A framework for an optimized capital structure for state-owned natural monopolies

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ABSTRACT

This study empirically examines whether the capital structure for natural monopolies (parastatals) dynamically responds to macroeconomic conditions. It further examines whether the balance sheet channel theory holds for this industry sample. The study adopts a double sampling approach from the population of water boards in South Africa (SA), which raise their capital in open financial markets. A quantitative research approach is adopted with a descriptive design to achieve relevant deductions. Panel techniques are used in the descriptive design for the regressions.

The study finds that leverage partly dynamically responds to macroeconomic conditions. Furthermore, the evidence shows that inflation is an exception that has no significant relationship with leverage. The balance sheet channel theory is found to hold for water boards that access capital in open financial markets. Specifically, empirical evidence shows that changes in the interest rate have a delayed impact on the companies' characteristics, including capital structure.

Overall, our evidence suggests that water boards in SA need to consider the benefits of linking financial policies to the business cycle and that their policies should consider the delayed effect of interest rate changes.

Keywords:

Leverage, Coverage ratio, GDP, interest rate, inflation

DECLARATION

I declare that the contents of this submission are my own work. This thesis is submitted to partially fulfill of the requirements of the Master of Management in Finance and Investments at the Wits Business School of the University of the Witwatersrand.

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DEDICATION

This thesis is dedicated to my beautiful wife and daughters; I am truly blessed to have you in my life. Thank you for being patient when I was consumed by this degree. May you be blessed now and always.

ACKNOWLEDGEMENTS

I would like to acknowledge Rand Water for allowing me the time to obtain this exceptional degree. More importantly, I would like to thank the institution's leadership for their unwavering commitment to this process. I am forever indebted and truly grateful.

To my supervisor, Professor Ojah, you are a gift to finance. May the Lord bless and keep you for future generations.

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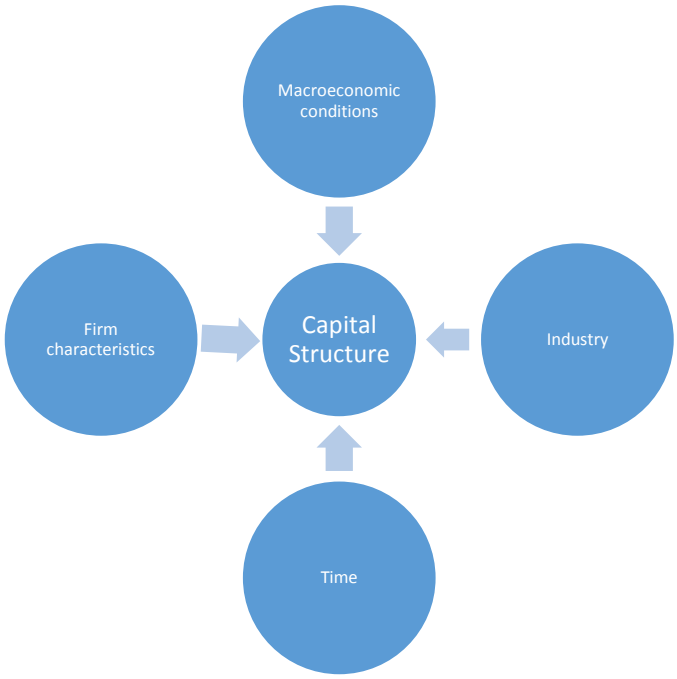
CHAPTER 1: Introduction

1.1 CONTEXT OF THE STUDY

Perkins, Fedderke, and Luiz (2005) find that inadequate investment in economic infrastructure can lead to bottlenecks and missed opportunities for economic growth. Furthermore, they note that executing the correct project at the appropriate time is imperative and that the basis for choosing each project should be a cost-benefit analysis. Although they define economic infrastructure in a way that does not include some important production units i.e. water and sanitation. Fourie (2006) includes water and sanitation and other producing units for public goals as part of the economic infrastructure.

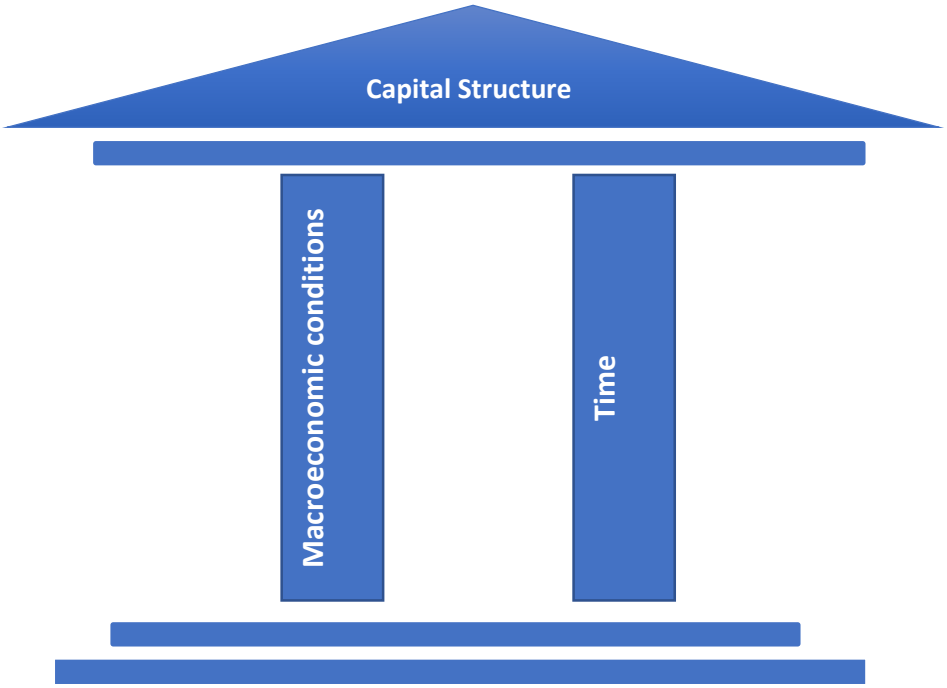
Institutions that use leverage and/or other external financing to develop their economic infrastructure need to optimize their capital structure to ensure that no bottlenecks and missed opportunities occur. As shown in Figure 1, theory has identified four categories that influence capital structure decisions: 1) macroeconomic conditions, 2) firm characteristics, 3) industry characteristics (Bokpin, 2009; Frank & Goyal, 2009; Axelson, Jenkinson, StrÖMberg, & Weisbach, 2013; Kayo & Kimura, 2011), and 4) time (Kayo & Kimura, 2011).

Figure 1 Influences on or pillars of the capital structure



These four pillars frame the optimized capital structure, and they are guided by multiple arguments. This study focuses on companies in the same industry; as a result, the industry influence is not be investigated. Other studies have used firm characteristics to explain capital structure behavior for predictive investigations through tax-based theories, such as the pecking order theory or the trade-off theory (Pandey, 2001). This study does not focus on such predictive investigations; thus, firm characteristics is not be investigated. The investigation is conducted over the same time period; however, the evolution of the capital structure over time due to macroeconomic shocks is of interest here. Therefore, the study focuses on two of the four pillars: macroeconomic conditions and time. The first pillar investigates how the macroeconomic conditions influence capital structure, and the second pillar examines the intermediary effect of time on capital structure.

Figure 2. Pillars of the capital framework



In the literature, financial leverage/debt is used as an indicator of capital structure (Frank & Goyal, 2009; Delcoure, 2007; Korajczy & Levy, 2003). Different variations have been used to define leverage, but most authors have used the $\frac{total\ debt}{total\ Asset}$ ratio (Korajczy & Levy, 2003; Frank & Goyal, 2009; Delcoure, 2007) as an indicator. This study uses the same indicator.

Korajczy and Levy (2003) argue that capital structure dynamically responds to macroeconomic conditions and financial constraints. Other authors, such as Hackbarth, Miao, and Morellec (2006), have argued that firms can benefit from linking their financial policies to the position of the economy in the business cycle. Furthermore, Akhtar (2012) find a strong relationship between capital structure and the business cycle. For the macroeconomic pillar, this study investigates these arguments and their validity for the potable bulk water industry in South Africa (SA).

This pillar investigates whether a relationship exists between the capital structure and macroeconomic indicators, such as the following:

- Gross domestic product (GDP) (Kayo & Kimura, 2011; Bokpin, 2009; Axelson et al., 2013; Frank & Goyal, 2009)
- Interest rate (Axelson et al., 2013)
- Inflation (Bokpin, 2009; Frank & Goyal, 2009)

Kayo and Kimura (2011) argue that "time cannot be ignored in the capital structure evolution". They further indicate that time reflects a company's macroeconomic shocks within a given year. In their findings, Lam, Zhang, and Lee (2013) emphasize the impact of time on the capital structure and country-specific variables. The macroeconomic shocks experienced by a firm within a given year are examined in studies on balance sheet channel theory. The balance sheet channel theory seeks to explain the influence of macroeconomic shocks (through monetary policy) on the firm's income statement, the balance sheet, net worth, cash flow and even liquid assets (Bernanke & Gertler, 1995).

Bernanke and Gertler's (1995) methodology is adopted in this study to investigate the evolution of capital structure due to macroeconomic shocks. Their methodology tests whether a relationship exists between the interest coverage ratio ($\frac{interest\ expenses}{(interest\ expenses+Net\ Profit)}$) and the macroeconomic shocks represented by interest rate changes due to monetary policy changes over time. The time lapsed is represented by lags in the interest rate changes.

Although firm characteristics are not be investigated in this study, their critical role in the optimal capital structure cannot be ignored, as they are primarily driven by the firm's assets (Axelson et al., 2013). These assets can range from the firm's cash flows (stable or instable), profitability, governance structure, and mix of tangible and intangible assets, among others. The dynamic nature of the firms' characteristics thus drives the ideal optimal capital structure. Three schools of thought grapple with the optimal capital structure driven by firm characteristics: the 1) tax-based, 2) modern and 3) norm-based theories. However, this study does not seek to determine which theory best describes the existing phenomenon based on firm characteristics.

The outcome of this study is informing the creation of a framework for natural monopolies that is capable of responding effectively to macroeconomic conditions and their shocks over time when they change within the parameters of the study's findings. These findings then become a framework for capital structure optimization for natural monopolies in the bulk water sector limited to the South Africa context.

1.2 RESEARCH QUESTIONS

Given the context of the study outlined above, the following research questions guide this research:

- Does the capital structure for natural monopolies (parastatals) dynamically respond to macroeconomic conditions?
- Does the balance sheet channel theory hold for natural monopolies (parastatals), or do macroeconomic shocks have an impact on capital structure over time?

1.3 PROBLEM STATEMENT

Inadequate investment in economic infrastructure can lead to bottlenecks and missed opportunities for economic growth (Perkins et al., 2005). Inadequate investment also occurs due to investment inefficiencies based on poor policies or lack of frameworks that do not consider investment timing and macro-economic conditions. Sanchez-Robles (1998) also notes the importance of efficiency for maximum output, which is suggested as a challenge currently.

Economic growth is one of the critical macroeconomic conditions that have an impact on unemployment, interest rates and equity markets etc. Thus, a lack of or inefficient investment in economic infrastructure can have devastating effects on the economic growth for the entire country. Sanchez-Robles (1998) emphasizes this point by documenting a positive relationship between economic growth and infrastructure investment. Esty, Chavich, and Sesia (2014) have even gone so far as to state that infrastructure investment is related to a one-for-one increase in GDP.

Noting that Governments normally controls economic infrastructure through management and investments through their entities and departments. Thus, government officials need to make informed decisions to ensure that the country does not experience economic infrastructure bottlenecks. In South Africa, state owned entities are one of the critical units used to develop and manage economic infrastructure. They make the day to day management decisions as well as investment decisions, thus playing a critical role in economic growth.

Thus, a lack of a framework to guide officials may lead to inefficiencies in their financial policies thus negatively affecting daily decision making. Finance policies must guide the timing of the investment (aligned with the firm needs) and also consider macro-economic conditions to ensure the delivery of economic infrastructure. Without a framework to guide these decisions and ensure investment efficiencies, economic infrastructure bottlenecks will undoubtedly occur at some point. One such inevitable bottleneck has been observed in the case of Eskom in South Africa—a natural monopoly producing electricity. Thus, if a framework is not established to prevent such bottlenecks, a similar complication is possible in the bulk water industry.

1.4 PURPOSE OF THE STUDY

Therefore, this study aims to use empirical data to create a capital structure optimization framework for bulk water natural monopolies (parastatals), such as Rand Water, to ensure sustainable bulk water production through the development and maintenance of the economic infrastructure.

1.5 SIGNIFICANCE OF THE STUDY

If capital structure frameworks are not created and used effectively and efficiently to optimize the capital structure to meet future water demands, a water crisis is seemingly inevitable in SA, a water-scarce, drought-prone developing country. Such a crisis could lead to inadequate capacity in the water infrastructure and negatively affect the South African economy. The water

infrastructure is a critical facility that makes business activity possible (Fourie, 2006); without water, no life can exist—let alone business activity.

Note that Rand Water's economic infrastructure mainly supplies the Gauteng province with potable water, primarily from raw water procured from another country (Lesotho) through the Lesotho Highland scheme. In addition, as a province, Gauteng accounts for the largest share of SA's population at 24% (11.2 million people), contributing 33.9% to SA's GDP and 10% to the continent's GDP (Gautengonline, 2016). If a capital structure optimization and investment decision fails, inadequate infrastructure may have a negative impact on the local, provincial and national levels.

Based on empirical evidence, this research provides guidance on how to use a framework to achieve capital structure optimization for natural monopolies within the bulk water industry. This guidance will help policymakers in bulk water natural monopolies, such as Rand Water, to use the optimized capital structure approach to deliver a sustainable economic water infrastructure.

1.6 OVERVIEW OF METHODOLOGY

This is a descriptive study that has adopted a quantitative research approach and double sampling. Descriptive research collects information concerning the current status of particular phenomena and defines which conditions or variables exist within specific situations (Sekaran & Bougie, 2013). The phenomena of interest is the dynamic nature of capital structure with macroeconomic conditions and the impact of time on the company characteristics.

