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A STUDY INTO THE EVOLUTION OF BANK CAPITAL IN SOUTH AFRICA (1994 – 2010)

A research report in partial fulfilment of Masters in Commerce, University of Cape Town

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Abstract

The period 1994 to 2010 has seen marked changes in both the capital and reporting requirements for banks globally. In South Africa, Basle I was in effect in 1994, whilst Basle II came into being in 2008, both of which placed new requirements on banks in terms of the calculation of their capital positions. During 1999 the South African Reserve Bank (“SARB”) moved from a policy of direct controls to inflation targeting. Banks were also required to comply with IAS 39 from 2005 onwards. This impacted on the manner in which both financial performance and position were reported. During the period, the South African banking sector has seen a reduction in the number of banks in the country as a result of a number of factors. This paper investigates the changes that took place from both a regulatory and accounting standpoint, as well as the impact of these changes on banks’ capitalisation levels. Using the data available, it is clear that there exists a relationship between the factors identified and changes in the capital structure of South African banks.

Table of Contents

Abstract.....	2
1. Introduction and Background.....	5
2. Literature Review	8
2.1 Banking and Capital.....	8
2.2 Bank Measurement and Control (Regulation)	11
2.3 Basle	14
2.3.1 Basle I	14
2.3.2 Basle II	15
2.3.3 Effects of the capital standards.....	17
2.4 Accounting changes.....	20
2.5 Securitisation	23
3. Hypothesis and Proposals.....	25
4. Methodology.....	27
4.1 Data.....	28
4.2 Data Collection and Model.....	29
5. Results and Findings.....	32
5.1 Summary Statistics	32
5.2 Removing Investec	35
5.3 Means Testing	40
5.4 Data Integrity	41
5.5 Differencing process observations and analysis.....	42

5.6 Regression estimation	46
5.7 Summary of results from statistical analysis.....	51
6. Conclusions and areas for further study	53
7. References.....	56

1. Introduction and Background

The period 1994-2010 has witnessed a number of marked changes in the South African banking sector as well as direct and indirect factors impacting on the sector. Post 1994 re-introduction into the global financial system compelled a traditionally conservative banking regulator to ensure that South Africa complied with the international standards at that time. Pre-1994 no international banks maintained a presence in South Africa. The likes of Standard Chartered and Barclays, amongst others, had withdrawn by selling off their local operations as a means to voice their opposition against the Apartheid Government of the time. These protest actions resulted in all banks operating in South Africa at the time being locally owned.

The South African banking landscape has for a number of years been in a position where the big four banks (Standard Bank; First National Bank; ABSA and Nedbank) have dominated the local banking sector. Although there has been some competition more recently from new local entrants such as Investec and Capitec in the retail space, as well as some interest from large international banks (e.g. HSBC, Citibank) in Merchant Banking, there has during the period under review been a marked reduction in the number of banks operating in the domestic market.

Although already largely compliant with Basle I pre 1994, South African banks were required to formally comply with the standard by the SARB leading up 1994. Conservative lending activities, largely limited to a small portion of the South African market as a result of Apartheid era policies, meant that for the most part compliance with Basle I was a formality. Consolidation amongst a number of second tier banks towards the end of the 1990s for a number of differing reasons, although temporarily destabilising the local banking sector, ensured that, moving forward, South Africa had a smaller number of well capitalised banks.

The introduction internationally of IAS39 in 2005 and the subsequent adoption by the South African Accounting Board resulted in substantial changes in which banks reported their performances to stakeholders. The changes in accounting policy resulted in the much discussed Fair Value Accounting (“FVA”) methodology being adopted and, depending on the standpoint taken, the instability in the global banking sector during 2008 and 2009 as a result thereof. To a large degree the conservative stance taken by the majority of South African banks, coupled with the previously unheralded benefits of exchange control restrictions and a conservative regulator, meant that the local sector was well insulated from the fallout of the events internationally.

The move to Basle II in 2008 provided an opportunity for banks globally to assign a capital weighting against asset classes that more accurately reflected the risk associated with those assets. The new standard required banks to develop models to demonstrate the perceived risk of an asset based on historical default rates, and coupled with more sophisticated monitoring of these assets, it was thought that the methodology would permit banks to ‘free-up’ capital to the extent that the benefits from this additional capital outweighed the increased onus on banks in terms of back office expenditure. For the most part these models were based on default events being normally distributed; an assumption that did not take into account extreme market move events and proved to be a critical factor in banks holding lower levels of capital. While South African banks have readily been proactive in adopting new regulations, there have been some concerns raised as to the volume and validity of data locally available with which reliable models can be produced in order to replicate the majority of foreseeable future events.

