studies that focus on the impact of financial liberalisation on firm financing choices for other emerging markets (see Table 4.1) use capital stock, total assets and natural logarithm of net fixed assets. Given the preceding caveats, it appears that there is no reason to suspect that one proxy is more superior to the others. Hence, any of the proxies discussed can be used. This study uses the natural logarithm of total assets.

[14] Refer to section 2.4 for a detailed discussion on the relationship between size and leverage

Table 5.2: Summary of suitable proxies for size

Select studies on firm determinants of capital structure	
Reference	**Proxy used**
Gupta (1961: 518)	Total assets
Marsh (1982: 132)	Log of capital employed[15]
Kester (1986: 22)	Volume of sales
Titman and Wessels (1988: 6)	Log of sales and quit rates[16]
Rajan and Zingales (1995: 1452)	Log of sales
Wald (1999: 173)	Log of total assets
Booth *et al*. (2001: 103)	Log of sales rescaled by multiplying by 100
Eriotis *et al.* (2007: 325)	Total sales
Select studies on financial liberalisation and capital structure	
Reference	**Proxy used**
Dermiguc-Kunt and Maksimovic (1996: 351)	Total assets
Galego and Loayza (200: 28)	Capital stock
Bhaduri (2000: 417)	Total assets
Schmukler and Vesperoni (2006: 190)	Log of net fixed assets

Asset tangibility

A reliable proxy for asset tangibility is the ratio of fixed assets to total assets. A high proportion of fixed assets in the firm's balance sheet can serve as collateral for lenders of finance. Moreover, in the event of bankruptcy, a higher proportion of tangible assets could enhance the salvage value of the firm's assets. Lenders of finance are thus willing to lend money to firms with a high proportion of tangible assets. It is expected that leverage will be positively correlated to asset tangibility.

[15] Marsh (1982: 132) performs back of the envelope experiments with log of total assets and equity market capitalisation and documents similar results.
[16] Titman and Wessels (1986: 6) find that parameter estimates are insensitive to the choice between the natural logarithm of total assets and sales.

Profitability

Profitability is defined as the ratio of net operating profit after taxes to total assets. Evidence regarding the relationship between profitability and leverage tends to support the theoretical predictions of Myers and Majluf (1984: 188)[17]. It is therefore expected that there will be a negative relationship between firm profitability and leverage.

Growth prospects

A reliable proxy for a firm's growth prospects is the ratio of market value of equity to the book value of equity. Barclay and Smith (1999: 14) posit that the stock price of a firm reflects the firms present value of growth opportunities, whereas balance sheet values do not. It follows that the higher the market value relative to the book value of equity, the higher the growth prospects for the firm. Corporate finance theory predicts that high growth firms are exposed to potential costs of financial distress. This prohibits them from acquiring more debt in their capital structure. Conversely, firms with low growth prospects will be faced with a potential overinvestment problem, and are expected to have higher debt ratios[18]. Bearing this prediction in mind, it is expected that there is a negative relationship between growth prospects and leverage.

- **Dummy variables**

In order to determine the effects of financial liberalisation on the choice of capital structure, this study utilises four macroeconomic variables and two firm level dummies. The macroeconomic variables are lifting of international sanctions, stock market, domestic financial sector and capital account liberalisation. The firm level variables relate to internationally financed firms.

[17] Kester (1986: 13) finds a negative relationship between profitability and leverage for the United States And Japan. Rajan and Zingales (1995: 1457) and Wald (1999: 169) draw similar conclusions for the United States, United Kingdom and Japan.

[18] For a detailed discussion on the empirical evidence of this relationship, see Barclay and Smith (1999: 13-14)

Lifting of international sanctions (LIS)

This variable captures the impact of the lifting of international sanctions on capital structure. The variable takes on the value of one for periods after the removal of most economic sanctions and zero otherwise.

Stock market liberalisation (SML)

This variable captures the impact of stock market liberalisation on capital structure. The variable takes on the value of one for periods after stock market liberalisation and zero otherwise.

Domestic financial sector liberalisation (DFSL)

This variable captures the impact of the removal of restrictions on the domestic financial sector. A progressive dummy is used that increases by 0.5 for each subsequent lowering of reserve requirements.

Capital account liberalisation (CAL)

This variable is related to the easing of exchange controls. The series of exchange control relaxations in South Africa provided opportunities for local firms to invest more funds abroad. This capital could have been raised from either internal sources or external security issues. Following Loots (2003: 237), the variable takes on the value of zero for the period between 1989 and 1994. The value increases by 0.5 for each subsequent exchange control relaxation date, starting from 1995, the date of the abolition of the financial Rand.