Panel techniques are used for the regression between the independent and dependent variables. The use of panel techniques is common for leverage and macroeconomic regression studies, as demonstrated in the work of Korajczy and Levy (2003). This is due to the cross-sectional nature of the data, the exclusive use of panel techniques would be expected; however other studies like Bernanke and Gertler (1995) have used VAR models. Panel techniques are used to analyze both pillars, as the data meets the panel data criteria defined by Brooks (2014).

The study investigates two regressions, the first is the relationship between leverage and macroeconomic conditions and the second one the Coverage ratio with the changes in interest rate and their lags. This is aimed at answering the questions of the study. Two critical tests are conducted to ensure that the results are not spurious and these are the unit root test and the cointegration test. Descriptive statistics are also used to analyze the data for outliers and to better understand the raw data.

1.7 STRUCTURE OF THE STUDY

This research report is structured as follows:

Chapter 1 introduces the research, including the problem statement, the research questions, purpose, the significance and the limitations of the study.

Chapter 2 outlines a review of the key literature and concepts on macroeconomic conditions and capital structure theories. This chapter closes by describing the essence of the literature.

Chapter 3 outlines the research methodology used to address the research questions.

Chapter 4 presents the results and the discussion of the empirical analysis on the sampled utilities over the 10-year period considered in this study.

Chapter 5 presents the conclusions and the resulting optimized capital structure framework of the study.

CHAPTER 2: Literature Review

2.1 Introduction

This chapter outlines all the relevant literature with regard to this study. This review includes studies that are relevant to this investigation and some that are not. Different arguments from the literature are consulted to inform the use of some variables over others, presenting different schools of thought across of relevant subjects related to capital structure. This review first introduces the indicators of capital structure, identifying the ones relevant for this study. It then presents studies that examine all four pillars of capital structure (see Figure 1).

Bokpin (2009) notes that there is a relationship between indicators of macroeconomic conditions (e.g., GDP per capita), and firms' capital structure. However, Frank and Goyal (2009) highlight that some indicators of macroeconomic conditions (e.g., inflation) do not show a reliable relationship with capital structure. Although Axelson et al. (2013) agree that a relationship exists between capital structure and some indicators of macroeconomic conditions, they also indicate that a relationship exists between firm characteristics and capital structure.

Frank and Goyal (2009) agree to the relationships identified above, but they add industry as another factor. Kayo and Kimura (2011) investigated all the three identified relationships (the macroeconomic conditions, firm characteristics and industry), however they also include time as a fourth relationship/ a direct influencing factor. According to them firm characteristics and time best explain capital structure. Thus, according to Kayo and Kimura (2011), macroeconomic conditions and industry do not help explain capital structure. Therefore, in general, theory has identified four relationships that influence capital structure decisions (see Figure 1): 1) macroeconomic conditions, 2) firm characteristics, 3) industry and 4) time. All these findings will be discussed further in this chapter.

2.2 Capital structure indicators

Previous studies of capital structure have used financial leverage/debt as an indicator of capital structure (Frank & Goyal, 2009; Delcoure, 2007; Korajczy & Levy, 2003). Depending on the purpose of specific studies, different variations have been used to define book leverage. Most authors have used the $\frac{total\ debt}{total\ Asset}$ ratio (Korajczy & Levy, 2003; Frank & Goyal, 2009; Delcoure, 2007) as an indicator of capital structure; however, Axelson et al. (2013) use other variations such as $\frac{total\ debt}{Ebitda}$ and $\frac{total\ debt}{enterprise\ value}$. In line with most studies, this study uses the $\frac{total\ debt}{total\ Asset}$ as an indicator of capital structure.

2.3 Macroeconomic conditions

Korajczy and Levy (2003) argue that capital structure dynamically responds to macroeconomic conditions and financial constraints. They state that the optimal capital structure is countercyclical for a financially unconstrained sample and pro-cyclical for a financially constrained sample. Hackbarth et al. (2006) agree with this notion and further indicate that firms can benefit from linking their financial policies to the position of the economy in that business cycle. Akhtar (2012) agrees with this view based on a study conducted using four stages of the business cycle, which affirms a strong relationship between capital structure and the business cycle. She also indicates that this relationship is relevant when the cash flows depend on current economic conditions.

Hackbarth et al. (2006) further argue that macroeconomic conditions should have a major influence on firms' financing decisions, especially if the optimal capital structure is achieved by balancing tax benefits and bankruptcy costs factors. Since both of these factors depend on cash flows, both are also influenced by current economic conditions. Therefore, the dependence of the capital structure on macroeconomic conditions is evident. Thus, any economic movement should have an impact on the optimal capital structure.

There are a number of indicators from previous capital structure studies used to define macroeconomic conditions, including the following:

- GDP (Kayo & Kimura, 2011; Bokpin, 2009; Axelson et al., 2013; Frank & Goyal, 2009)
- Interest rate (Axelson et al., 2013)
- Inflation (Bokpin, 2009; Frank & Goyal, 2009)
- Taxation (Frank & Goyal, 2009; Delcoure, 2007)

2.4 Firm characteristics

Firm characteristics are primarily driven by the firm's assets (Axelson et al., 2013). These assets can range from the firm's cash flows (stable or instable), profitability, governance structure, and mix of tangible and intangible assets, among others. Gwatidzo & Ojah (2009) investigate other drivers like tax, size and age in their study amongst the firm assets like profitability and assets. Depending on the country size and age have a role to play while tax was found to be insignificant for all countries and their samples.

The dynamic nature of firm characteristics thus drives the ideal optimal capital structure. The following three schools of thought approach the optimal capital structure in different ways: 1) tax-based theory, 2) modern theory and 3) norm-based theory. The tax-based model has two important theories of capital structure: 1) the trade-off theory and 2) the pecking order theory (Korajczyk & Levy, 2003 and Booth, Aivazian, Demirguc-Kunt, & Maksimovic, 2001).

Modern theory mainly has four models based on 1) agency costs, 2) asymmetric information, 3) behavior in the product or input market and 4) corporate control considerations (Harris & Raviv, 1991). Myers (1993) refers to the agency-based theory as "an organisational theory of capital structure", but he does not deny the validity of tax-based theories. However, he does indicate that "In the end none of these theories is completely satisfactory" (Myers, 1993), although they

attempt to provide give the firm's view when applied. By contrast, norm-based theory is based on the idea that "the norms of decision makers can bridge the gap between New Classical economic theories and conflicting empirical evidence" (Lam et al., 2013).

Delcoure (2007) highlights the existence cross-country differences in the capital structure, which are associated with differences related to country tax policies, bankruptcy, agency problems, moral hazard costs and information asymmetry.

2.4.1 Taxed-based theories

2.4.1.1 Trade-off theory

Myers (1984) and Korajczy and Levy (2003) agree that the trade-off theory is about balancing the tax benefits against the bankruptcy costs, thereby achieving an optimal capital structure. Bradley, Jarrel and Kim (1984) partly agree; in their study they rest the optimum capital structure on the balance between tax advantages of debt and the leverage related cost including bankruptcy, agency and loss of non-debt tax shield costs etc. Booth et al. (2001) state that the capital structure targets a balance that mirrors tax rates and bankruptcy costs, incorporating other firm characteristics such as asset type, business risk and profitability. These tax benefits or the relevant tax rate is derived from the interest tax shield due to tax rates on debt interest payments. The bankruptcy costs cover any costs ultimately incurred due to the actual bankruptcy (Dang, 2013).

Other assets are incorporated, as identified by Booth et al. (2001), because companies want to use their tangible assets to provide lenders with security, thereby minimizing their risk should financial distress materialize (Delcoure, 2007). However, companies are not always balancing tax benefits and bankruptcy costs. According to DeAngelo, DeAngelo, and Whited (2011), companies sometimes deviate from this approach to address investments needs that might not result in the ideal balance. Ramjee and Gwatidzo (2012) then define a dynamic trade-off model as one in which firms attempt to quickly return to the targeted balance after an investment shock.

Myers (1993) indicates that "the most telling evidence against the static trade-off theory is the strong inverse correlation between profitability and financial leverage. Within an industry, the most profitable firms borrow less, the least profitable borrow more". When the trade-off theory is put into practice, the fundamental approach involves dynamically choosing the optimal leverage until the value of the firm is maximized (Bhamra, Kuehn, & Strebulaev, 2010) or minimizing the weighted average cost of capital (Firer, Ross, Westerfield & Jordan, 2012).

2.4.1.2 Pecking order theory

Myers (1984) and Korajczy and Levy (2003) define the pecking order theory as the preference for internal funding over external funding. Booth et al. (2001) argue that market imperfections are central with regard to the pecking order theory. They also indicate that "transaction costs and asymmetric information link the firm's ability to undertake new investments to its internally generated funds". As such, if the firms rely on external funding for growth, they choose debt over equity due to the asymmetry of information. However, Frank and Goyal (2009) suggest other causes; for instance, they argue that tax, agency and behavioral considerations may influence debt preferences.

Myers (1993) also argues that, in the pecking order theory, the debt ratio is not well-defined into a specific target as in the trade-off theory. Instead, the theory reasons according to the four logical principles:

1. Dividend policies are difficult to change.
2. Internal financing is preferred over external financing.
3. The instrument considered cheapest and safest are chosen first.
4. Due to the need for more external financing, a pecking order is used to prioritize options based on safety, risk, and cost considerations, but equity is normally the last resort.

Gwatidzo & Ojah (2009) find evidence of the pecking order theory for listed African companies. Their findings indicate that they tend to rely more on internal funding and these findings are relevant. Although the context of the studies might not be the same but the natural monopolies being investigated are in South Africa which is within their study region as well.

2.4.2 Modern models

2.4.2.1 Agency costs

Agency cost models are mainly used due to conflicts of interest (Harris & Raviv, 1991). Conflicts between managers and shareholders occur because managers' benefit to a limited degree from the profits earned due to their activities. Managers are the only ones bearing the costs of responsible management, which results in profitable organizations; however, the managers' benefits are limited, and mainly the shareholders benefit from the profits that the former generate (Harris & Raviv, 1991). Jensen (1986) states that shareholder pay-outs tend to create conflicts between the interests of shareholders and corporate managers (the agents).

At the center of this conflict is resource control and the benefits of debt financing. For agents, resource control decreases when shareholder pay-outs to shareholders are executed. As a result, agents are exposed to external capital market scrutiny when they need to source funds to finance projects and/or enjoy personal benefits. If no pay-outs occur, resource control improves, thereby allowing agents to finance projects internally and to avoid capital market scrutiny (Jensen, 1986). Another source of conflict concerns the shareholder benefits associated with debt. Harris and Raviv (1991) state that the "debt contract gives equity holders an incentive to invest sub-optimally". The shareholders gain on debt returns, but the agents bear the brunt of the negative consequences if the investment fails because shareholders have limited liability. Drawing on the work of other authors, Harris and Raviv (1991) refer to the trade-off between the agency costs and benefits of debt as the optimal capital structure.

2.4.2.2 Asymmetric information

Private information is the backbone of the models that use asymmetric information. The market assumes that company insiders have private information related to potential investment opportunities and/or returns. As a result, the market views capital structure decisions as signals of this private information (Harris & Raviv, 1991). Stock price reactions to the exchange and

issuance of securities, leverage amounts and a firm's alignment with the pecking order theory are the best predictors of asymmetric information (Harris & Raviv, 1991).

In their dynamic model of corporate investment and financing decisions (whereby corporate insiders have superior knowledge of the firm's investments), Morellec and Schürhoff (2011) show that firms with positive private information can time their corporate actions and capital structure to credibly signal the market. As a result, asymmetric information encourages firms with worthy prospects to fast track investments with better terms for the securities that they issue. They further find that informational asymmetries may translate into the trade-off theory rather than the pecking order theory. They predict that "the use of debt should decline with the quality of good types of investment opportunities, the volatility of the cash flow shock, bankruptcy costs, and operating leverage" (Morellec & Schürhoff, 2011).

Leary and Roberts (2010) find that the pecking order is never able to accurately categorize more than 50% of the witnessed financing decisions. The pecking order only starts improving the predictability when alternative theories are considered. They find that the minimal pecking order behavior in the data is driven by incentive conflicts rather than information asymmetry.

2.4.2.3 Behavior in the product or input market

Models based on product/input market interfaces for capital structure have explored its relationship with product market strategies or product/input characteristics. They are characterized by two strategic variables: price and quantity. They focus on how the capital structure affects the product's availability, service, quality and the brokering between the management and input merchants (Harris & Raviv, 1991). In their study, Brander and Lewis (1986) find that oligopolists tend to have more debt than monopolists in the long term. Oligopolists further increase their risk by implementing aggressive output policies, which result in increased debt.

2.4.2.4 Corporate control considerations

Harris and Raviv (1991) indicate that "capital structure affects the value of the firm, the probability of the takeover, and the price effects of takeover" because it helps determine the value of the firm because it contributes to the firm's asset value. This asset value then influences whether the firm can be taken over (considering other factors such as free cash flow and debt) and, if so, at what price.

The theory of capital structure in relation to takeover contests is found to have the following characteristics (Harris & Raviv, 1991) associated with short-term changes in capital structure:

1. Takeover targets have, on average, higher debt levels, and their stock prices react positively.
2. Leverage is negatively related to the success of the tender offer.
3. Targets of proxy fights have, on average, less debt than targets of unsuccessful tender offers.
4. The premium paid to target shareholders increases as the target's equity and debt increases.
5. Costly takeover targets have less debt.

6. High debt takeovers have greater potential.

2.4.3 Norm-based theory of capital structure

The norm-based theory of capital structure is based on Akerlof's (2007) claim that "the norms of decision makers can bridge the gap between New Classical economic theories and conflicting empirical evidence". Lam et al. (2013) argue that their study is among the first to operationalize the direct link between national culture and capital culture through managerial norms. They argue that traditional capital structure theories assume that agents are sensible; unfortunately, the authors provide empirical evidence that proves otherwise. According to Lam et al. (2013), agents are affected by behavioral factors (i.e., managerial traits and biases), which then affect financial decisions.