The SARB has moved from a mythology of stringent monitoring and control through setting specific limitations on activities per bank, to one of establishing policies and procedures requiring adherence (supervision). This has resulted in a change in the local banking sector structure. This mandate of inflation targeting was formally adopted in 1999 with the SARB

making use of the Repurchase Rate ('REPO Rate') as its mechanism for controlling inflation levels. The SARB maintains a targeted inflation range of 3% - 6%.

The South African banking sector, with its comparatively high returns, has since 1994 continued to attract the interest of international banks seeking to establish a local presence often through a local acquisition. The entry of a number of international banks, albeit primarily in the Corporate and Investment Banking spaces, has led to increased competition in the local market.

Basle III has been structured in response to the concerns raised in respect of its' predecessor. With implementation requiring resources in excess of those mandated by Basle II, and the benefits as yet not clearly quantifiable, it remains to be seen what the impact would be on the local banking sector when implementation commences in 2012.

Available literature on the factors identified is reviewed in order to fully understand the workings of the factors as well as their potential impact on capitalisation levels. These factors are considered to have impacted on bank capitalisation and are utilised in order to establish sample periods within the dataset collected as part of the study. Monthly data allows for an improved level of accuracy in terms of the results obtained. This as opposed to the majority of comparable studies which have made use of quarterly or semi-annual data for the most part.

Analysis of the dataset tests for significant differences in capitalisation levels, between the sample periods established, as a result of the factors previously identified. Intuitively it is believed that the factors would have resulted in changes in capitalisation. The data will be examined at both the aggregate and individual bank level for significance in order to establish differences in the means as well as the variances of the samples in order to test the intuitive findings.

2. Literature Review

2.1 Banking and Capital

Although there are a number of theories as to the role of banks in the economy; banks essentially extend loans to borrowers in order to create assets on the banks' balance sheets; whilst at the same time providing depositors with liquidity, indirectly creating liabilities for the bank. The differences between the depositors' requirement for liquidity within a relatively short time span, and illiquid assets created through loans result in a fragile capital structure maintained by banks (Diamond & Rajan, 2001).

The problem of the mismatch between the asset and liability sides of a bank's balance sheet is mitigated through a buffer, or capital requirement, maintained by the bank. Modern bank capital requirements are the most widely utilised method for providing buffers against economic shocks and seek to control the level of risk taking by a bank (Jokipili & Milne, 2010). History has however demonstrated numerous bank failures, despite the banks in question meeting the required capital standards at the time. This phenomenon has led to research being conducted into the factors that make a bank resilient to external shocks, and subsequently how best these factors can be implemented in a uniform manner across banks on a global scale (Barth, Caprio & Levine, 2004: 206).

It is widely accepted that higher levels of capital enable banks to better cope with variability in their asset values. However, the associated cost of holding capital results in banks having to balance the opportunity costs of higher levels of capitalisation against the market view of the banks vulnerability (Bank of England, 2011). The ability of banks to generate profits comes largely from the leverage gained against deposits held, which results in a lower capitalisation ratio (Mimmel & Raupach, 2010: 510). The recent financial crisis demonstrated the associated risks with high leverage levels (Ackerman, 2008).

Ultimately, banks are required to hold capital at a level, as deemed by the bank regulators, which will provide the market with sufficient comfort to prevent a run on the bank. The difficulty in predicting the value of bank assets, especially in the event of extreme market moves, leads to the inherent vulnerability facing banks, even with the presence of capital buffers in place (Jacques & Nigro, 1997).

As a means to prevent the costs of the recent financial crisis occurring again, there have been moves by regulators to increase the equity holding requirement for banks in order to strengthen their capital positions. Although higher capitalisation levels are thought to lead to more stable banks, concerns have been raised about the associated increased lending cost as a result. Modigliani and Miller (1958) demonstrated that in a world with complete information and complete markets, a firm's value is separate to its capital structure. This critical assumption has raised much debate in the academic community about the relevance of the study to banks, given that, at first glance, a bank's sound capital structure is surely a key component of the value inherently assigned to it by the market (depositors creating liabilities for the bank). The Modigliani Miller theorem implies that as more equity capital is utilised, the volatility of the return on the equity falls, and the safety of the debt increases, so that the required rate of return on both sources of funds falls. This occurs in such a manner that the weighted average cost of finance remains unchanged (Bank of England, 2011). Hoshi and Kashyap (2010) find that the long term impact of an increase in external equity finance has only had a small impact on bank lending rates. These findings serve to detract to some extent the concerns around the implications of Basle III on banks and the cost of debt post implementation of the new standard.