Internationally financed firms (IFF)

In order to capture the firm's access to international equity markets, the study incorporates a step dummy that takes the value of one from the time the firm issues equity in the

international equity markets and zero for periods prior to the date of the first issue[19]. Firm access to international markets can refer to a cross listing or issue of ADRs in the foreign market.

Domestic financed firms (DFF)

Another dummy variable that captures firms that have no access to international equity markets is included in the analysis. This variable takes on the value of one if the firm is domestically financed and zero otherwise.

Financial market development

Since financial liberalisation leads to the increased financial market activity, it is plausible to include in the analysis variables that capture the level of financial market development. Hence, two ratios are proposed; the ratio of stock market capitalisation to GDP (SMC/GDP) and the ratio of domestic credit to the private sector to GDP (DC/GDP). SMC/GDP measures the ability of the stock market to allocate capital for investment projects. DC/GDP measures the resources channelled to the private sector by domestic commercial banks.

[19] A step dummy is appropriate for capturing international participation in equity markets because it is assumed that once a firm lists abroad, it will continue to raise equity finance for the foreseeable future.

Table 5.3 summarises the variables discussed and their expected signs.

Table 5.3: Variables and expected signs

Variable	Expected sign	Reference
Size	+	Rajan and Zingales (1995: 1453) Wald (1999: 169)
Tangibility	+	Friend and Lang (1988:), Rajan and Zingales (1995: 1453)
Profitability	-	Rajan and Zingales (1995: 1453) Wald (1999: 169)
Growth	-	Rajan and Zingales (1995: 1453), Barclay and Smith (1999: 14)
Non-debt tax shields	+/-	Bradley, *et al* (1984: 873), Ozkan (2001: 187), Ngugi (2008: 620)
Tax	+	Mutenheri and Green (2003: 166)
Dividend payout	+/-	Boyle and Eckhold (1997: 434)
Stock Market Development	+	Demirguc-Kunt and Maksimovic (1996: 363)
Banking Sector Development	+	Galego and Loayza (2000: 34)
Internationally Financed Firms	-	Schmukler and Vesperoni (2006: 183) Flavin and O'connor (2010: 202)
Lifting of international sanctions	-	N/A
Stock Market Liberalisation	-	Schmukler and Vesperoni (2006: 183) Flavin and O'connor (2010: 202)
Capital Account Liberalisation	+	Schmukler and Vesperoni (2006: 183)
Domestic Financial Sector Liberalisation	+	Hübler, *et al.* (2008: 393)

5.5 CHAPTER SUMMARY

This chapter has addressed three main issues. Firstly, some caveats relating to the dating of financial liberalisation have been clarified. Secondly, the problems associated with the measurement of leverage have been resolved. Lastly, each variable used in the analysis has been defined.

The main challenge with dating financial liberalisation is the gradual and multifaceted nature of financial liberalisations. This chapter has carefully identified these issues and recommended on a suitable approach towards dating of financial liberalisation in relation to this study. The choice of the appropriate measure of leverage has been justified by the object of the study. Because this is an exploratory study, broad measures of leverage are included.

Book value balance sheet data have been argued for, because of three main reasons. Firstly, there are inherent problems in calculating market values of debt with special conditions. Following this, empirical evidence suggests the importance of market value measures over book values is insignificant. Secondly, firm level analysis provides reliable insights which may not be captured at the aggregate level. In this regard, micro analysis can help explain how individual firms' access to international equity markets can affect the choice of capital structure.

Finally, changes in the market value ratios are sensitive to various macroeconomic disturbances and hence may not reflect any underlying alteration within the firm. However, both measures of leverage have been recommended.

To capture the effect of financial liberalisation on capital structure, a set of variables were identified and classified under dependent and explanatory variables. The dependent variables include the various measures of leverage. The explanatory variables include a set of firm level controls, macroeconomic and firm level dummies and financial development indicators. The next chapter focuses on the research design and the appropriate econometric models.

CHAPTER 6
RESEARCH DESIGN AND ECONOMETRIC APPROACH

6.1 INTRODUCTION

The preceding chapter recommended suitable approaches to resolving the dating and leverage measurement problem, and defined the variables to be used in the analysis. This provides a basis for choosing the appropriate research design. In this chapter, the research design is described based on the inputs from the preceding two chapters.

6.1.1 Goal of this chapter

The primary goal of this chapter is to specify the overall research design by describing the data sources, sampling plan and the estimation techniques for testing the hypotheses. In establishing the appropriate techniques, the object is firstly, to develop suitable static and dynamic panel data models. Secondly, to devise an appropriate technique for testing the stability of the parameter estimates for the period of financial liberalisation.