Furthermore, Lam et al. (2013) define norms "as implicit or explicit rules that a group (or society) uses to identify acceptable and unacceptable values, beliefs, attitudes and behaviours". They argue that people can deviate from rational reasoning to conform to norms, a concept aligned with that of Akerlof (2007). Furthermore, Akerlof (2007) emphasizes that the community knows, generates, observes, and abides by norms. In their study, Lam et al. (2013) introduce two new theories: 1) the manager–subordinate norm and 2) the manager–environment norm; they argue that these theories can explain capital structure decisions.

2.5 Industry-level category/ determinant

According to Kayo and Kimura (2011), certain industry characteristics can be reasonably expected to influence capital structure due to the firm's strategic approach and external factors. They argue that industry dynamism and munificence are two factors that can influence capital structure. Simerly and Li (2000) demonstrate that the trend is to analyze the environmental dynamics of the industry (i.e., industry dynamism) rather than the direct influence of the environmental characteristics on leverage. This trend relates to a company's business risk, and firms in similar industries tend to experience similar business risks due to similar costs for skilled labor and raw materials and similar technologies (Kayo & Kimura, 2011). Thus, "it is predicted that the larger the business risk, the smaller the level of firm leverage" (Kayo & Kimura, 2011).

However, the effect of profitability on leverage cannot be generalized due to firm characteristics that may be aligned with the pecking order theory or the trade-off theory (Kayo & Kimura, 2011).

2.6 Time

Kayo and Kimura (2011) argue that "time cannot be ignored in the capital structure evolution". They further indicate that time reflects a company's macroeconomic shocks within a given year. This observation seems to contradict the findings of Lemmon, Roberts, and Zender (2008), who find that capital structure seems to be stable over time. Kayo and Kimura (2011) indicate that these findings do not necessarily contradict one another because the samples used in the two

studies are different. The main difference is that the sample of Kayo and Kimura (2011) includes more developed countries, while Lemon et al.'s (2008) sample includes 40 developing countries. Lam et al. (2013) then find that the leverage ratios in multiple countries and time are significantly affected by four environments: 1) economic, 2) financial, 3) legal and 4) tax environments. Their findings emphasize the impact of time on the capital structure and country-specific variables.

Titman and Tsyplakov (2007) demonstrate in their study the existence of time-series variations of debt ratios. This is an indication as well of the impact of time on debt ratios. Although the context of their study was different, their findings that companies move slowly towards their targeted debt ratio after an impact in time. This is a demonstration of the time effect, within the dynamic environment of incorporating continuous investment and financial choices.

Bernanke and Gertler (1995) identify two critical theories that are relevant to economic responses through monetary policy changes. Monetary policy changes are normally necessitated by changes in macroeconomic conditions. These two critical theories are the bank lending and balance sheet channel theories. In their paper, Bernanke and Gertler (1995) question the relevance of the "controversial" bank lending theory, while they argue that the balance sheet theory "seems fairly well established" (Bernanke & Gertler, 1995).

2.6.1 Bank lending channel theory

The bank lending channel seeks to explain the influence of macroeconomic conditions (through monetary policy) on the number of loans supplied by depository institutions (Bernanke & Gertler, 1995). Bernanke and Gertler (1995) doubt the relevance of the bank lending channel theory, but Zulkhibri (2013) disagrees with their assessment. In his paper, he indicates that the bank lending channel theory applies to emerging market economies or transition economies if the panel data approach is used. Observing banks in France, Germany, Italy and Spain, Favero, Giavazzi, and Flabbi (1999) find no evidence of a significance response of bank loans to monetary tightening. However, in a study conducted in Spain, Jimenez, Ongena, Peydro, and Saurina (2012), analyzing the extensive margin of lending with loan applications, find that lower GDP growth (during periods of higher short-term interest rates) reduces the number of loans granted, especially by banks with low capital or liquidity.

Nilsen (2002) finds that the bank lending channel theory is valid; he finds that small financial institutions increase trade credit as a substitute for loans, which indicates that the demand for loans increases. Thus, according to Nilsen (2002), this finding supports the bank lending channel theory, as banks do not voluntarily cut loans; instead, they issue a less-desirable alternative. He also finds evidence of large firms also increasing trade credit, which further supports the existence of the of the bank lending channel.

The study of Zulkhibri (2013) supports the bank lending channel theory in some countries. A number of factors influence these findings, including the following:

- Market segment
- Bank liquidity
- Bank role

- Flexibility between insured and uninsured sources of funding

2.6.2 Balance sheet channel theory

The balance sheet channel seeks to explain the influence of macroeconomic conditions (through monetary policy) on a firm's income statement, balance sheet, net worth, cash flow and even liquid assets (Bernanke & Gertler, 1995). The empirical work of Villegas Salazar (2009) supports the balance sheet channel theory for non-financial institutions in Colombia during the 1995–2007 period. Shabbir (2012) also finds similar results in Pakistan, arguing that the "monetary contraction increases the financial expenses of the firms, reduces their profits and squeezes their cash flow".

Angelopoulou and Gibson (2009) find that the balance sheet channel theory is important in explaining the macroeconomic changes in the manufacturing sector in the United Kingdom. They further conclude that financially constrained firms are more cash flow sensitive during periods of low growth. Sousa and Gameiro (2013) do not find any substantial evidence of systematic governmental behavior in response to monetary shocks. In their empirical study, they do find that macroeconomic changes in Portugal, materializing in monetary policy shocks, have a contractionary effect on the economic activities, increasing the financing needs of the household and the non-financial institution.

2.7 Essence of the research

This research essentially aims to ensure that economic infrastructure planning is customized (within the bulk water industry in SA) to respond to macroeconomic conditions and their impact over time. It also seeks to use empirical evidence from previous similar studies to describe the existing phenomenon. The many empirical studies referred to in this chapter presents findings that must be scrutinized to determine their relevance or be used to describe the phenomenon. These findings include but not limited to the following:

1) The relevance of linking financial policies to the economy (Hackbarth et al., 2006), if relevant.
2) The potential of planning leverage considering monetary contractions their impact over time. However If they do have an impact, they increase financial expenses, resulting in squeezed cash flows (Shabbir, 2012). However, if monetary contractions do not have an impact, as in the study of Sousa and Gameiro (2013) on government institutions, then they do not need to be considered in the financial planning policies.
3) The relevance of other empirical findings in explaining the bulk water industry phenomenon in SA e.g., deviations to address investment needs, even if doing so not optimal (DeAngelo, DeAngelo, & Whited, 2011).

CHAPTER 3: Research Methodology

The literature review in the previous chapter covers other studies in this field, presenting their arguments and findings. This chapter discusses the methodology used to answer the research questions and to propose a capital structure framework model. Creswell (2013) argues that research methods involve the researchers' intended forms of data collection, analysis and interpretation. Therefore, this chapter first justifies the selected research approach and methodology in terms of how they relate to the stated research problem. The chapter then describes the research analysis, outlining the variables and model creation. It further proposes how the results should be interpreted, using the selected statistical procedures with a specific reference to decision making.

As part of the aforementioned research methods, this chapter also covers sample collection, sampling strategy and units of analysis. Finally, the chapter concludes by highlighting the methodologies adopted to ensure that the results are reliable.

3.1 Data Collection

The research approach and design guides the data collection. The next two subsections outline the logic of the chosen approach and design. They then describe the population studied, the sampling procedure and the data collection process.

3.1.1 Research Approach

Research approaches are plans and procedures that cover the steps from broad assumptions to detailed methods of data collection, analysis and interpretation. The most common research approaches use qualitative, quantitative and mixed methods (Sekaran & Bougie, 2013).

Qualitative research is the analysis, recording and attempt to unpack the deeper meaning and significance of human experience and behavior (Saunders, Lewis, & Thornhill, 2009). This approach explores and attempts to understand the meaning that individuals or groups ascribe to a social or human problem. Myers (2009) states that qualitative research is designed to help researchers understand people and the social and cultural contexts in which they live. Johnson and Christensen (2010) define quantitative research as the collection and conversion of data into numerical forms to enable statistical calculations and conclusions to be easily drawn. Quantitative research examines the links between variables to test objective theories. Mixed method mixes the qualitative and quantitative methods.

This study applies quantitative research methods because it aims to link variables and draw conclusions regarding their relationships.

3.1.2 Research Design

Lewis and Saunders (2012) differentiate between three types of research designs, namely, exploratory, explanatory and descriptive designs. An exploratory study is conducted when little is

known about the situation at hand and the objective is to discover insights. Explanatory studies test whether one variable causes another to change. These studies normally use experiments as a data collection method.

Descriptive research collects information concerning the current status of particular phenomena and defines which conditions or variables exist within specific situations (Sekaran & Bougie, 2013). This research is a descriptive study investigates the dynamic relationship between capital structure and macroeconomic conditions; furthermore their impact over time in the bulk water industry in SA. This study gathers information concerning the current status of capital structure phenomena in state-owned bulk water monopolies and define what exists with respect to the identified variables within phenomena.

Theoretical propositions are tested with regard to the two pillars identified, macroeconomic conditions and time. The phenomena of interest in the macroeconomic pillar is its dynamic relationship to capital structure. While the balance sheet channel theory is of interest in the time pillar. Thus, as this study seeks to use a research strategy to test theoretical propositions, it adopts a deductive approach (Lewis & Saunders, 2012).

3.1.3 Sampling and data collection process

In a study, the population is the entire group being investigated (Sekaran, 2003). The population in this study consists of nine water boards in SA: Rand Water, Umngeni Water, Mhlathuze Water, Sedibeng Water, Amatola Water, Bloem Water, Magalies Water, Lepelle Northern Water and Overberg Water (Department of Water and Sanitation, 2014). According to the Department of Water and Sanitation (2014), water boards derive their mandate from the Water Service Act of 1997, and they operate under Schedule 3B of the Public Finance Management Act as national government business enterprises.

The main purpose of the water boards is to provide bulk water services to the municipalities in which they operate and to other entities (i.e., mines, industries, etc.). This study utilizes a share of this population, which Sekaran (2003) refers to as a subset of the population, which allows a researcher to draw conclusions about the population after studying it. According to Sekaran (2003), the two most common sampling methods are probability and non-probability sampling.

Probability sampling is used when parts of the population have a known probability of being chosen as subjects in the sample. This type of sampling is also chosen when representativeness is critical for the study, whereas non-probability sampling is used when it is not critical. The probability sampling methods can be classified into random, systematic, cluster, area and double sampling. All these sampling methods have their advantages and disadvantages, and they are used for specific reasons and purposes. For instance, random sampling and systematic sampling are advantageous for generalization, while double sampling is used to gather more information from a subset of the sample. Since this study aims to create a capital structure optimization framework that prevents economic infrastructure bottlenecks in the bulk water industry, focusing on an unrestricted subset within the water board sample is critical. Water boards that do not raise capital from markets are restricted to internal returns (revenues) and commercial banks, which limits the capital available compared to those that are able raise capital from the financial markets.

When water boards cannot access markets, a massive bottleneck already exists in the bulk water's economic infrastructure. Thus, these water boards are not of interest here because their capital-raising approaches are already limited. The suitable sampling design is probability sampling, using a double sampling technique. Johannesburg Stock Exchange (JSE) statistics identify only two water boards that raise money in public financial markets: the Rand and Umngeni water boards. These water boards thus represent 22% of the population. However, due to the small population size, the ideal sample is close to the total population. This study aims to gather more information from a subset of water boards that raises capital from the public financial markets; thus, the double sampling design is used to focus on the two water boards. The secondary data from the annual financial reports of Rand and Umngeni water boards is used in this study.

The water boards that raise their funds from public capital markets post their annual financial statements (AFSs) for the past ten years on their websites. These annual financial statistics are the source of the data required for this study. The data is observed annually for a 10-year period.

3.1.4 Descriptive statistics

The Jarque–Bera test is used to test the data for normality. If the histogram of the residuals is bell shaped, then they are normally distributed (Brooks, 2014). This test is then measured against a significance level of 5%. The null hypothesis cannot be rejected if the normally distributed error is significant (above 5%); if not, it can be rejected. The Jarque–Bera test uses skewness and kurtosis to fully describe the data (Brooks, 2014). Skewness measures the extent to which the data are not symmetric to their mean. Kurtosis measures the fatness of the tails and the ways in which they peak at the mean.

3.2 Regression Analysis

The sampled data contains both time-series and cross-sectional elements; according to Brooks (2014), these data are known as "panel of data". These panel data apply to both of the analyzed pillars: macroeconomic conditions and time. The macroeconomic pillar is characterized by the leverage ratio (of the water boards) measured over time as the dependent variable and the macroeconomic conditions as the independent variables. The time pillar is characterized by the coverage ratio measured over time as the dependent variable and a macroeconomic variable (interest rate) and its lags as the independent variables. Both pillar investigations meet the criteria of panel data, as they contain time-series and cross-sectional components. However, the regression methodology for the time pillar is further discussed to enhance clarity.

3.2.1 Time pillar regression analysis

Based on the definition of Bernanke and Gertler (1995), the balance sheet channel explains the influence of monetary policy changes on income statements, balance sheets, net worth, cash flows and even liquid assets. In their study, Angelopoulou and Gibson (2009) use the monetary changes, measured as changes in interest rates over time, independently regressed against changes in investments and cash flows. Villegas Salazar (2009) use investments to investigate a

monetary shock in Colombia; alternatively, Shabbir (2012) uses financial expenses and monetary policy changes in his methodology.

The methodology used for the time pillar is similar to the methodology used by Bernanke and Gertler (1995) in terms of variables. They use the coverage ratio ($\frac{interest\ expenses}{(interest\ expenses+\ Profit)}$) as the dependent variable regressed against changes in monetary policy represented by changes in the interest rate. Instead of using a variable influenced by the monetary changes as in the other study, they choose a ratio to represent the impact. This study adopts this approach rather than choosing just one or two influenced variables. They argue that the coverage ratio is highly correlated to other indicators of a company's financial health.