It remains difficult to predict the distribution of potential shocks to bank asset values given that the distribution of these events is not normal. Considering this, the benefits of higher levels of capitalisation through equity held are considered to be greater than the nominal value held (Hancock, Laing & Wilcox, 1995).

Wellink (2007) states that the rapid innovation in financial instruments witnessed recently, in particular the interaction of the credit derivatives market with the fast growth of securitisation technology, and the growth of the investor base and risk appetite, has resulted in a shift from the traditional banking business model. Banks now seek to more quickly distribute assets that they have originated, where previously these assets may have been held to maturity.

These changes have resulted in a move from the majority of a bank's income being generated from the banking book, to one where the trading book is responsible for the majority of income earned. This change in turn exposed these banks to increased levels of credit, market and liquidity risk given the nature of trading books. These risks were highlighted by the recent global financial crisis, where banks were shown to hold insufficient capital against the instruments in their trading books (Anagnostopoulos & Buckland, 2005).

Rose and Hudgins (2008) discuss the use of financial derivatives such as Futures, Options, Swaps and others as being effective tools in the management of the asset-liability balance. When utilised correctly, these tools enable managers to ensure that the net interest margin is maintained.

2.2 Bank Measurement and Control (Regulation)

Normally a country's central bank will fulfil the role of regulation, although this task is sometimes undertaken by different bodies. Ultimately, the high levels of regulation and control have resulted in onerous reporting requirements being placed on banks. Given that banks are tasked with both the roles of creating liquidity as well as taking deposits, they are well suited to monitoring activities in the economy (Santos, 2001).

Regulation of bank capital derives its importance from the role capital plays in both the soundness of banks, as well as the bank's risk-taking incentives and in the corporate governance of banks. Banking is considered to be one of the most regulated industries in the world. The primary method utilised for regulation is that of Capital Adequacy Requirement ("CAR") levels being stipulated and closely monitored. Regulation impacts on the competitiveness of banks given the associated cost of holding capital. These influences were part of the key considerations in the Basle Capital Accord signed by the G10 countries in 1988 (Santos, 2001).

The major objectives of bank regulation can be considered to be:

- To sustain systemic stability in the sector. It is important for banks as well as the economy to ensure that maturity levels of loans and currencies meet requirements; that there is sufficient liquidity available from the central bank as well as domestic banks in order to prevent a collapse of the sector should a crisis occur.
- To ensure the ongoing soundness of financial institutions. Banks have to remain financial viable; ensure adequate capital to cover risk exposures; ensure appropriate risk management processes to mitigate credit, market, liquidity, counterparty and operational risks; as well as maintaining reliable and secure infrastructure. These factors, if correctly managed, will reduce the probability of insolvency.

- To ensure consumer protection. Protect consumers against unsound financial institutions. The main protection lies in a combination of competition, disclosure, reputation and legal redress.

(Bamber, Falkena & Llewellyn, 2001).

Typically regulators make use of either bank regulation or bank supervision in order to ensure that banks comply with the capital levels and other measures as established.

Bank regulation is a form of control instituted in a number of countries and is considered to be more prescriptive than bank supervision. This direct method of control removes much of the autonomy that banks might otherwise maintain by allowing the regulator to stipulate directly the levels of loans, advances, capital and other measures to be maintained by a particular bank. Although this form of bank control is considered to be obsolete in South Africa, it was successfully implemented for many years and some argue, formed the basis for the current stable banking environment now enjoyed. It has however been argued that the approach could also have lead to the presence of micro lenders in the market (Thakor, 1996).

Bank supervision has become more prevalent in recent years and was adopted in South Africa in 1999. This method of control requires banks to report to the regulatory authority periodically on certain key ratios and measures. The central bank, along with other Governmental bodies, seeks to manipulate the activities of banks through adjustments to external influencing factors, such as the Repo Rate in South Africa.

Both bank regulation and supervision have been shown to be effective techniques to ensure bank stability. Debate however still exists around the need for bank control by a central authority (Barth et al, 2004).