6.1.2 Layout of this chapter

The rest of the chapter is organised as follows: Section 6.2 describes the choice of firms and data. Section 6.3 outlines the data analysis plan and discusses the advantages and disadvantages of panel data techniques. Section 6.4 specifies the models to be estimated. Section 6.5 establishes the model to test for structural shifts in the parameter estimates. Section 6.6 identifies the formal tests of specification in panel data. Section 6.7 concludes the chapter.

6.2 CHOICE OF FIRMS AND DATA

The sample consists of JSE-listed non-financial firms that operated before and after the financial liberalisation phase. The I-Net Bridge[20] database is used to source audited income statements, balance sheets and financial ratios for a sample of firms that operated from 1989 to 2007. The stock market and banking sector development ratios are calculated from data obtained from the SARB. Information on the firm participation in international equity markets is obtained from the JSE and the Bank of New York Mellon Corporation website[21].

The selected firms are the ones that did not change identity and main line of business. This will enable the facilitation of reliable inter temporal comparisons and also to minimise the effects of confounding factors such as mergers, acquisitions and restructurings. The firms should have reported consecutively on their financial position on an annual basis. Financial firms such as banks and insurance companies are excluded from the overall analysis[22] because their reporting of leverage is different from that of the non-financial firms.

To minimise confounding effects, all firms with market to book values exceeding 20 are removed from the analysis. Another possible confounding effect is the adoption of international financial reporting standards (IFRS). The treatment of certain accounting items may influence the behaviour of the financial ratios. This caveat is assumed to be a minor concern and therefore, not controlled for because the impact of financial liberalisation occurred mainly in the period before the effective dates of the implementation of IFRS. These dates are primarily from 2004 onwards. Firms with missing data points are excluded from the analysis.

[20] Licensed to the University of the Witwatersrand. Financial ratios generated by I-Net Bridge are discussed in Section 5.4. Due to the subjective nature of financial ratios, It must be noted that the convention followed by I-Net Bridge may differ from other databases.
[21] www.bnymellon.com.
[22] Most capital structure studies exclude financial firms due to the different financing behaviour of the firms in these industries. To allow for valid comparisons with other studies on emerging markets, this study excludes financial firms in the overall analysis.

Following Falkender and Peterson (2006: 52), ratios with a value greater than 1 are reset to 1. This exercise is carried out in order to prevent the means from being distorted by a few extremely high observations. The firms chosen are mainly from the six sectors of the JSE namely; Resources, Basic Industries, General Industrials, Cyclical Consumer Goods, Non-Cyclical Consumer Goods and Cyclical Services. The analysis is performed in two stages. The first stage utilises data set for the period 1989 to 1999. This is because the reforms that are being examined were implemented during this period. Furthermore, the specified period is used to include, in the analysis, as many firms as possible. Initially, the total number of firms that are continually listed for the years 1989 to 1999 is 120. The preceding criteria reduce the sample size to 100 firms with complete data for the period 1989 to 1999. This translates to a total of 1100 observations.

The sample is further split between small, large, internationally financed and domestically financed firms. Small firms have an average value of total assets below the median and large firms have an average total asset value higher than the median. The average value of total assets for each firm is calculated as the average of total assets for the years 1989 to 1994. Internationally financed firms are separated from domestically financed firms for purposes of calculating the average values of leverage for the two sets of firms. These average values are further calculated for the pre and post liberalisation periods. This exercise is performed to assess the contrasting effects of financial liberalisation on different sets of firms.

The second stage is performed to estimate the dynamics of firm leverage in the pre and post liberalisation regimes. This involves an extended data period ranging from 1989 to 2007. This reduces the sample size further to 70 firms, which translates to a total number of 280 observations for the pre liberalisation period and 688 observations for the post liberalisation period. Makina and Negash (2005a: 151) examine the effects of stock market liberalisation on the cost of equity capital for firms listed on the JSE, and they utilise a sample of 83 firms over a period of 10 years (1987 to 1997).

6.3 DATA ANALYSIS

6.3.1 Data analysis plan

The data on leverage ratios and explanatory variables are recorded in Microsoft Excel, and later exported onto the relevant statistical packages. In order to evaluate the accuracy of the data, a cross check is performed to ensure that all the figures are correct. All the relevant calculations are performed twice to ensure more accuracy. The structural break and pooled OLS estimations are carried out in E-Views version 7[23]. Stata version 11[24] is used to carry out the following panel data estimations; fixed (within) effects and random effects, instrumental variable, dynamic panel data estimations and tests of significance for panel data.