Bernanke and Gertler's (1995) analysis is conducted over four lags. The lags in their study capture the delayed impacts of the interest rate changes on the coverage ratio. This delayed impact of the macroeconomic shock represents/reflects the evolution of capital structure. They use the vector autoregression (VAR) technique to regress the variables instead of panel techniques.

3.2.2 Panel techniques

Four main panel techniques are available: seemingly unrelated regression (SUR), fixed effects, pooled time-fixed effects and random effects models; however, these effects can be grouped as fixed, random and pooled effects (Brooks, 2014). Brooks (2014) indicates that the random effects model assumes the following: firstly, the intersection of each entity arises from the common intercept α, and the model is the same for all entities and over time; secondly, a random variable ϵ_i varies cross-sectionally but is fixed over time. The intersection thus deviates from the global intersection term. Furthermore, this model is more appropriate for random samples; thus, it is not relevant in this study, because the sample is not random.

The SUR requires that the number of time-series observations per cross-sectional area, at a minimum, as large as the cross-sectional units. This requirement is met by the observations in the data, but the disadvantage is the very high number of parameters. The pooled effects model is either fixed or random; it is used in the study to compare with the fixed effects to identify the most suitable model for the data.

The fixed effects model fixes entities, which is applicable in this study. Furthermore, the model is more parsimonious than the SUR. However, it is said to be more appropriate when examining the entire population; otherwise, it is not relevant (Brooks, 2014). For this study, although the full water board population is not used, the full population of water boards that raise money from markets is used. The time fixed effects model fixes time as opposed to the entities, which makes it irrelevant in this study in which time is varied. Based on the fixed effects and pooled model, the regression model equations used in this study for the macroeconomic and time pillars are presented below.

Pillar 1: Macroeconomic conditions:

$$L_{it} = \propto +\beta_1 G_t + \beta_2 Inf_t + \beta_3 Int_t + \mu_i + v_{it} \quad \text{.....Eq. 1}$$

Pillar 2: Time:

$$CR_{it} = \theta + \delta_1 Int_t + \delta_2 Int_{t-1} + \delta_3 Int_{t-j} + \mu_i + v_{it} \text{ ..... } \text{.....Eq. 2}$$

Table 3.1 describing the equation symbols

Equation Symbols	Description
L_{it}	Leverage ratio = $\frac{total\ debt}{total\ assets}$
$\propto$	Intercept of the macro-economic conditions pillar
β_i	Variable coefficient for the macro-economic conditions pillar, where i varies from 1 to 3
G_t	Gross domestic product (GDP) varying with time t
Inf_t	Inflation varying with time t
Int_t	Interest rate varying with time t
μ_i	All variables that affect L_{it} cross-sectionally but are not time variable
v_{it}	Remainder of the disturbance per entity i and varying with time t
CR_{it}	Coverage ratio = $\frac{interest\ expenses}{(interest\ expenses + Net\ Profit)}$
θ	Intercept of the macroeconomic pillar
δ_i	Variable coefficient for the macroeconomic pillar, where i varies from 1 to 3
Int_t	Interest rate varying with time t
Int_{t-j}	Interest rate varying with time t lagged by time period j, where j ranges from 1 to 4
ε_i	Cross-sectional error term per entity i
γ_{it}	Error term per entity i and varying with time t

Pillar 1 seeks to answer the first question of the study: Does the capital structure for natural monopolies (parastatals) dynamically respond to macroeconomic conditions? As a result capital structure represented by leverage is regressed against macroeconomic conditions. The results advise if there is a relationship and its associated strength. Pillar 2 seeks to answer if the balance sheet channel theory holds for natural monopolies (parastatals), or do macroeconomic shocks have an impact on capital structure over time? To achieve this changes of the interest Coverage ratio representing company characteristics is regressed against changes in interest rate. The same regression has been used by other studies to test the existence of the balance sheet channel theory.

The use of panel techniques is common for pillar 1 studies, as demonstrated in the work of Korajczy and Levy (2003), due to the cross-sectional nature of the data. However, in their study, Bernanke and Gertler (1995) use VAR models. For this study panel techniques are used to analyze both pillars, as the data meet the panel data criteria defined by Brooks (2014). The variables

chosen as the independent variables are identified from previous studies of this nature. Previous capital structure studies have used the following macroeconomic conditions:

- GDP (Kayo & Kimura, 2011; Bokpin, 2009; Axelson et al., 2013; Frank & Goyal, 2009)
- Interest rate (Axelson et al., 2013)
- Inflation (Bokpin, 2009; Frank & Goyal, 2009)
- Taxation (Frank & Goyal, 2009; Delcoure, 2007)

All these have been used in this study except for the taxation as the sample exists under the same tax laws. All these are relevant for the Pillar 1 regression. As per section 3.2.1 the choice of the independent variables are based on the work by Bernanke and Gertler (1995).

3.2.2.1 Interpretation of panel techniques

The original data trends are the first analyzed and interpreted to identify outliers and trends within the data. Thereafter, the regression results are interpreted and analyzed based on theoretical expectations presented in chapter 2. Basic theoretical interpretations are then used to provide indicators of the signs of the coefficients, and such indicators are also analyzed and interpreted. The R-squared is used to explain the influence of the independent variables on the dependent variable.

Information criteria are used to select between the competing models in this study, i.e., the fixed and pooled model options. A number of these methods can be used to select between these models, including adjusted R-SQUARED, the Akaike information criterion (AIC), Schwarz's Bayesian information criterion (SBIC) and the Hannan–Quinn information criterion (HQIC) (Brooks, 2014). The most common criteria used in similar studies are the AIC and the SBIC (Frank & Goyal, 2009; Kayo & Kimura, 2011). The three information criteria considered here have different levels of stiffness in their penalty term, with the SBIC being the stiffest, followed by the HQIC and then the AIC. The SBIC is very consistent but inefficient, while the AIC is more efficient but inconsistent. Brooks (2014) indicates that “SBIC will asymptotically deliver the correct model order”.

3.2.2.2 Reliability of the results

Two critical tests are conducted to ensure that the results are not spurious: the unit root test and the cointegration test. The panel unit root test is conducted to determine whether the data are stationary. According to Ramirez (2006), they are more powerful and less likely to commit type II errors, and they lead to “statistics with a normal distribution in the limit”. Stationarity can strongly influence the behavior and the properties of a series. When the series is not stationary, the impacts of shocks can last beyond the shock period and can even increase, thus altering the properties of that series (Brooks, 2014). The panel unit root test used for this study is the Levin, Lin and Chu test.

The Pedroni residual cointegration test, which is frequently used in panel studies, including that of Ramirez (2006), is used to test cointegration. To interpret the results, the probability is compared to the significance level. If the probability is higher than the significance level of 10%,

the null hypothesis of no cointegration cannot be rejected. If the probability is lower than 10%, the null hypothesis can be rejected.

CHAPTER 4: Results and Discussion

The results from the data analysis are presented and discussed in this chapter, starting with the data modification performed. The descriptive statistics are then presented for all the independent variables across the two regressions. The descriptive statistics for the dependent variable are then presented before the regression results for both pillars. Pillar one presents the regression results for the leverage analyzed against three macroeconomic conditions, namely, GDP, changes in interest rate and inflation. Pillar two is the coverage ratio analyzed against the changes in interest rate and its three lags.

4.1 Data modification

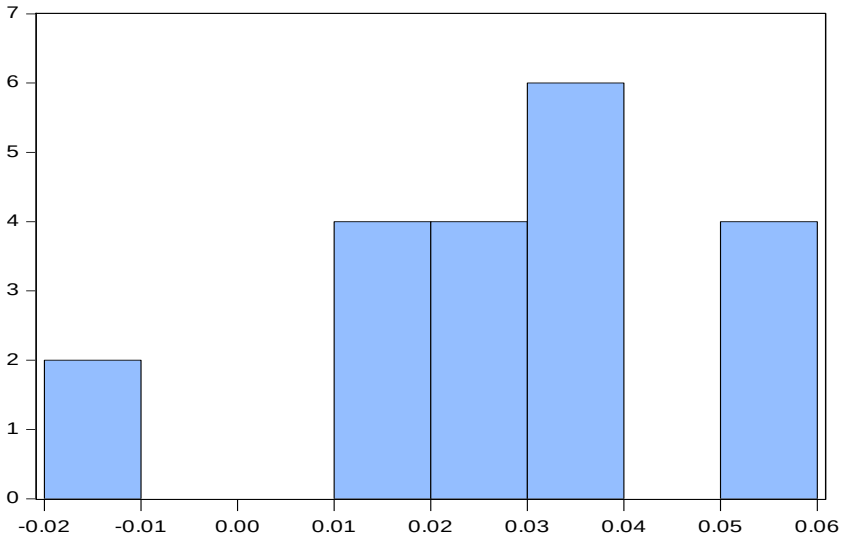
Macroeconomic data from the period of interest are downloaded from the World Bank database into an Excel spreadsheet. The data was collected annually in line with the source of time regression data. The time regression data is sourced from the AFSs of the study samples. Leverage is calculated as $=\frac{total\ debt}{total\ Asset}$, while the Coverage ratio is calculated as $=\frac{interest\ expenses}{(interest\ expenses+Profit)}$.

AFSs are available for all years in the study period, except for 2008 for sample 2 (Umngeni Water Board data). A dummy variable is then used for the leverage and Coverage ratio, derived from the fiscal years of 2007 and 2009 based on the gradient of the data over time. The formula used to estimate the dummy variables is $F_{2007} - (\frac{F_{2007} - F_{2009}}{2})$, where F is the leverage ratio or the Coverage ratio. The two data sets (from each water board) are then combined and arranged for a panel analysis. The data are then uploaded to EViews for analysis.

4.2 Descriptive statistics (independent variables)

The probability of the Jarque–Bera test for GDP is found to be significant (at the 5% significance level) with a probability of 75% (see Figure 4.2.1). As a result, the null hypothesis for residual normality cannot be rejected for the GDP series. The third and fourth moments (skewness and kurtosis) are found to be -0.41 and 3.1, respectively. A normal distribution has a kurtosis coefficient of 3 and a skewness coefficient of 0. The GDP series is found to have kurtosis and skewness coefficients close to those of the normally distributed series, as would be expected for a significant probability.

Figure 4.2.1 Jarque–Bera normality test results for GDP

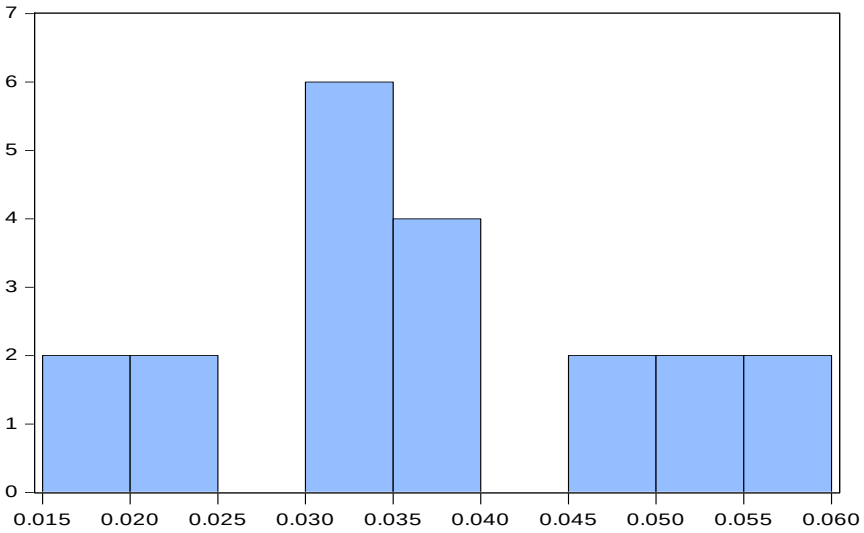


GDP data is found to have a negative GDP of -0.015 in the year 2009, representing an outlier in the data. This negative growth is a result of the 2009 recession. Appendix C contains the panel data series for all the macro-economic variables over time and GDP is represented by figure C1. This repeats the GDP series over the ten-year period for both sample 1 (Rand Water) and sample 2 (Umngeni Water). The recession point can be clearly observed in this time series. The Levin, Lin and Chu unit root test results indicate that the null hypothesis of a unit root test can be rejected for the GDP series at a significance level of 10% per Appendix B (Table B1: Unit root results for GDP)

For the interest rate the probability of the Jarque–Bera test is found to be significant (0.75), indicating that the null hypothesis for a normal distribution also cannot be rejected (see Figure 4.2.2). The Jarque–Bera statistic is found to be 0.6 (rather than zero) due to a skewness of 0.12 (rather than 0) and a kurtosis of 2.2 (rather than 3). However, the results of the Levin, Lin and Chu unit root test show a significant probability, indicating that the null hypothesis for a unit root cannot be rejected (Appendix B: Table B2: Unit root results for interest rate).