The two main arguments in favour of regulation are considered to be:

- The systemic risk argument forms the basis of the classical view, which argues that a run on a single bank may cause contagion runs, potentially leading to the failure of the whole banking system. A run on a bank is as a result of asymmetry in information available with regards to a banks' assets. The systemic risk argument furthers the natural instability case of banks' arising from monitoring and liquidity provision services (Santos, 2001)
- The depositors representative argument expands on the corporate governance problems in banks as a result of the separation of ownership from management and depositors being unable to effectively monitor banks. The authors state that banks, like corporates, suffer from the moral hazard problem. The time, cost and difficulty of accessing information when monitoring banks makes it impractical for any entity, other than a large oversight organisation, to fulfil this task (Santos, 2001).

Despite banking regulation being in place, we have continued to witness numerous bank failures both locally and abroad. There remains no evidence that there exists a universal set of best practices that when applied will promote well functioning stable banks (Bath et al, 2004). Those who are opposed to bank regulation in its currently accepted form argue that there exist more efficient mechanisms to ensure bank stability whilst not adversely impacting on financial performance.

2.3 Basle

2.3.1 Basle I

The Basle I Accord, implemented in 1988 by the G10 countries, and later amended with the Basle II Accord, established minimum requirements under the belief that there remained globally, an opportunity for banking sectors to operate better, thus encouraging growth and stability for the banks. Studies have however shown that there is little evidence to suggest that such a set of best practices can be applied to all banks globally, while achieving optimum levels of performance and stability. To this end, there remains debate around the optimum factors to be applied in order to achieve the best balance (Barth et al, 2004). These differences in opinion reflect the limited understanding we currently have as to the effects of such regulation (Santos, 2001).

Basle I is a standardised approach to measuring capital adequacy across banks. The primary focus is on credit risk in terms of both on and off balance sheet exposures. Capital is defined as being split between two tiers, Tier 1 and Tier 2, with Tier 1 required to be a minimum of 50% of total capital (Bank of International Settlements, 1998).

Under Basle I, assets are assigned risk-weightings based on the perceived level of risk against the asset class in question. Risk weighted capital required to be held against assets is standardised at 8%.

$$\frac{\text{Tier 1 + Tier 2}}{\text{Risk Weighted Assets + Market Risk}} \} > 8\% \text{ of RWA}$$

(Anagnostopoulos et al, 2005)

Standard thought amongst finance circles is that a higher CAR will result in a lower Return on Equity (“ROE”). As a result of this belief, the introduction of Basle I was met with some resistance by a number of banks globally. However, Berger (1995) demonstrates that the

relationship is not always as simple as a Capital versus Earnings problem with many other factors having to be taken into account.

There is some debate as to the effect that the capital standard under Basle I has had on capital levels maintained by banks and the degree to which the standard has actually resulted in bank stability (Kahane, Koehn & Santomero, 2007). The Accord has however achieved a convergence in capital standards globally. It is argued that some banks took advantage of the broad risk classifications under Basle I to lower their overall capital requirement by moving to riskier assets within the same broad category as the lower risk assets they might have already held (Santos, 2001).

2.3.2 Basle II

Basle II was developed to address the weaknesses identified under Basle I. The standard came into effect in 2008 with a focus on increased risk management and measurement, alignment of regulatory capital with economic capital, and improvement of supervision, market discipline and financial stability (Bank of International Settlements, 2005).

Basle II is based on three pillars:

- Pillar 1 addresses minimum capital requirements. These requirements have been expanded to include operational, credit and market risk. Although Basle II retains the essential aspects of Basle I, under Basle II assets are measured on a more risk sensitive basis.

$$\frac{\text{Tier 1 + Tier 2}}{\text{Risk Weighted Assets + Market Risk + Operational risk}} \} > 8\% \text{ of RWA}$$

(Anagnostopoulos et al, 2005)

- Pillar 2 seeks to encourage risk-based regulatory oversight. Basle II promotes bank management and regulators to actively engage with regards to banks' risk

management processes. Risks not considered under Pillar 1 such as concentration, interest, liquidity, reputational and business risks aim to be covered by Pillar 2. Banks are required to demonstrate that they meet the minimum capital requirements as well as being able to withstand a range of possible market scenarios.

- Pillar 3 stipulates standards with regards to the disclosure of risk, with the aim of fostering market discipline and encouraging banks to operate in a prudent manner. The requirements seek to enable market participants to more easily assess the good standing of banks.

(Bank of International Settlements, 2005)

The increase in the levels of complexity required in terms of the monitoring of risks and controls placed a much higher onus on banks and increased operational requirements. However, banks were able to gain some advantage in certain instances as many believed they could more accurately demonstrate the relatively lower associated risk profiles of their assets through internal models based on historic default rates of these assets (Moyer, 1990).