6.3.2 Panel data analysis

Various econometric procedures have been used to model capital structure behaviour. MacKie-Mason (1990: 1472) argues that incremental financing decisions can best be depicted by a probit model. However, panel data estimation techniques have been argued to be stronger due to their ability to combine the cross-sectional and time series nature of data[25]. This enhances the quality of the data being analysed.

Since panel data incorporates a cross-section of firms over a period of time, there is bound to be heterogeneity in the observed firms. Panel data techniques can take such heterogeneity into account by incorporating individual specific variables. This powerful combination provides less collinearity between variables and more degrees of freedom. The other advantage that is particularly suited to this study is that panel data analysis is well suited to detect the dynamics of change.

[23] Licensed to the University of the Witwatersrand.
[24] Licensed to the University of the Witwatersrand
[25] See Ozkan (2001: 175), Ngugi (2008: 617) and Gwatidzo and Ojah (2009: 5) for arguments in favour of panel data.

Ozkan (2001: 176) advises that panel data techniques are more flexible in the choice of variables to control for endogeneity. This is a situation where unobservable factors affecting financing decisions may affect some of the firm specific characteristics such as the market value of equity. The three widely used applications of panel data are the pooled ordinary least squares (Pooled OLS), fixed and the random effects models[26].

- **The pooled OLS model**

The pooled OLS model uses a constant intercept across all cross-sectional units. As a result, the slope and intercepts are assumed to be equal for all observations. Therefore, this model assumes that there is no observed heterogeneity among the units of analysis, and OLS can provide consistent and reliable estimates (Greene, 2003: 285).

- **The fixed effects model**

The fixed effects model assumes that differences in the cross-sectional units can be captured by differences in the constant term. Therefore, each cross-sectional unit has a fixed and unique intercept. Differences in the intercepts are the unobservable differences between the cross-sectional units which could be due to unique elements such as management style. Dummy variables are used to capture the unique unobservable elements of each firm; hence, this model is usually referred to as the Least Squares Dummy Variable (LSDV) Model.

Gujarati (2003: 646) highlights several drawbacks of the fixed effects panel data models. He cautions firstly, that the inclusion of too many cross-sectional units of observation necessitates the inclusion of several dummy variables. This has the potential to dilute the power of statistical tests by denying a certain degree of freedom to the analysis. Owing to the fact that 100 firms are examined in this study, the inclusion of dummy variables will be immense thereby eliminating the degrees of freedom that permit for powerful statistical

[26] See Mutenheri and Green (2003: 166); Eriotis *et al*. (2007: 324) and Gwatidzo and Ojah (2009: 5) for a detailed discussion on these methods.

analysis. Secondly, the precise estimation of parameters may be difficult due to the possibility of multicollinearity. Finally, the fixed effects model assumes that the error term follows the classical assumptions.

To overcome the inherent weaknesses of the LSDV approach, two estimation techniques are used; the within estimator and the random effects model. The within estimator is used to transform variables by utilising group means to avoid dummies. As a result, this model provides more degrees of freedom as compared to the LSDV model.

- **The random effects model**

The random effects model can be used to address the assumption that the error term follows the classical assumptions. This approach expresses the lack of knowledge about the true model through the disturbance term. In this case, the intercept value represents the mean value of all cross-sectional intercepts, and the error component represents the random deviation of the individual intercept from the mean value. In other words, the selected firms in the analysis are a drawing from a larger universe of firms which have a common mean value for the intercept.

The individual differences in the firm intercepts are captured by the error term. Hence, the random effects model would be more appropriate for a random drawing from a larger sample[27]. The random effects model can be estimated by Generalised Least Squares (GLS) if the variance structure is known, and by Feasible Generalised Least Squares (GLS) if the variance structure is not known.

[27] For a detailed discussion of the choice between the fixed effects and random effects model, see Gujarati, (2003: 650).

6.4 MODEL SPECIFICATION TECHNIQUES

This section specifies the equations to be used for the static and dynamic panel data models. The static panel data models include the fixed (within) and random effects estimation techniques. The dynamic panel data techniques include the Difference and System GMM models.

6.4.1 The static panel data model

The general static panel data model is specified as follows:

$$Lev_{i,t} = \alpha_i + \beta x'_{i,t} + u_{i,t} \quad (6.1)$$

$$\mu_{i,t} = \mu_i + v_{i,t}$$

Where:

$Lev_{i,t}$= leverage *(TD/TA(B), TD/TA(M) TD/E (M), TD/E (B), STD/TA)* for firm i at time t

$x'_{i,t}$ = a vector of exogenous variables (Size, Growth, Tangibility, Taxes, Non-debt tax shields, Profitability and Dividend payout) for firm i at time t

β= A vector of slope parameters

$u_{i,t}$= The composite error term

μ_i = The unobserved, time invariant firm specific effect.