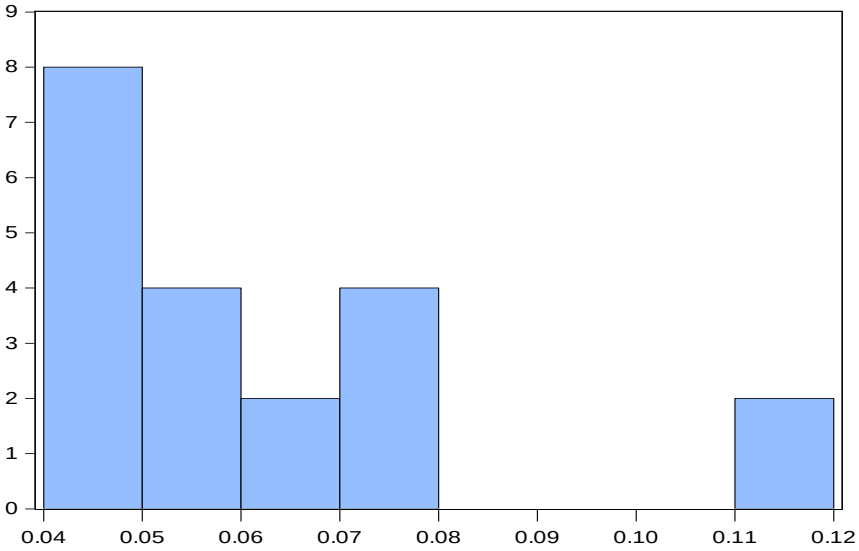
This finding poses a problem if the data is used under the current conditions, as the results may be spurious. To improve the statistical quality of the interest rate data, it is differentiated. The differential interest rate is then used in the regression, representing the changes in interest rates over time. Appendix C contains the panel data series for the changes of the interest rate over time represented by Figure C2. The interest rate changes are aligned with known events such as the 2009 recession, resulting in a reduced interest rate to stimulate the economy. The GDP increase in 2010 is aligned with the tourism contribution due to the FIFA World Cup held in SA that year.

Figure 4.2.2 Jarque–Bera normality test results for the interest rate



The probability of the Jarque–Bera test is found to be insignificant for inflation as per Figure 4.2.3. Thus, the null hypothesis of a normal distribution can be rejected. The unit root test probability is also found to be insignificant; thus, the null hypothesis for a unit root can be rejected (Appendix B: Table B3: Unit root results for inflation).

Figure 4.2.3 Jarque–Bera normality test results for inflation



The inflation time series (as per appendix C, figure C3) does not present any outliers that cannot be explained. The 2009 recession also results in an inflation spike. Similarly, due to a panel analysis, the inflation data are repeated over the two sample analysis periods. For two of the independent variables (GDP and inflation), the null hypothesis for a unit root can be rejected. As indicated the null hypothesis cannot be rejected for the interest rate variable, the series is differentiated to improve the data

quality. These results and the differentiated interest rate confirm that the data can the used in a regressions.

4.3 Pillar one: Results for the macro-economic conditions regression

The probability of the Jarque–Bera test is found to be significant (0.051) for leverage, indicating that the null hypothesis for a normal distribution cannot be rejected, as shown in Figure 4.3.1. The results of the Levin, Lin and Chu unit root test show an insignificant probability, indicating that the null hypothesis for a unit root can be rejected (as shown in appendix B, Table B4). Figure 4.3.2 presents data on the two samples over time, and sample 2 continuously decreases from a high position of leverage over time. This corporate strategy is clearly associated with gearing in the earlier stages of the period and then paying off the debt over time, irrespective of the macroeconomic conditions. This finding is aligned with those of DeAngelo et al. (2011), who find that companies sometimes deviate to address investment needs that might not be within the ideal balance. However, sample 1 shows a reaction trend based on the macroeconomic conditions.

Figure 4.3.1 Jarque–Bera normality test for leverage

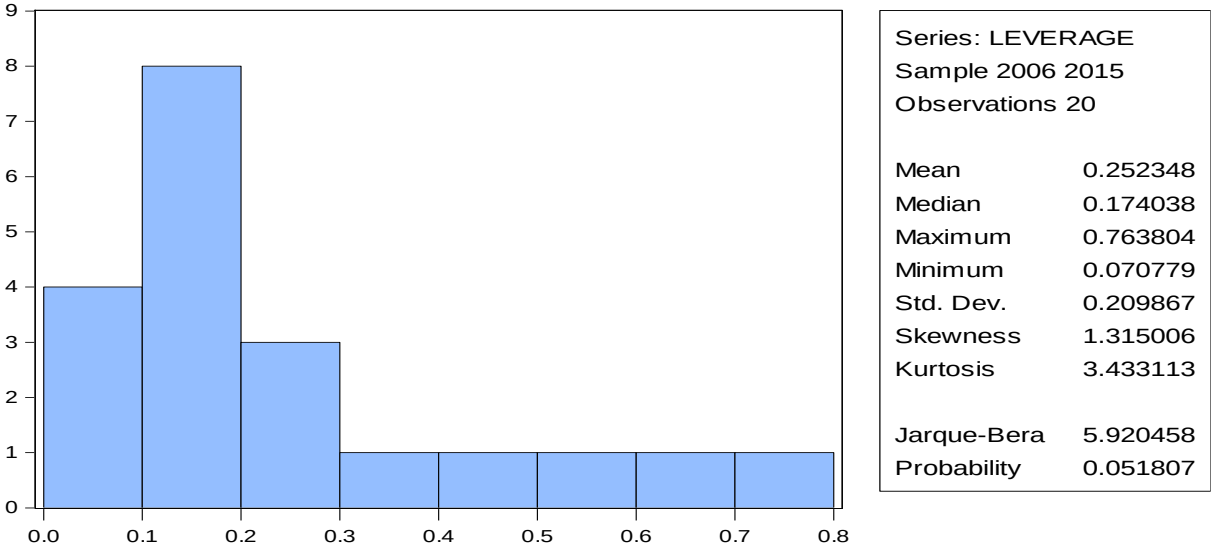
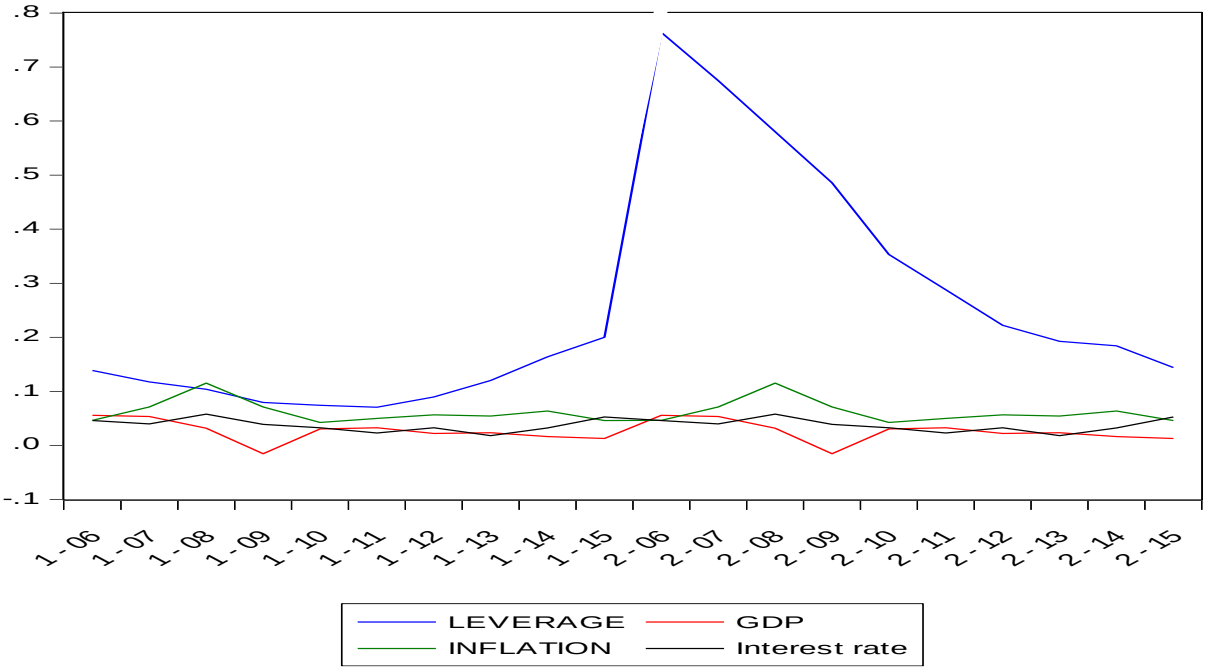


Figure 4.3.2 Leverage change series over time for both water boards



The panel least squares model is used for the regression, with fixed or pooled cross-section options. The information criteria used in previous similar studies are used to choose the best model. The ideal model is chosen based on low values for information criteria, especially the AIC and SBIC. Table 4.3.1 shows the results of this comparison, which reveal that the fixed option is superior.

Table. 4.3.1 Information criterion results indicating that the fixed model is superior

Fixed	
Akaike information criterion	-0.985938
Schwarz criterion	-0.738613

Pooled	
Akaike information criterion	-0.313383
Schwarz criterion	-0.115522

The results of this model are then used to define the relationships between the dependent variable and the independent variables. The R-squared is found to be 59.2%, implying that only 59.2% of the dependent variable's variation can be explained by the independent variables. Thus, other factors that are not considered in this study are at play. The signs of the coefficients are found to be aligned with theory, as the leverage is expected to increase as the interest rate decreases.

$$L_{it} = 0.0061 + 1.4474\, G_t + 3.0305\, Inf_t - 1.9939\, \partial Int_t + \epsilon_i + \mu_{it} \ldots \quad \text{.....Eq. 3}$$

Std. error	0.1090	1.7750	1.5622	2.3050
t-Statistic	0.0556	0.8155	1.9400	-0.8650
Prob.	0.9565	0.4295	0.0744	0.4027

The Pedroni residual cointegration test is conducted to test the model for cointegration. The null hypothesis for the test is that no cointegration exists, and 11 methods are used to generate the results. All 11 methods are found to be significant at the 10% level, implying that the null hypothesis cannot be rejected. Since one of the five assumptions of ordinary least squares (OLS) is that the residuals are

normally distributed, the Jarque–Bera normality test is performed on the residuals, and the probability is significant, implying that the null hypothesis of normal distribution cannot be rejected.

Table. 4.3.2 Pedroni residual cointegration test results

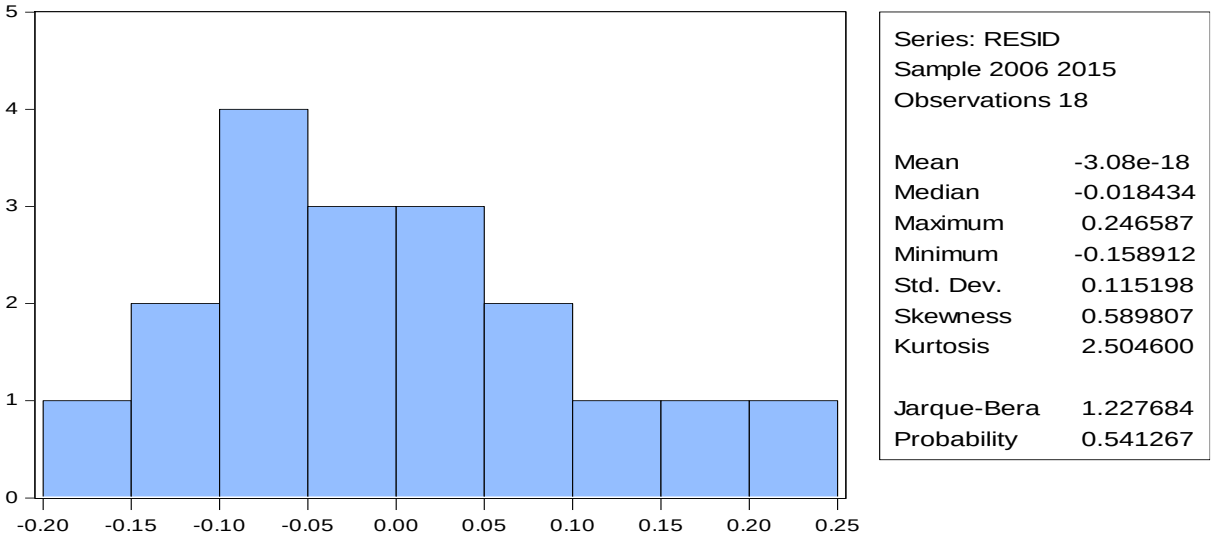
Indicating that the null of no cointegration cannot be rejected

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.461862	0.6779	-0.319435	0.6253
Panel rho-Statistic	0.753911	0.7745	0.809696	0.7909
Panel PP-Statistic	-0.333369	0.3694	-0.055121	0.4780
Panel ADF-Statistic	1.421246	0.9224	1.741191	0.9592

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.532871	0.9373
Group PP-Statistic	0.441040	0.6704
Group ADF-Statistic	2.713193	0.9967

Figure 4.3.3 Jarque–Bera normality test for the leverage residuals



The findings of this study agree with those of Bokpin (2009), who document a relationship between macroeconomic conditions and capital structure. Although the variables are only able to explain 59% of the dependent variable in this case, the GDP and interest rate are significant. The insignificance of inflation is in line with the findings of Frank and Goyal (2009), as inflation does not demonstrate a reliable relationship with capital structure. The negative sign of the interest rate is also aligned with the findings of other theoretical studies, including that of Korajczy and Levy (2003). They argue that optimal capital structure is counter-cyclical for financially unconstrained firms and the findings in this study are aligned with these notions.

The other factors that might help explain the dependent variable may be aligned with theories that are not investigated in this study, such as modern theories (Harris & Raviv, 1991) rather than tax-based theories (Korajczyk & Levy, 2003 and Booth et al., 2001). As previously mentioned, the modern theory primarily relates to four models based on 1) agency costs, 2) asymmetric information, 3) behavior in the product or input market, and 4) corporate control considerations (Harris & Raviv, 1991). Given the product that water boards sell (i.e., water), the behavior-in-the-product-or-input-market model may explain the high gearing observed in sample 2 and its decrease over time.

The behavior-in-the-product-or-input-market model is characterized by two strategic variables, namely, price and quantity (Harris & Raviv, 1991). In SA, parliament approves the prices, but the users determine the quantity. Thus, if demand increases, water boards must fund new infrastructure projects to respond to the quantity demanded by users. This finding is aligned with the theoretical findings of DeAngelo et al. (2011).