Basle II was implemented in South Africa in 2008 with increased liquidity requirements. Although there have to date been few formal studies as the impact on the local banking sector, indications have been that the implementation allowed banks to hold lower levels of capital from the analysis completed (von Thadden, 2004).

Subsequent to the global financial crisis (2007-2008), in December 2009, the Basle Committee issued proposed amendments to Basle II. As part of the proposals, additional requirements in terms of the levels of capital and liquidity maintained, seek to strengthen banks against potential external shocks through curtailing leverage in the banking system. The amendments build on the existing three pillars established under Basle II through:

- Raising the quality, consistency and transparency of the capital base
- Enhancing risk coverage to bolster the capital requirement

- Supplementing the risk-based capital requirement with a leverage ratio
- Reducing procyclicality and promoting countercyclical buffers to promote the build up of capital buffers
- Introducing a global minimum liquidity standard requirement that includes a 30-day liquidity coverage ratio

The amendments have been proposed for introduction to commence in 2012 and South Africa is expected to meet this requirement as per the stipulation within a 8 year time frame.

2.3.3 Effects of the capital standards

Better capitalised banks are generally viewed as being safer. Questions raised around the effectiveness of the previously accounting based measures of capital standards lead to a move towards risk based standards. The capital standards as laid out by the Basle Accords have been designed with the aim of more accurately representing the true risk associated with the banks' assets and applying an appropriate capital charge in lieu of this risk.

Despite all of the theoretical evidence to the contrary, there have been a number of bank failures during the period that the accords have been in place, both in the domestic and international markets.

A study commissioned by the Basle committee sought to investigate the effectiveness of the implementation of the capital standards. The study found that the standards did indeed contribute to bank strength, largely through requiring weakly capitalised entities to increase their level of capital maintained. However, given the cost of raising additional capital, in many cases banks cut back on lending activities instead of increasing capital, which had macroeconomic implications. The study was, however, unable to determine as to whether the regulations resulted in banks lowering their risk taking activities. The regulations are thought to

have also assisted regulators to implement improved market discipline in their jurisdiction given the framework provided (Besanko & Kanatas, 1996).

The uncertainty surrounding the impact of the capital standards has led to further studies in this area. Besanko and Kanatas (1996) find in their study that the enforcement of an accounting based capital standard on a bank may have the undesired effect of reducing the banks' market value of equity. However, whether the effect of capital standard implementation causes a reduction in a bank's equity value, or results in market benefits, is dependent on the level of capital pre the standard implementation, as well as the particular circumstances surrounding the bank. These factors have resulted in proposals for differing capital standards to be put in place for different banks (Besanko & Kanakas, 1994).

Given the significance of the Basle Accords for banks and the financial community a large volume of research has been conducted to investigate the relationship between the changes in bank capital and the impact on lending behaviour. Current theoretical debate centres around two issues: the impact of the capital requirement on banks credit activities, and the effect on the monetary transmission mechanism (Gambacorta & Mistrulli, 2004).

The idea of the "Bank Lending Channel" finds that an increase in bank capital has the effect of increasing the banks' ability to raise unsecured deposits; the increase in capital does however curtail the banks' ability to extend loans. Given these impacts there is also a macroeconomic impact that needs to be understood (Tanaka, 2002).

Studies of the slowdown of lending activities undertaken by banks during the period 1992 to 1997 in Scandinavia demonstrated that the decline in lending had more to do with a reduction in 'credit demand' than 'credit supply'. However, similar studies undertaken in the United States in the early 1990s demonstrated that a reduction in the availability of capital, around the time of the adoption of Basle I, may have contributed to the recession. Similar studies in

Latin America have concluded much along the same themes. However, there is no definitive evidence as to what effect Basle I had on both the stability of banks and levels of credit extension globally (Barajas, Chami & Cosimano, 2004).

On a macroeconomic level, the strength of the monetary transmission mechanism may depend upon how well banks' are capitalised. Kashyap, Lamont and Stein (1994) show that in the case of capital adequacy levels being stringently enforced, bank loans may not respond to monetary expansion. Furthermore, Tanaka (2002) shows that the monetary transmission mechanism is weakened if banks are poorly capitalised, or the capital adequacy requirement is very stringent. Under these circumstances banks have little scope for expanding their loan supply in response to a monetary expansion.

Conventional banking wisdom dictates that for the most part, the higher the level of capital-to-assets ratio maintained, the lower the level of the associated return on equity achievable. The higher capital-to-assets ratio lowers the risk associated with the bank equity and as such investors are more comfortable with position of the bank. The additional capital also reduces the potential tax shield by reducing the interest claimable. However, studies in the USA on bank data from the 1980s indicate that the relationship of higher capital leading to lower earnings doesn't always hold. A positive capital-earnings relationship is explained by the reduction in potential distress levels incurred by a bank, and hence the access to additional markets (Berger, 1995).