$v_{i,t}$= The stochastic term

The assumptions of this model are as follows:

- $Lev_{i,t}$, $x'_{i,t}$: (i = 1,..., *N*; t= 1,...,*T*) is a random sample where *N* is large and *T* is small.
- $x'_{i,t}$ is exogenous in relation to $u_{i,t}$, that is Cov ($u_{i,t}$, $x'_{i,t}$) = 0
- The error term takes the following classical structure: E $(u_{i,t}|x'_{i,t})$ = 0

6.4.2 Estimation technique for testing the impact of financial liberalisation on capital structure.

To model the impact of financial liberalisation on capital structure, the static panel data model is used. The classical regression model follows, *inter alia*, the assumption of homoscedasticity. If this assumption is dropped and replaced with the assumption of heteroscedasticity, then the proposed model estimation may yield spurious correlations. Regressing leverage on the various independent variables would imply the assumption that there is inter-firm variability in leverage.

The plausible approach is to estimate the model in such a way that observations with greater variability in leverage are given less weight than those coming with smaller variability in leverage. Thus the usual Ordinary Least Squares (OLS) does not follow this convention as it assigns equal weight to each observation. The method of Generalised Least Squares (GLS) takes this inter-firm variability into account. Gujarati (2003: 397) adds: "... this is the right strategy, for in estimating the population regression function (PRF) more reliably we would like to give more weight to observations that are closely clustered around their (population) mean than those that are widely scattered about ..." Therefore, to model the effects of financial liberalisation on capital structure, the GLS estimation technique (with standard errors robust to heteroscedasticity) is used. The following general specification is estimated for each dependent variable:

$$Lev_{i,t} = \alpha + \beta' X_{i,t} + \gamma IFF_{i,t} + \gamma DFF_{i,t} + \varphi(SMC/GDP)_t + \varphi(DC/GDP)_t + \theta LIS_t + \theta SML_t + \theta DFSL_t + \theta CAL_t + \mu_{i,t} \quad (6.2)$$

Where: $i = 1, \dots, N,$ and

$t = 1, \dots, T.$

.

$X_{i,t}$ is a vector of firm specific controls. These controls are size, profitability, asset tangibility and growth opportunities. *IFF* is a dummy that takes the value of one if the firm

is internationally financed[28] and zero otherwise. *DFF* is a dummy that takes the value of one if the firm is domestically financed[29] and zero otherwise. *SMC/GDP* captures the effects of stock market development on leverage. *DC/GDP* captures the effects of the significance of the banking sector on leverage. *LIS, SML, DFSL* and *CAL* are time variant and firm invariant macroeconomic dummies capturing the lifting of international sanctions, stock market liberalisation, domestic financial sector liberalisation and capital account liberalisation respectively. $\mu_{i,t}$ is the disturbance term. The assumption is that $\mu_{i,t}$ is characterised by an independently distributed random variable with a mean value of zero and variance, $\sigma_{i,t}^2$.

Robustness checks are performed to control for potential endogeneity in the estimated relationship by using the instrumental variable technique suggested by Anderson and Hsiao (1982: 47). The instrumental variable technique will produce consistent estimates if the error term $\mu_{i,t}$ is not serially correlated in levels.

6.4.3 The dynamic panel data model

In order to estimate the dynamics of firm leverage effectively, it is important to take note that there is a possibility that the dependence of leverage on the explanatory variables is rarely instantaneous. In most cases, the dependent variable responds to the vector of explanatory variables with a lag. MacKie-Mason (1990: 1472) argues that a dynamic model is often ignored by many researchers when attempting to model the effects of capital structure determinants. From this argument, it follows that a lagged dependent variable should be included on the right hand side of the equation. The proposed model can be estimated using the following general specification:

$$Lev_{i,t} = \Phi\big[Lev_{i,t-1} + Size_{i,t} + Tang_{i,t} + Profit_{i,t} + Growth_{i,t} + Tax_{i,t} + Ndts_{i,t} + Div_{i,t} + u_{i,t}\big] \quad (6.3)$$

$$\mu_{i,t} = \alpha_i + v_t + \varepsilon_{i,t}$$

[28] A firm is internationally financed if it is cross-listed or has issued ADRs in the United States.
[29] A firm is domestically financed if it has not listed abroad via a cross listing or ADR issue.