4.4 Pillar two: Results for the time regression

The probability of the Jarque–Bera test is found to be insignificant (0.020) for the Coverage ratio, indicating that the null hypothesis for a normal distribution can be rejected (see Figure 4.4.1). The Levin, Lin and Chu unit root test results show an insignificant probability, indicating that the null hypothesis for a unit root can be rejected (see Table 4.4.1). Figure 4.4.2 demonstrates the two samples' Coverage ratios over time. A leverage corporate strategy is also observed in this series for sample 2. The Coverage ratio for sample two is continuously decreasing from a high position over time. A delayed reaction trend in the Coverage ratio seemingly occurs due to interest rate changes. The observation further justifies the use of lags in the regression.

Figure 4.4.1 Jarque–Bera normality test for Coverage ratio

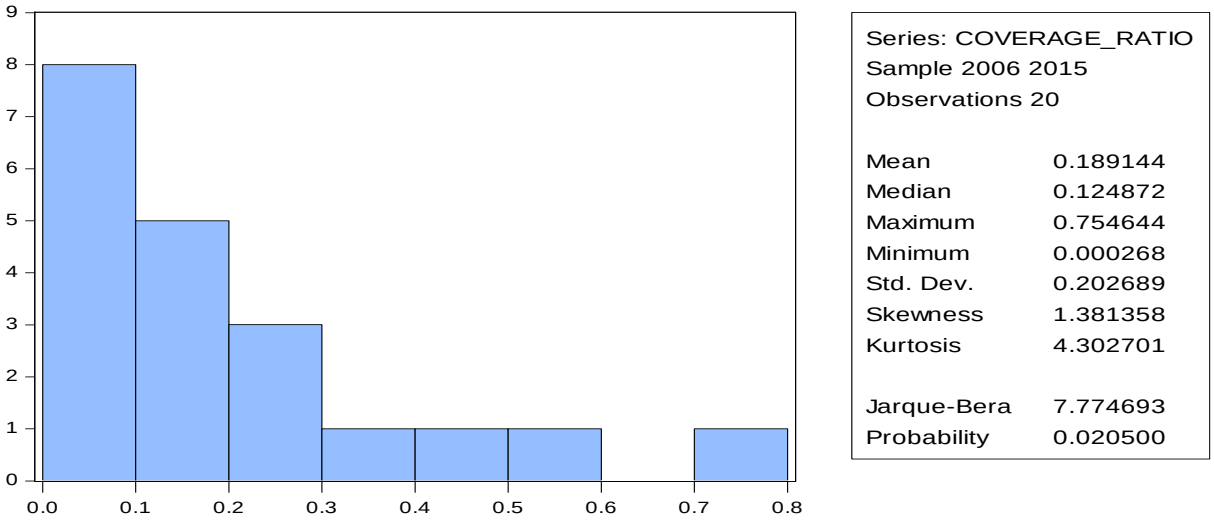
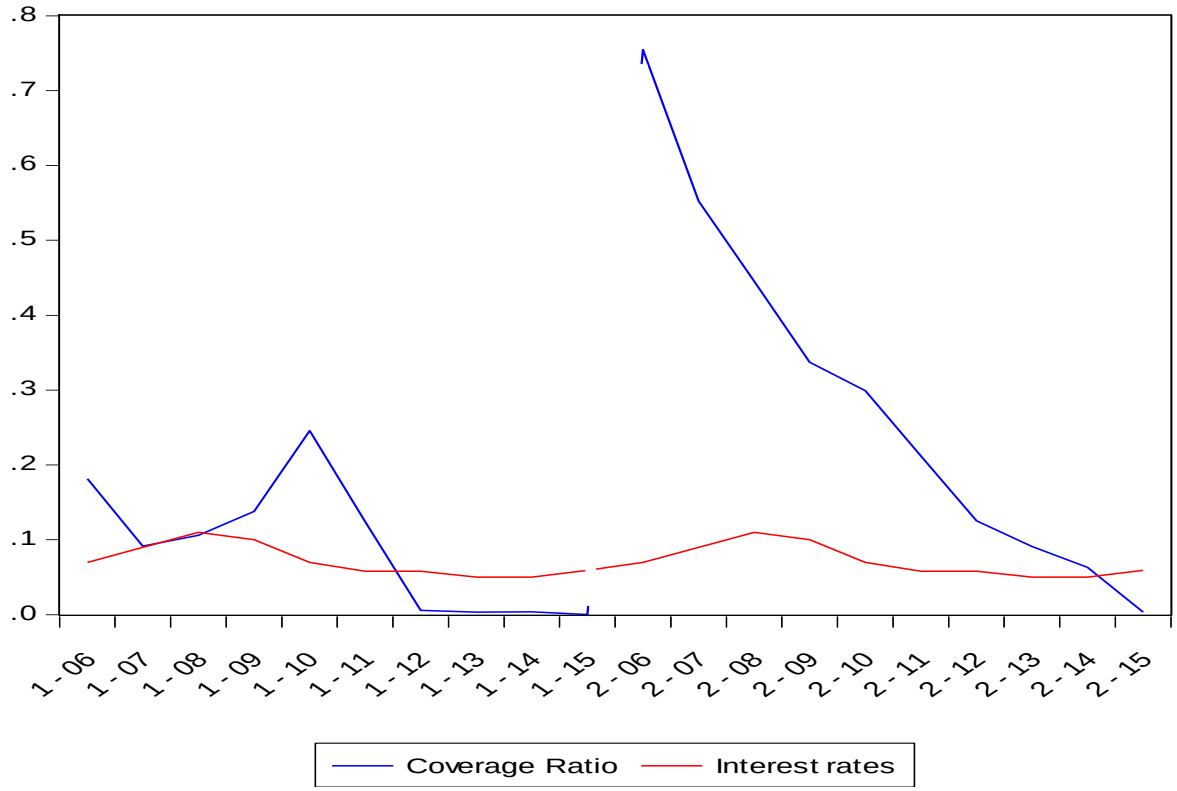


Table 4.4.1 Unit root test results for leverage

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-1.75131	0.0399

Figure 4.4.2 Coverage ratio series over time for both water boards and interest rates



The panel least squares model is used for the regression with fixed or pooled cross-sectional options. Lags are progressively tested from the first lag one to the third lag. The third lag gave the highest R-squared among other results. The fixed or pooled models were then compared at this lag to choose the best model. The best model was chosen using the information criterion used in previous similar studies. The idea model was chosen based on low information criterion figures, especially from the AIC and the SBIC. Table 4.4.2 presents the results of this comparison. The information criterion results demonstrate that the fixed option is superior to the pooled model at the third lag.

Table. 4.4.2 Information criterion results indicating that the fixed model is superior

Fixed	
Akaike information criterion	-4.079858
Schwarz criterion	-3.837405

Pooled	
Akaike information criterion	-2.808616
Schwarz criterion	-2.606571

The results of this model are then used to define the relationship between the dependent variable and the independent variables. The R-squared is found to be 96.4%, implying that 96.4% of the

dependent variable's variation can be explained by the independent variable and its lags. The signs of the coefficients are found to be aligned with theoretical assumptions.

$$CR_{it} = 0.0563 - 6.4160\, dInt + 0.3923 dInt_{-1} - 0.9212\, dInt_{-2} + 2.155\, dInt_{-3} + \varepsilon_i + \gamma_{it}$$

Eq 4

Std. error	0.0146	0.9964	1.4105	2.3050	0.8179
t-Statistic	3.863	-6.4392	0.2782	-0.8650	2.6353
Prob.	0.0083	0.0007	0.7902	0.4027	0.0388

The Pedroni residual cointegration test is conducted to test the model for cointegration. The null hypothesis for the test is that no cointegration exists, and 11 methods are used to generate the results. All 11 methods are found to be significant at the 10% level, implying that the null hypothesis cannot be rejected. The Jarque–Bera normality test is used to test the normality of the Coverage ratio residuals, and the null for normality cannot be rejected.

Table. 4.4.3 Pedroni residual cointegration test results

Indicating that the null of no cointegration cannot be rejected

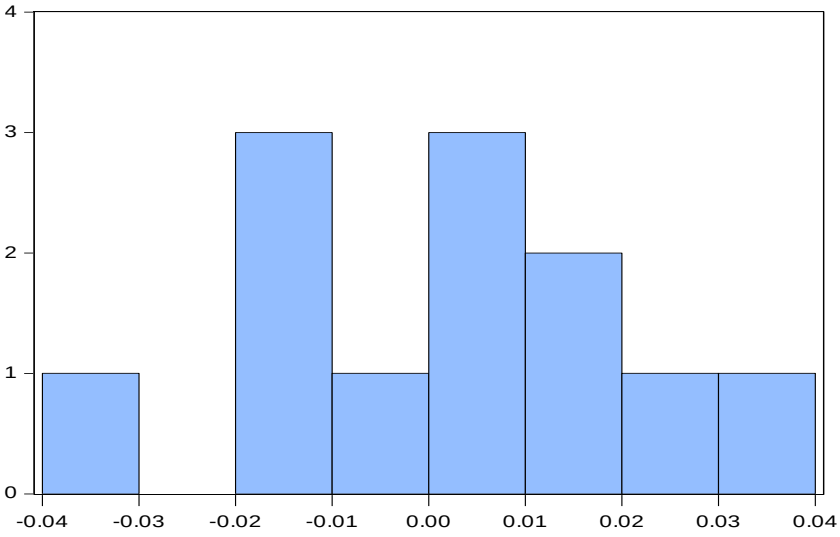
Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.576112	0.7177	-0.632648	0.7365
Panel rho-Statistic	1.024836	0.8473	0.972729	0.8347
Panel PP-Statistic	1.170652	0.8791	1.015598	0.8451
Panel ADF-Statistic	1.856722	0.9683	1.056897	0.8547

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.626841	0.9481
Group PP-Statistic	1.746365	0.9596
Group ADF-Statistic	2.059837	0.9803

Figure 4.4.3 Jarque–Bera normality test for the Coverage ratio residuals



As stated earlier, the balance sheet channel seeks to explain the influence of macroeconomic conditions (through monetary policy) on income statements, balance sheets, net worth, cash flows and even liquid assets (Bernanke & Gertler, 1995). This study uses changes in the real interest rate to represent monetary policy. The changes in the income statement are investigated through the coverage ratio. The changes in the interest rate and its lags are able to explain 96.4% of the coverage ratio, which supports the balance sheet channel theory in the bulk water industry for water boards that access capital from the markets.

The current change in the real interest rate is not significant; its first and second lags are found to be significant. Therefore, the impact of the interest rate change is delayed. These findings are aligned with the empirical findings of Villegas Salazar (2009), who validates the balance sheet channel theory in non-financial institutions in Colombia. Using data on Pakistan, Shabbir (2012) documents similar results as those documented by Villegas Salazar (2009). According to Shabbir, “the monetary contraction increases the financial expenses of the firms, reduces their profits and squeezes their cash flow”. This finding is also aligned with the relationship noted between the Coverage ratio and the change in the interest rate in the current study.

CHAPTER 5: Conclusions and the proposed optimized capital structure framework for natural monopolies in the bulk water industry

This study investigates the answers to two questions in order to create a capital structure framework for natural monopolies within the bulk water industry. The two questions are as follows:

- Does capital structure for natural monopolies (parastatals) dynamically respond to macroeconomic conditions?
- Does the balance sheet channel theory hold for natural monopolies (parastatals)?

The investigation takes a two pillar approach. On the one hand, the regressions for the microeconomic conditions pillar aim to investigate whether the capital structure dynamically responds to the macroeconomic conditions. On the other hand, the regressions for the time pillar aims to determine whether the balance sheet channel holds for natural monopolies. For both pillars, a literature review has been conducted to assess the current knowledge on the subject matter, including capital structure behavior due to macroeconomic conditions and relevant theories, the variables found to be more theoretically relevant, and the methodology used to conduct previous empirical studies.

The empirical investigation for both pillars has been conducted with data from the Annual Financial Statements of the relevant water boards and macroeconomic data from the World Bank. The data is analyzed in EViews, first testing for the existence of a unit root and normality. After the regression is conducted, it is tested for cointegration. These tests are conducted to ensure that the results and subsequent inferences are not spurious. Some variables are differentiated to improve the statistical quality for the analysis. The macroeconomic variables used in the study are GDP, the interest rate and inflation—in line with previous empirical studies conducted by authors such as Kayo and Kimura (2011), Bokpin (2009), Axelson et al. (2013), and Frank and Goyal (2009). The variables for the macroeconomic conditions are regressed as independent variables for both pillars. For the two regressions conducted, the dependent variables are leverage and the coverage ratio.

The Jarque–Bera normality test is used to investigate normality of all the variables. According to its null hypothesis, the series are normal; thus, if the probability is significant, the null cannot be rejected at a significance level of 5%. The null hypothesis cannot be rejected for any variables, except for the inflation and the Coverage ratio. The normality of the variables is not assumed under OLS, but the normality of the error is assumed under OLS (Brooks, 2014). The Jarque–Bera normality test is performed on the residuals, and the null hypothesis for normal distribution cannot be rejected for either regression. The Levin, Lin and Chu unit root test is conducted to investigate the existence of a unit root at a significance level of 10%, and all series, except for the interest rate, are found not to have a unit root except. The interest rate is not directly used in the regression; it is differentiated to improve the statistical quality, and its change over time is used in the regression.

5.1 Does the capital structure for natural monopolies (parastatals) dynamically respond to macroeconomic conditions?

This question is answered in the macroeconomic pillar; all the macroeconomic variables are regressed against leverage. The findings of this study agree with those of Bokpin (2009), who document a relationship between the macroeconomic condition variable and capital structure. Although the

variables are only able to explain 59% of the dependent variable in this case, the GDP and the interest rate are significant. The insignificance of inflation is aligned with the findings of Frank and Goyal (2009), who show that inflation does not have a reliable relationship with capital structure. Therefore, the answer is yes—leverage does partly dynamically respond to macroeconomic conditions in water boards in SA.

5.1.1 Macroeconomic framework

In their study, Hackbarth et al. (2006) have indicated that firms benefit from linking their financial policies to the position of the economy in the business cycle. The results of this empirical study is in support of their findings. The water boards in SA that raise their capital in the open market should align their policies to the economic business cycle.