2.4 Accounting changes

Fair Value Accounting (“FVA”), through the accounting standard IAS 39, was introduced into South Africa by way of the adoption of the International Financial Reporting Standards (“IFRS”) in 2005. The change impacted financial institutions in terms of their reporting and the regulations used to establish their financial position (Barth, Landsman & Wahlen, 1995). Particular attention has been paid to the impact that the new system had on the capital adequacy levels and how these new levels were calculated. Subsequently, the recent global financial crisis again placed the spotlight on FVA and its’ role in the crisis (Wallace, 2008).

FVA is also known as mark-to-market (“MtM”) and market value based (“MVB”) accounting. Proponents of the methodology believe that FVA provides a more relevant measure of assets and liabilities than historical cost could provide, as the carrying value of assets on balance sheet can be amended to reflect the current market value (Wallace, 2008). However, critics of FVA claim that the subjectiveness of the values assigned results in the measure not being as reliable as the historical cost base. Furthermore, adjustments made to the value of assets are put through the income statement as either a profit or loss and can have a material impact on the financial performance of the entity as a result (Enria, Capiello, Dierick, Grittini, Haralambous, Maddaloni, Molitor, Pires & Polini, 2004).

The FVA debate relates to the impact on all types of entities, the focus has however been primarily on the valuation of banks and their investments. The extent to which reliance, when determining the required level of bank capital to be held, is placed on estimated valuations under FVA as opposed to historical cost, has been at the centre of the debate. Furthermore, the implications that a potential change in an accounting standard might have on the condition of a banks’ capital are contested (Barth et al., 1995).

It has been argued for some time that the use of an accounting methodology in order to satisfy bank capital requirements has led to banks altering their activities in order to comply with the accounting principles, as opposed to the capital reflecting the economic reality of the bank's position. The use of reported accounting numbers in determining capital levels provides a direct link between accounting standards and capital adequacy. This link could create an incentive for banks to alter their behaviour when there is a change in accounting policy (Beatty, 2006). Given the move towards a standardised approach to bank capital measurement as well as adherence to a small number of 'globally accepted accounting standards' the changes in accounting policies have an impact on the reporting of bank capital (Ryan, 2009).

With the introduction of FVA, banks were able to reflect assets held at their market value, and not at cost as previously required. Although this created the problem of accurately demonstrating the value assigned to an asset, particularly in markets not highly traded, many key players believed the change would permit banks to more accurately reflect true values (Barth et al., 1994).

The main argument against the move towards fair value accounting underpins the idea that FVA introduces unnecessary volatility in both earnings and capital levels reported by banks. Bernard, Merton & Palepu (1995: 602) find that using FVA causes banks to violate regulatory capital requirements more often; whilst earnings reported are more volatile than those achieved using a historical cost basis for the same period.

During hearings conducted by the Financial Accounting Standards Board in order to address the issue of FVA and bank capital, the following points were identified:

- Earnings based on assets valued under FVA are likely to be more volatile.
- Banks are likely to violate regulatory requirements more often using FVA.
- Fixed investment securities should be excluded from reported earnings.

South African banks were required to adopt IFRS for their 2005 annual reports onwards. Table 1 illustrates the data from which the financial results were presented under IFRS. The majority of banks also restated their 2004 financials to IFRS for purposes of comparison.

Table 1: SA Banks IFRS/IAS39 adoption date

Bank	IFRS adoption date
Nedbank	January 2004
Standard	January 2004
ABSA	April 2004
FNB	July 2004
Investec	June 2005

Although all banks operating in South African are required to comply with the new accounting standards, the quantum of the impact that these standards have had will differ depending on the makeup and structure of each banks' balance sheet.

2.5 Securitisation

Securitisation is a process that enables a company to convert a pool of assets with regular and predictable cash income held on its balance sheet into securities which can be sold onto a Special Purpose Vehicle ("SPV"). Securities are issued by the SPV against the cash flows from the assets in order to fund the purchase and these securities can be subsequently traded in the capital markets (South African Reserve Bank, 2005). The process allows for the creation of liquid assets from a previously illiquid asset base and new investment alternatives for potential investors (Rose & Hudgins, 2008: 282).