Where:

$Lev_{i,t}$ = Leverage ratio of firm i in year t is calculated as the ratio of short term debt to total assets and the ratio of long term debt to total assets[30] and Φ allows for lags in both the dependent and independent variables.

$Lev_{i,t-1}$ = The lagged dependent variable.

$Size_{i,t}$ = The size of firm i at time t and is measured by the log of total assets.

$Tang_{i,t}$ = The asset structure of firm i at time t and is calculated as the ratio of net fixed assets to total assets.

$Profit_{i,t}$ = The profitability of firm i at time t. It is calculated as the ratio of earnings before interest and taxes and depreciation (EBITDA) to total assets.

$Growth_{i,t}$ =The growth prospects of firm i at time t. It is computed as the ratio of the market value of equity to the book value of equity.

$Tax_{i,t}$ = The corporate tax rate of firm i at time . It is computed as the ratio of tax paid to earnings before taxes.

$Ndts_{i,t}$ = Non-debt tax shields for firm i at time t and is computed as the ratio of depreciation to total assets.

$Div_{i,t}$ = The corporate dividend payout for firm i at time t . It is calculated as the ratio of ordinary dividend paid to earnings attributable to ordinary shareholders.

$\mu_{i,t}$ = The vector of unobserved disturbances, where α_i is the unobservable firm specific effect that varies across firms but is fixed over time. v_t is the firm invariant time specific effect. $\varepsilon_{i,t}$ is the white noise disturbance.

Firm adjustment to the targeted level of leverage is an important issue in modern day capital structure research (Huang & Ritter, 2009: 239). Given this observation, transaction costs and the associated speed of adjustment to the desired level of leverage needs to be established. The presence of transaction costs presents an impediment for firms to adjust automatically to their capital structure to the target level. Hence, the following partial adjustment model is specified:

[30] Alternative leverage ratios are used to estimate the determinants of capital structure. These ratios are defined in section 5.4

$$Lev_{i,t} - Lev_{i,t-1} = \delta\left(Lev^{*}_{i,t} - Lev_{i,t-1}\right), 0 < \delta \leq 1 \quad (6.4)$$

The parameter δ is the speed of adjustment. $Lev_{i,t} - Lev_{i,t-1}$ is the actual change in leverage and $Lev^{*}_{i,t} - Lev_{i,t-1}$ is the desired change in leverage. If transaction costs are zero, then δ = 1, meaning that firms will automatically adjust to their target capital structure. If transaction costs are 1, then δ = 0, meaning that transaction costs are so high that $Lev_{i,t} = Lev_{i,t-1}$.From equation 6.4, the actual leverage level can be computed as:

$$Lev_{i,t} = \delta Lev^{*}_{i,t} + (1-\delta)Lev_{i,t-1} \quad (6.5)$$

Substituting equation 6.5 into equation 6.1 gives the following specification:

$$Lev_{i,t} = (1-\delta)Lev_{i,t-1} + \delta\alpha_i + \delta\beta X'_{i,t-1} + \mu_{i,t-1} \quad (6.6)$$

Where $1-\delta$ is a measure of the transaction costs, and $X'_{i,t-1}$ is a vector of lagged firm specific determinants shown in equation 6.3. The presence of the lagged dependent variable on the right hand side of the equation provides a statistical bias where $Lev_{i,t-1}$ will be correlated with the error term, even if $v_{i,t}$ are not serially correlated. This renders OLS estimators to be inefficient. One way to resolve this problem is to first difference equation 6.6 in order to eliminate the firm specific effects:

$$Lev_{i,t} - Lev_{i,t-1} = \delta\beta_1 + (1-\delta)(Lev_{i,t-1} - Lev_{i,t-2}) + \delta\beta\left(X'_{i,t-1} - X'_{i,t-2}\right) + \mu_{i,t-1} - \mu_{i,,t-2} \quad (6.7)$$

Estimating equation 6.7 by using OLS may not consistently estimate the parameters because $Lev_{i,t-1} - Lev_{i,t-2}$ and $\mu_{i,t-1} - \mu_{i,,t-2}$ are correlated through $Lev_{i,t-1}$and $\mu_{i,,t-1}$. This problem can be resolved by utilising instrumental variables, on condition that the error term $\mu_{i,t}$ is not serially correlated. Anderson and Hsiao (1982: 47) propose $\Delta Lev_{i,t-2}$ or $Lev_{i,t-2}$ as instruments for the first difference. The instrumental variable estimation technique may not be efficient due to lack of utilisation of all available moments. Arellano and Bond (1991: 279) resolve this by using the generalised method of moments (GMM) estimation technique. The GMM estimation utilises instruments that can be obtained from

the orthogonality conditions that exist between the lagged dependent variable and the error term.