5.2 Does the balance sheet channel theory hold for natural monopolies (parastatals)?

This question is answered by the time pillar, whereby the change in the interest rate over time and its lags are regressed as independent variables with the Coverage ratio as the dependent variable. This result is then used to determine the influence of the macroeconomic conditions (through monetary policy) on income statements, balance sheets, net worth, cash flows and even liquid assets (represented by the Coverage ratio). This approach is aligned with those of other studies and their conceptualizations of the balance sheet channel theory (Bernanke & Gertler, 1995). This study uses the changes in the real interest rate over time to represent monetary policy. The changes in the interest rate and its lags are able to explain 96.4% of the Coverage ratio. Thus, the balance sheet channel theory holds for water boards that access capital from the markets.

5.2.1 Macroeconomic conditions framework

The benefit of linking policies to the business cycle holds for this pillar as well. The critical observation from this empirical exercise is the significance of the delayed impact of the interest rate changes. This significance is observed on the first and second lags of the interest rate changes. Thus, the water boards' policies should incorporate a two-year interest rate impact delay into their financial planning.

5.3 Research limitations

The study has been conducted on two of the nine water boards—a subsample focusing on water boards that obtain capital from the open financial markets only. Thus, the findings of this study do not apply to other water boards and cannot be generalized. The study specifically focuses on one industry and thus cannot be generalized to other industries.

5.4 Recommendations for future studies

As indicated firm characteristics are not investigated in this study however their critical role in the optimal capital structure cannot be ignored; as they are primarily driven by the firm's assets (Axelson et al., 2013). These assets can range from the firm's cash flows (stable or instable), profitability, governance structure, and mix of tangible and intangible assets, among others. The dynamic nature of the firms' characteristics thus influences the ideal optimal capital structure as well. This influence is recommended for future studies.

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Captured data, leverage and Coverage ratio information for the panel analysis

Time	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
RAND WATER										
Revenue	ZAR 3,667,557,000.00	ZAR 4,101,080,000.00	ZAR 4,258,538,000.00	ZAR 4,632,484,000.00	ZAR 4,966,187,000.00	ZAR 5,887,992,000.00	ZAR 6,838,493,000.00	ZAR 7,751,214,000.00	ZAR 8,664,894,000.00	ZAR 9,802,542,000.00
Expenses	ZAR 2,991,493,000.00	ZAR 3,353,109,000.00	ZAR 3,463,818,000.00	ZAR 4,114,314,000.00	ZAR 4,641,269,000.00	ZAR 5,314,815,000.00	ZAR 6,108,933,000.00	ZAR 6,799,723,000.00	ZAR 7,551,327,000.00	ZAR 8,444,942,000.00
Operational profit	ZAR 676,064,000.00	ZAR 747,971,000.00	ZAR 794,720,000.00	ZAR 518,170,000.00	ZAR 324,918,000.00	ZAR 573,177,000.00	ZAR 729,560,000.00	ZAR 951,491,000.00	ZAR 1,113,567,000.00	ZAR 1,357,600,000.00
Interest expenses	ZAR 129,999,000.00	ZAR 74,580,000.00	ZAR 97,599,000.00	ZAR 95,795,000.00	ZAR 101,799,000.00	ZAR 78,788,000.00	ZAR 4,338,000.00	ZAR 3,237,000.00	ZAR 4,543,000.00	ZAR 387,000.00
Net profit	ZAR 586,260,000.00	ZAR 742,078,000.00	ZAR 823,817,000.00	ZAR 598,579,000.00	ZAR 312,438,000.00	ZAR 553,891,000.00	ZAR 771,506,000.00	ZAR 974,845,000.00	ZAR 1,182,667,000.00	ZAR 1,441,044,000.00
Coverage ratio	0.181497196	0.091323418	0.10592284	0.137958795	0.245750621	0.124530765	0.00559133	0.003309538	0.003826619	0.000268483
Current interest-bearing borrowing	ZAR 13,087,000.00	ZAR 9,499,000.00	ZAR 358,000.00	ZAR 100,000.00	ZAR 0.00	ZAR 0.00	ZAR 208,228.00	ZAR 1,818,000.00	ZAR 2,458,000.00	ZAR 2,469,000.00
Non-current interest-bearing borrowing	ZAR 735,175,000.00	ZAR 725,736,000.00	ZAR 726,998,000.00	ZAR 628,252,000.00	ZAR 629,665,000.00	ZAR 645,517,000.00	ZAR 984,636,000.00	ZAR 1,514,586,000.00	ZAR 2,510,093,000.00	ZAR 3,672,432,000.00
Total debt	ZAR 748,262,000.00	ZAR 735,235,000.00	ZAR 727,356,000.00	ZAR 628,352,000.00	ZAR 629,665,000.00	ZAR 645,517,000.00	ZAR 984,844,228.00	ZAR 1,516,404,000.00	ZAR 2,512,551,000.00	ZAR 3,674,901,000.00
Total assets	ZAR 5,389,055,000.00	ZAR 6,253,635,000.00	ZAR 7,012,667,000.00	ZAR 7,911,184,000.00	ZAR 8,462,459,000.00	ZAR 9,120,138,000.00	ZAR 10,992,797,000.00	ZAR 12,630,891,000.00	ZAR 15,321,711,000.00	ZAR 18,373,466,000.00
Leverage	0.138848462	0.117569222	0.103720311	0.079425785	0.07440686	0.070779302	0.089589959	0.120055189	0.16398632	0.20001131
UMNGENI WATER										
Revenue	ZAR 1,076,703,000.00	ZAR 1,180,260,000.00		ZAR 1,485,496,000.00	ZAR 1,622,380,000.00	ZAR 1,648,950,000.00	ZAR 1,835,075,000.00	ZAR 1,895,887,000.00	ZAR 2,187,886,000.00	ZAR 2,207,704,000.00
Expenses	ZAR 639,040,000.00	ZAR 709,705,000.00		ZAR 843,362,000.00	ZAR 1,002,280,000.00	ZAR 1,203,892,000.00	ZAR 1,259,772,000.00	ZAR 1,298,971,000.00	ZAR 1,590,965,000.00	ZAR 1,540,061,000.00
Operational profit	ZAR 437,663,000.00	ZAR 470,555,000.00		ZAR 642,134,000.00	ZAR 620,100,000.00	ZAR 445,058,000.00	ZAR 575,303,000.00	ZAR 596,916,000.00	ZAR 596,921,000.00	ZAR 667,643,000.00
Interest expenses	ZAR 473,895,000.00	ZAR 309,417,000.00		ZAR 267,571,000.00	ZAR 230,499,000.00	ZAR 114,237,000.00	ZAR 84,567,000.00	ZAR 66,477,000.00	ZAR 45,510,000.00	ZAR 2,672,000.00

Net profit	ZAR 154,077,000.00	ZAR 250,752,000.00		ZAR 525,638,000.00	ZAR 540,024,000.00	ZAR 425,052,000.00	ZAR 590,815,000.00	ZAR 664,468,000.00	ZAR 673,969,000.00	ZAR 800,929,000.00
Coverage ratio	0.754643519	ZAR 0.55	Not Available	0.337327237	0.299146164	ZAR 0.21	0.125213583	0.090946651	0.063254105	0.003325033
Current interest-bearing borrowing	ZAR 116,190,000.00	ZAR 120,268,000.00		ZAR 1,061,455,000.00	ZAR 117,282,000.00	ZAR 115,006,000.00	ZAR 12,831,000.00	ZAR 109,451,000.00	ZAR 78,263,000.00	ZAR 78,433,000.00
Non-current interest-bearing borrowing	ZAR 2,168,572,000.00	ZAR 2,060,323,000.00		ZAR 917,448,000.00	ZAR 1,400,166,000.00	ZAR 1,257,787,000.00	ZAR 1,136,306,000.00	ZAR 1,025,930,000.00	ZAR 1,171,766,000.00	ZAR 1,093,331,000.00
Total debt	ZAR 2,284,762,000.00	ZAR 2,180,591,000.00		ZAR 1,978,903,000.00	ZAR 1,517,448,000.00	ZAR 1,372,793,000.00	ZAR 1,149,137,000.00	ZAR 1,135,381,000.00	ZAR 1,250,029,000.00	ZAR 1,093,331,000.00
Total assets	ZAR 2,991,292,000.00	ZAR 3,230,495,000.00		ZAR 4,073,721,000.00	ZAR 4,297,404,000.00	ZAR 4,770,642,000.00	ZAR 5,173,778,000.00	ZAR 5,893,407,000.00	ZAR 6,790,319,000.00	ZAR 7,598,673,000.00
Leverage	0.763804403	0.675002128	Not Available	0.485772835	0.353108062	0.287758545	0.222107906	0.192652739	0.184089879	0.143884465
GDP growth (annual %)	5.585045962	5.360474053	3.191043888	-1.538089135	3.039734625	3.284197135	2.213258978	2.330342259	1.628871543	1.264651378
Inflation, consumer prices (annual %)	4.641624894	7.098419808	11.53645077	7.13	4.26234355	4.995510185	5.653583003	5.445279482	6.375259009	4.588271042
Real interest rate (%)	4.603671469	3.966380361	5.78272573	3.910367979	3.274351919	2.316472195	3.289403088	1.794189268	3.239059816	5.251954785

Appendix B

Detailed unit root results

Table B1: Unit root results for GDP

Null Hypothesis: Unit root (common unit root process)
Series: GDP
Date: 01/20/17 Time: 00:10
Sample: 2006–2015
Exogenous variables: Individual effects
User-specified lags: 1
Newey–West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 16
Cross-sections included: 2

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-4.80117	0.0000

** Probabilities are computed assuming asymptotic normality

Intermediate results for GDP

Cross-section	2nd-Stage Coefficient	Variance of Reg.	HAC of Dep.	Lag	Max Lag	Band-width	Obs.
1	-1.29252	0.0002	9.E-05	1	1	8.0	8
2	-1.29252	0.0002	9.E-05	1	1	8.0	8

	Coefficient	t-Stat	SE Reg.	mu*	sig*	Obs.
Pooled	-1.29252	-5.783	1.000	-0.554	0.919	16

Table B2: Unit root results for interest rate

Null Hypothesis: Unit root (common unit root process)
Series: INTEREST_RATE
Date: 01/20/17 Time: 00:27
Sample: 2006–2015
Exogenous variables: Individual effects
User-specified lags: 1
Newey–West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 16
Cross-sections included: 2

Method	Statistic	Prob.**
Levin, Lin & Chu t*	0.62880	0.7353

** Probabilities are computed assuming asymptotic normality

Intermediate results for INTEREST_RATE

Cross-section	2nd-Stage Coefficient	Variance of Reg.	HAC of Dep.	Lag	Max Lag	Band-width	Obs.
1	-0.74023	0.0002	0.0001	1	1	1.0	8
2	-0.74023	0.0002	0.0001	1	1	1.0	8

	Coefficient	t-Stat	SE Reg.	mu*	sig*	Obs.
Pooled	-0.74023	-2.285	1.000	-0.554	0.919	16

Table B3: Unit root results for inflation

Null Hypothesis: Unit root (common unit root process)
Series: INFLATION
Date: 01/20/17 Time: 21:26
Sample: 2006 2015
Exogenous variables: Individual effects
User-specified lags: 1
Newey–West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 16
Cross-sections included: 2

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-2.70684	0.0034

** Probabilities are computed assuming asymptotic normality

Intermediate results on INFLATION

Cross-section	2nd-Stage Coefficient	Variance of Reg.	HAC of Dep.	Lag	Max Lag	Band-width	Obs.
1	-1.07602	0.0003	0.0002	1	1	8.0	8
2	-1.07602	0.0003	0.0002	1	1	8.0	8

	Coefficient	t-Stat	SE Reg.	mu*	sig*	Obs.
Pooled	-1.07602	-4.144	1.000	-0.554	0.919	16

Table B4: Unit root results for leverage

Null Hypothesis: Unit root (common unit root process)
Series: LEVERAGE
Date: 01/20/17 Time: 22:28
Sample: 2006–2015
Exogenous variables: Individual effects
User-specified lags: 1
Newey–West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 16
Cross-sections included: 2

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-1.89061	0.0293

** Probabilities are computed assuming asymptotic normality

Intermediate results for LEVERAGE

Cross-	2nd-Stage	Variance	HAC of		Max	Band-

section	Coefficient	of Reg.	Dep.	Lag	Lag	width	Obs.
1	-0.27601	8.E-05	0.0013	1	1	2.0	8
2	-0.14954	0.0005	0.0026	1	1	2.0	8
	Coefficient	t-Stat	SE Reg.	mu*	sig*		Obs.
Pooled	-0.16627	-3.168	1.021	-0.554	0.919		16

Table B4: Unit root results for Coverage ratio

Null Hypothesis: Unit root (common unit root process)
Series: COVERAGE_RATIO
Appendix A Date: 01/21/17 Time: 00:49
Sample: 2006–2015
Exogenous variables: Individual effects
User-specified lags: 1
Newey–West automatic bandwidth selection and Bartlett kernel
Total (balanced) observations: 16
Cross-sections included: 2

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-1.75131	0.0399

** Probabilities are computed assuming asymptotic normality

Intermediate results for COVERAGE_RATIO

Cross-section	2nd-Stage Coefficient	Variance of Reg.	HAC of Dep.	Lag	Max Lag	Band-width	Obs.
1	-0.48596	0.0040	0.0008	1	1	8.0	8
2	-0.19104	0.0004	0.0033	1	1	1.0	8
	Coefficient	t-Stat	SE Reg.	mu*	sig*		Obs.
Pooled	-0.20659	-2.684	1.024	-0.554	0.919		16