According to the South African Reserve Bank (2005), the use of securitisation by originators has grown in popularity as a result of the benefits thereof:

- Issuing of highly rated debts to capital markets can lower a company's weighted average cost of funds as strong demand for this debt drives down financing costs.
- Removal of assets from the balance sheet can lead to an improved gearing ratio and return on equity. Costs associated with capital reserve requirements can also be reduced as a result.
- Securitisation can be utilised to reduce interest rate risk present on the balance sheet.
- Capital is also made available to be utilised for alternative investment opportunities by the company.

The securities created through the securitisation process are rated by rating agencies in order to assign a credit rating to them and increase the ability to attract investors. The rating also assists in determining the interest rate to be paid on the notes issued to investors. These ratings are assigned based on an analysis of the credit risk associated with the underlying assets held in the vehicle (Deloitte Financial Services, 2006).

Although the South African banking sector lagged somewhat behind in terms of timing in adopting securitisation techniques; once the first issues have been completed, good growth in

the size and frequency of securitisation was recorded (South African Reserve Bank, 2005). Issuance of new assets by South African banks grew from R250mn in 1989 to a total of R26bn by the end of October 2005.

Following the global financial crisis in 2008, securitisation reported a substantial decline in activity. Capital markets no longer demonstrated confidence in ratings assigned against the asset portfolios, given the high level of non-performance in the underlying assets and the extent to which the ratings assigned did not match this performance, so called “sub-prime” assets. As a result, demand for these securities was substantially reduced.

In South Africa liquidity levels have remained and interbank lending has continued without any notable disruption. The SARB followed other central banks by reducing the REPO rate by 550 basis points between 2007 and 2010 (South African Reserve Bank).

3. Hypothesis and Proposals

The study aims to examine the evolution of bank capital in South African during the period 1994 to 2010. The literature review conducted has focussed on a number of factors that are thought to have potentially impacted on capitalisation, as identifying the potential consequences that these factors may have had. The factors have been identified as being:

1. The move from a methodology of Direct Controls up until the end of 1998, to one of Indirect Controls from 1999 onwards by the South African Reserve Bank.
2. The advent of the utilisation of securitisation techniques by South African banks from 2002 onwards which enabled banks to move assets off balance sheet.
3. The adoption of IAS39 in 2005 (backdated to 2004) under IFRS as the accounting standard in South Africa. IFRS and IAS39 were adopted by the majority of the banks from this point onwards.
4. Compliance with Basle II being a requirement for South African banks from 2008 onwards.

Identification of these major events enables the establishment of four sample periods as per the table below:

Table 2: Study sample periods – Tier 1 Capitalisation

Period	Bank					Average	Sample
	Nedbank	Standard	ABSA	FNB	Investec		
1994 - 1998	4.96%	4.42%	4.38%	4.58%	14.58%	6.58%	S1
1999- 2002	7.62%	6.16%	4.96%	4.07%	9.69%	6.50%	S2
2003 - 2007	6.47%	4.11%	5.24%	5.19%	7.52%	5.71%	S3
2008 onwards	6.37%	4.84%	6.25%	5.74%	7.64%	6.17%	S4
Average Capitalisation	6.28%	4.81%	5.07%	4.83%	10.18%	6.23%	

The above table indicates the average capitalisation level for the period under consideration on a monthly basis for each bank individually as well as on an average basis.

The introduction of securitisation, and the adoption of IAS39 by South African banks, would under normal circumstances be considered as separate events given the potential impact that they could have on banks' capitalisation levels. However, given that these events took place within a relatively short time period from one another, they have been combined to form the end of sample period S(2) at December 2002. The small sample universe between the two events results in statistical analysis not returning significant findings. As such the study has been conducted using four sample periods for analysis.

The study seeks to test the impact of the factors on capitalisation levels in the South African banking sector. To this end, the null hypothesis for the research undertaken is presented as:

The introduction of the major event factors identified did not have a material impact on South African bank capitalisation levels reported during the period 1994 to 2010.

The study aims to test for differences in capitalisation levels between the sample periods, as well as for differences in volatility in capitalisation for the samples. Based on initial observations, expectations are that both of the considerations will be found to be true. The number of significant changes in influencing factors that took place during the period indicates a potential high degree of volatility to be expected in capitalisation levels.

4. Methodology

In its' simplest form, the study seeks to establish whether the event factors identified have had a statistically significant impact on changes in capitalisation levels reported by South African banks from 1994-2010.

By dividing the monthly data into samples based on significant events thought to impact on capitalisation levels during the investigation period, the effect of these events in terms of causing a material change in bank capitalisation is assessed.