Indeed, the GMM technique has proven to be a more superior method than other estimation techniques. However, Antoniou, Guney and Paudyal (2006: 176) and Antoniou *et al*. (2008: 70) argue that estimating equation 6.7 in its differenced form could lead to a problem of weak instruments. Specifically, first differencing causes loss of information. To minimise this loss of information, equation 6.6 is estimated simultaneously with equation 6.7 as a system. Hence, this approach is known as System GMM.

Following Arellano and Bover (1995: 29), instruments in differences are used for level equations and instruments in levels are used for equations in differences. This simultaneous approach to estimating the dynamic model of capital structure provides significant efficiency gains (Blundell & Bond, 1998: 115).

One important caveat should be mentioned about the System GMM estimator. Roodman (2009: 86) cautions that the coefficient of the lagged dependent variable could be sensitive to the choice of instruments. This could bias the true value of the coefficient estimate of the lagged dependent variable. The next section tests for the determinants of the adjustment speed to the target capital structure.

6.4.4 Estimation technique for the determinants of the adjustment speed

Following Drobetz and Wazenried (2006: 948), firms with high growth prospects may find it easier to alter the composition of new issues, even under asymmetric information. The intuition behind this argument is that, a growing firm's value may remain unchanged because of the positive effect of the future growth opportunities. Accordingly, growth firms should adjust to their target levels of leverage relatively fast.

Likewise, large firms should adjust rapidly to their target leverage. Because of sufficient analyst coverage and lower costs of information asymmetries, large firms should access debt and equity markets with relative ease. Moreover, the fixed costs associated with

capital structure changes should be smaller for large firms. On that account, size should be positively correlated to the adjustment speed.

It is expected that the speed of adjustment, denoted by δ, is a linear function of a constant and a set of firm specific variables. These variables are denoted as $\beta_1\gamma_{i,t}$. The overall expression is shown as:

$$\delta = \beta_o + \beta_1\gamma_{i,t} \tag{6.8}$$

Substituting equation 6.8 into 6.6 gives the following specification:

$$Lev_{i,t} = \left(1 - \beta_o - \beta_1\gamma_{i,t}\right)Lev_{i,t-1} + (\beta_o + \beta_1\gamma_{i,t})\beta X'_{i,t-1} + \mu_{i,t-1} \tag{6.9}$$

Equation 6.9 is multiplied out to obtain the following expression:

$$Lev_{i,t} = (1 - \beta_o)Lev_{i,t-1} - \beta_1\gamma_{i,t}Lev_{i,t-1} + \beta_o X'_{i,t-1} + \beta_1\gamma_{i,t}\beta X'_{i,t-1} + \mu_{i,t-1} \tag{7.0}$$

In equation 7, the lagged dependent variable is interacted with the firm specific determinants of capital structure. The coefficient of the interaction term, β_1, will provide an indication of the impact of the firm specific determinants on the adjustment speed.

6.5 TESTING FOR STRUCTURAL SHIFTS IN PARAMETER ESTIMATES

The economic reforms that were implemented in the early 1990s could have influenced the corporate financial policy of South African listed firms. This supposition can be validated by testing whether the parameter estimates for the estimated regression shifted at some point during the economic transition. The employment of one single regression for the entire period of 1989 to 2007 would imply that the relationship between leverage and firm specific determinants has not changed over time. This may not be plausible, owing to the fact that the opening of the economy to international investment could have initiated a structural shift in the determinants of corporate leverage.

6.5.1 Tests for the equality of intercepts and slopes

Where the break date is known *a priori*, the F test statistic developed by Chow (1960: 591) has been used extensively to test for structural stability of parameter estimates in OLS regressions. However, there are some qualifications with respect to the applicability of the Chow test. Firstly, the Chow test assumes that the error terms for the sub period regressions are normally distributed with the same homoscedastic variance. If the error terms are found to be heteroscedastic, then the Chow test may not be appropriate. Secondly, the Chow test will only report if two regressions are different and hence incapable of detecting which slope parameters are affected by the external shock. Given these caveats, the dummy variable estimation technique is used to test which coefficients are affected by financial liberalisation.