Appendix C

Time series for macro-economic variable

Figure C1 GDP series over time

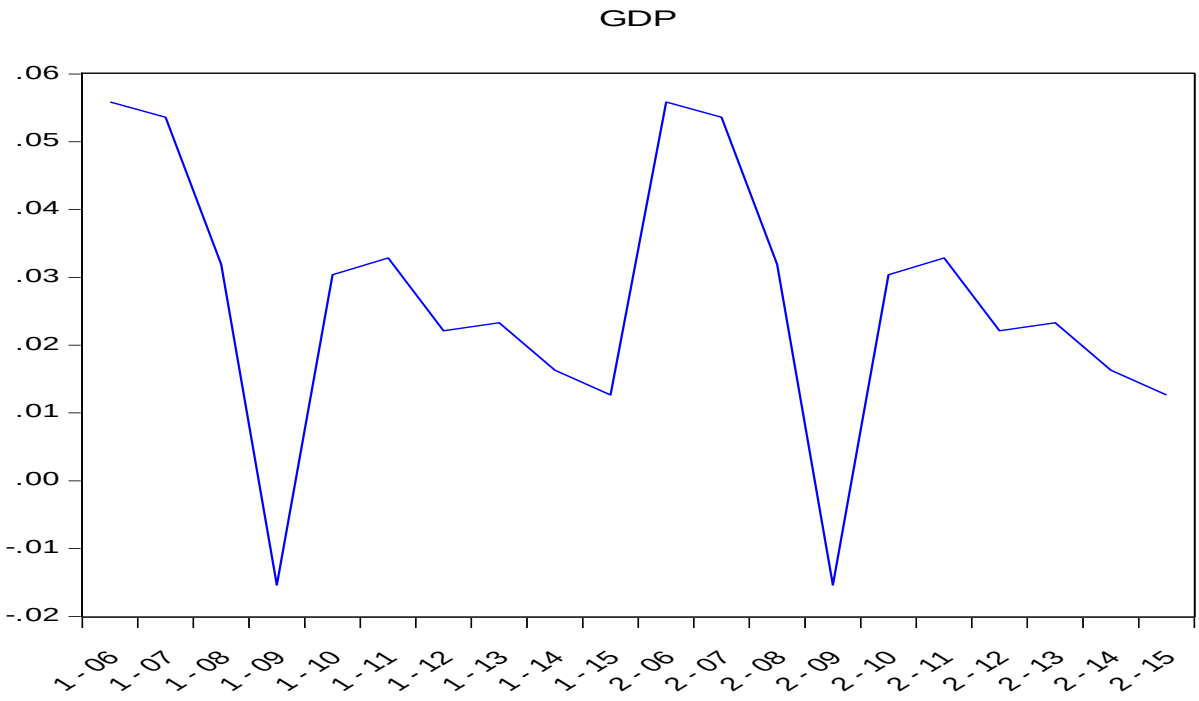


Figure C2 Interest rate changes over time for both water boards

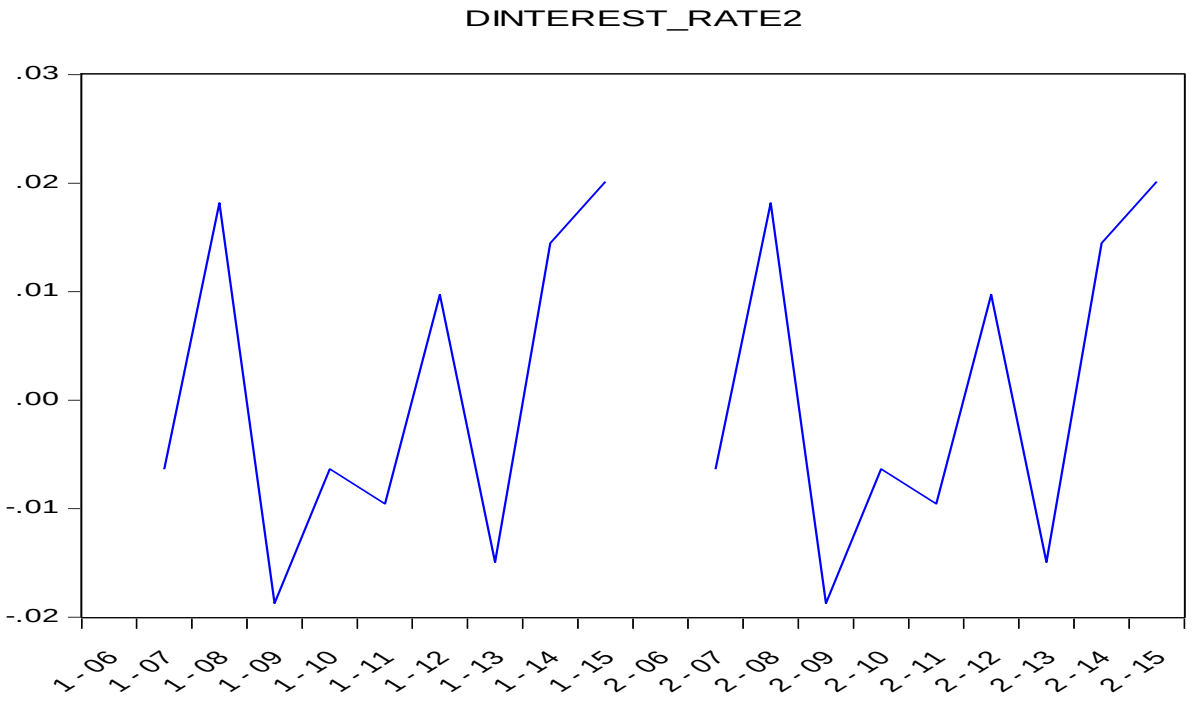
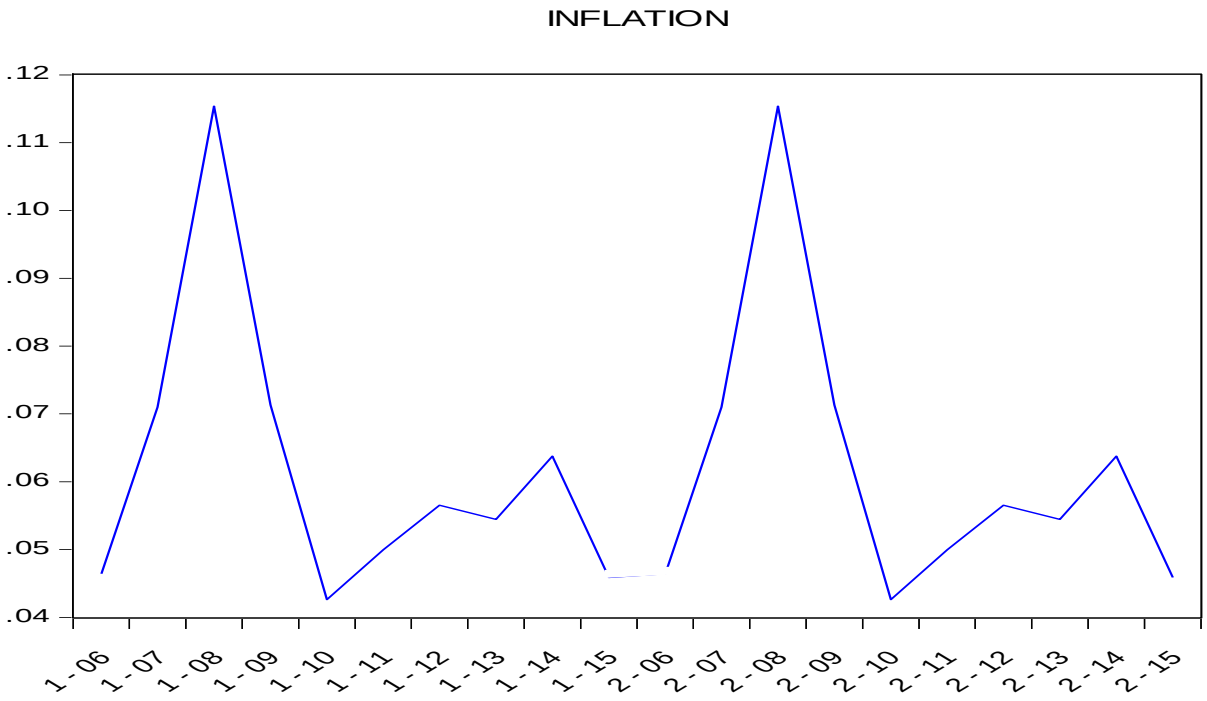


Figure C3 Inflation change series over time for both water boards



Appendix D

Regression results

Macroeconomic conditions regression

Regression results for panel options with a fixed cross-section

Dependent Variable: LEVERAGE
Method: Panel least squares
Date: 01/20/17 Time: 00:39
Sample (adjusted): 2007–2015
Periods included: 9
Cross-sections included: 2
Total panel (balanced) observations: 18

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006050	0.108888	0.055560	0.9565
DINTEREST_RATE2	-1.993846	2.304913	-0.865042	0.4027
GDP	1.447386	1.774847	0.815499	0.4295
INFLATION	3.030464	1.562195	1.939876	0.0744

Effects Specification
Cross-section fixed (dummy variables)

R-squared	0.592466	Mean dependent variable	0.230239
Adjusted R-squared	0.467071	S.D. dependent variable	0.180452
S.E. of regression	0.131734	Akaike information criterion	-0.985938
Sum squared residuals	0.225598	Schwarz criterion	-0.738613
Log likelihood	13.87345	Hannan–Quinn criterion	-0.951835
F-statistic	4.724799	Durbin–Watson stat	0.416689
Prob. (F-statistic)	0.014187		

Regression results for panel options with a pooled cross-section

Dependent Variable: LEVERAGE
Method: Panel least squares
Date: 01/15/17 Time: 01:46
Sample (adjusted): 2007–2015
Periods included: 9
Cross-sections included: 2
Total panel (balanced) observations: 18

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006790	0.287960	0.023580	0.9815
DINTEREST_RATE	-0.193892	5.485459	-0.035347	0.9723
GDP	0.202236	3.413132	0.059252	0.9536
INFLATION	3.605424	4.743769	0.760033	0.4598

R-squared	0.107711	Mean dependent variable	0.230239
Adjusted R-squared	-0.083494	S.D. dependent variable	0.180452

S.E. of regression	0.187834	Akaike information criterion	-0.313383
Sum squared residuals	0.493944	Schwarz criterion	-0.115522
Log likelihood	6.820444	Hannan–Quinn criterion	-0.286100
F-statistic	0.563325	Durbin–Watson stat	0.225885
Prob. (F-statistic)	0.648036		

Pedroni Residual Cointegration Test

Series: LEVERAGE GDP DINTEREST_RATE2 INFLATION
Date: 01/20/17 Time: 23:52
Sample: 2006–2015
Included observations: 20
Cross-sections included: 2
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey–West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.461862	0.6779	-0.319435	0.6253
Panel rho-Statistic	0.753911	0.7745	0.809696	0.7909
Panel PP-Statistic	-0.333369	0.3694	-0.055121	0.4780
Panel ADF-Statistic	1.421246	0.9224	1.741191	0.9592

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.532871	0.9373
Group PP-Statistic	0.441040	0.6704
Group ADF-Statistic	2.713193	0.9967

Cross-section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs.
1	0.203	0.000819	0.000873	1.00	8
2	0.097	0.007944	0.008709	1.00	8

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs.
1	0.475	0.000836	1	--	7
2	0.218	0.008670	1	--	7

Macroeconomic conditions regression

Dependent Variable: COVERAGE_RATIO
Method: Panel Least Squares
Date: 01/21/17 Time: 01:18
Sample (adjusted): 2010–2015
Periods included: 6
Cross-sections included: 2
Total panel (balanced) observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.056333	0.014582	3.863200	0.0083
DINTEREST_RATE	-6.416003	0.996393	-6.439226	0.0007
DINTEREST_RATE(-1)	0.392349	1.410470	0.278169	0.7902
DINTEREST_RATE(-2)	-0.921179	0.984862	-0.935339	0.3857
DINTEREST_RATE(-3)	2.155325	0.817852	2.635348	0.0388

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.964419	Mean dependent variable	0.098083
Adjusted R-squared	0.934768	S.D. dependent variable	0.105674
S.E. of regression	0.026990	Akaike information criterion	-4.079858
Sum squared residuals	0.004371	Schwarz criterion	-3.837405
Log likelihood	30.47915	Hannan–Quinn criterion	-4.169623
F-statistic	32.52562	Durbin–Watson stat	1.270118
Prob. (F-statistic)	0.000284		

Dependent Variable: COVERAGE_RATIO
Method: Panel Least Squares
Date: 01/21/17 Time: 01:20
Sample (adjusted): 2010–2015
Periods included: 6
Cross-sections included: 2
Total panel (balanced) observations: 12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.056333	0.027706	2.033211	0.0815
DINTEREST_RATE	-6.416003	1.893196	-3.388980	0.0116
DINTEREST_RATE(-1)	0.392349	2.679962	0.146401	0.8877
DINTEREST_RATE(-2)	-0.921179	1.871286	-0.492271	0.6376
DINTEREST_RATE(-3)	2.155325	1.553959	1.386990	0.2080

R-squared	0.850136	Mean dependent variable	0.098083
Adjusted R-squared	0.764499	S.D. dependent variable	0.105674
S.E. of regression	0.051282	Akaike information criterion	-2.808616
Sum squared residuals	0.018409	Schwarz criterion	-2.606571
Log likelihood	21.85169	Hannan–Quinn criterion	-2.883420
F-statistic	9.927249	Durbin–Watson stat	0.301556
Prob. (F-statistic)	0.005180		

Pedroni Residual Cointegration Test

Series: COVERAGE_RATIO DINTEREST_RATE
Date: 01/21/17 Time: 01:41
Sample: 2006–2015
Included observations: 20
Cross-sections included: 2
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey–West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.576112	0.7177	-0.632648	0.7365
Panel rho-Statistic	1.024836	0.8473	0.972729	0.8347
Panel PP-Statistic	1.170652	0.8791	1.015598	0.8451
Panel ADF-Statistic	1.856722	0.9683	1.056897	0.8547

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.626841	0.9481
Group PP-Statistic	1.746365	0.9596
Group ADF-Statistic	2.059837	0.9803