6.5.2 The dummy variable approach

The dummy variable technique addresses the inherent weakness of the Chow test by detecting the source of the difference in regression parameters over a period of time. To detect the source of the difference, a regime dummy variable is interacted with each explanatory variable as follows:

$$\mathrm{Lev}_{i,t} = \alpha_i + \alpha_2\,\mathrm{DUM}_t + \beta_1 \mathrm{X}'_{i,t}(\mathrm{DUM}_t) + \mu_{i,t} \qquad (7.1)$$

Where:

DUM_t = 1 for periods after the breakpoint and 0 otherwise.
$X'_{i,t}$ = The vector of explanatory variables to be interacted with the dummy variable.
$\mu_{i,t}$ = The composite error term

The interpretation of the output suggested by equation 7.1 is that, if the interaction between the dummy and the respective independent variable is statistically significant, then it can be concluded that there is a significant structural change in the coefficient of the interacted variable. This suggests that financial liberalisation has an influence on the respective determinants of corporate financial policy. In the next section, some formal specification tests for panel data are discussed.

6.6 FORMAL TESTS OF SPECIFICATION IN PANEL DATA

This section accounts for some of the important tests to be carried out in this analysis. These tests include the Sargan test, test for lack of first and second order autocorrelation, Wald test for joint significance, multicollinearity tests and the Hausman (1978: 1251) specification test.

6.6.1 Sargan Test

The Sargan test is a test of overidentifying restrictions. It is used to test for instrumental variable validity. The null hypothesis being tested is that the residuals are uncorrelated with the exogenous variables, under the assumption that these variables are truly exogenous. If the null hypothesis is accepted statistically, then the instruments are valid. In other words, a higher p-value indicates better instrument validity.

6.6.2 Test for lack of first and second order autocorrelation

To test for lack of first and second order correlation and the Arellano and Bond (1991: 279) test for zero autocorrelation in the residuals are used. If the null hypothesis of zero autocorrelation is not rejected in favour of the alternative hypothesis, then there is no autocorrelation in the residuals.

6.6.3 Wald Test: Joint Significance

The Wald test for joint significance has been widely used to test for the significance of independent variables in a regression. The null hypothesis is that all coefficients of the regressors are equal to zero. Conversely, the alternative hypothesis is that the coefficients are not equal to zero. If the Wald test is significant, then the interpretation would mean that the variables should be included in the model. If, on the other hand, the test is insignificant, then variables need to be omitted.

6.6.4 Multicollinearity tests

A common problem in multiple regressions arises when the explanatory variables in the regression equation are highly correlated with each other. If there is indeed a problem of severe multicollinearity, one may find spurious correlations. The use of a correlation matrix will determine which variables exhibit multicollinearity.

Another test that is widely used for multicollinearity is the variance inflation factor (VIF) for multicollinearity or the formal detection tolerance. This measures the increase in the variance of each coefficient when collinearity is present. VIF is the inverse of tolerance such that $VIF = \frac{1}{TOL}$. A tolerance of less than 0.10 or a VIF of 10 and above may indicate a multicollinearity problem (Menard, 1995: 66).

6.6.5 Hausman specification test

The choice between the fixed (within) and random effects models is dependent on a formal test of significance formalised by Hausman (1978: 1251). The null hypothesis of this test is that the residuals in the random effects model are uncorrelated with the regressors. Therefore, if the null hypothesis is true, then the random effects model is suitable. If the null hypothesis is rejected, then the fixed (within) effects model may be more suitable than the random effects model.

6.7 CHAPTER SUMMARY

This chapter has focused on the choice of data and empirical models to be used to test the hypothesis formulated in chapter 4. Panel data estimation techniques have been argued for due to their ability to combine a broad cross-section of firms over a short time period. The appropriate choice of an estimation model has been justified in relation to previous empirical work and the nature of this study.

The regime dummy variable technique has been proposed to test for structural breaks in the equation parameters. This method has been argued to be more effective than the Chow break point test, owing to its ability to detect the source of the structural breaks in the equation parameters.

To test the determinants of capital structure for the period before and after financial liberalisation, stronger econometric tests have been argued for based on the dynamic nature of the panel data. This procedure allows for lags in the dependent and independent variables, thereby providing a better framework for understanding the effects of firm specific characteristics on capital structure. The GMM technique has been recommended based on its ability to take into account the orthogonality conditions between the lagged dependent variable and the error term.

To test the impact of financial liberalisation on capital structure, the fixed (within) effects, random effects and pooled effects models are used. These models are adequate to capture the effects of a battery of events that occurred in the financial liberalisation phase of the 1990s. Formal tests of significance in panel data have been proposed: The Sargan test, tests for lack of first and second order autocorrelation, the Wald (Joint significance) test, Hausman specification test and multicollinearity tests. In the next chapter, the econometric procedures discussed in this chapter are applied and the results are discussed based on the conjectures formulated in Chapter 4.