Initial findings are first considered in order to establish observations through interpretation of the dataset. In order to test the assumption that there is a significant difference in the means between the sample periods as a result of the factors, the level data is tested using the T-test methodology at both the individual bank and aggregate bank level for significant differences.

As it is considered likely that the dataset is non-stationary as a result of its construction, the data is differenced in order to remove this effect. We test for a difference in the means of the observations from the differencing process in order to establish if there is a significant difference in the rate of change in capitalisation levels between the sample periods. In order to establish whether the factors resulted in a change in volatility levels between the sample periods, we test the variances observed from the differencing process.

A regression model is then estimated in order to understand the coefficients for each sample period and to establish a goodness of fit for the model. The regression also allows the initial finding from the level data to be examined using differenced data.

4.1 Data

Data was collected for the banks included in the study from January 1994 to August 2010 on a monthly basis; this resulted in 200 observations for each bank, as well as an additional 200 observations, per bank, for each factor considered. The large number of observations allows for a higher degree of accuracy when testing the data, as similar studies have been conducted on quarterly or semi-annual data.

In order to establish capitalisation levels, total assets and equity for each bank were captured from the SARB online resource for each month in the study period. The data collected was compared to individual bank financials in order to ensure accuracy on a random basis as well as extreme observations being confirmed. Capitalisation was then calculated from the data collected.

For the purposes of this study, capitalisation has been defined as being:

$$\frac{\text{Tier 1 Capital}}{\text{Total Assets}}$$

Although recent amendments to banking regulations have permitted the inclusion of Tier 2 and in some cases Tier 3 capital in the calculation of the capitalisation ratio, given that this study seeks to investigate the impact of these amendments on 'pure' levels of capitalisation, only Tier 1 capital is considered in order to calculate the ratio. Furthermore, this technique is considered to be in line with the proposals as per the Basle III accord, which has been described as seeking to simplify the measurement of bank capital.

Data was also collected for all the banks in the study on a monthly basis for the study period with regards to securitisation activities undertaken and the status of the adoption of IFRS/IAS39. The change from direct to indirect controls impacting on the banks, as well as the implementation of Basle II, were also captured for all of the banks.

4.2 Data Collection and Model

The following factors were considered to potentially have impacted on capitalisation levels reported by the banks during the period under review and form the basis of the sample periods identified:

- South African Reserve Bank (Direct versus Indirect controls): Up until December 1998 South African Banks were subject to direct controls imposed on them by the SARB. From January 1999 onwards the SARB switched to a policy of indirect controls. The factor has been included to ascertain whether the change in methodology utilised in the regulation of South African banking activities demonstrates a material influence on shifts in capitalisation levels reported. Intuitively our expectations would indicate that without the onus of direct controls placed on banks, a more aggressive approach would be adopted in terms of capital utilisation, which would result in lower capitalisation levels being reported.
- Basle II adoption: The adoption of Basle II by South African banks from January 2008 onwards has been included as a factor in the model. As has been previously discussed in this paper, the move from Basle I to Basle II introduced the concept of Risk Weighted Assets to the balance sheet, and as such the move was considered to have a potential material impact on capitalisation levels. Although a move to Basle II could potentially result in either an increase or a decrease in capitalisation levels depending on the nature of the makeup of the institutions balance sheet in question, given the balance sheet construction of the majority South African banks, we would expect the adoption of Basle II to result in a decline in capitalisation levels.
- International Financial Reporting Standards: The adoption of IFRS by South African banks did not occur at a uniform time given the differing year ends of banks as well as in some cases the year the standard was adopted. As previously discussed, the

implementation of the standard could potentially impact on a bank's balance sheet and hence capitalisation levels reported.

- Securitisation: The advent of the utilisation of securitisation activities by South African banks is recorded as a potential influencing factor on capitalisation levels. With the introduction of securitisation, we would expect an increase in capitalisation levels as excess capital is made available through assets being moved off balance sheet.

Although the items below have not been considered as part of the statistical analysis undertaken, the impact of the changes witnessed during the period under review should be considered:

- Prime Lending Rate: The benchmark rate for lending activities set by South African banks (has been linked to the REPO rate by a margin of 3.5% above for the majority of the sample period) was thought to potentially impact on capitalisation levels. The expectation of lower capitalisation levels during periods of relatively inexpensive lending opportunities being available to clients given lower interest rates is considered. This is further supported by the assumption of an improvement in bank asset quality as consumer's ability to service obligations is eased by relatively low interest rates.
- Johannesburg Stock Exchange All Share Index: The closing price of the JSE ALSI from 1994 to 2010 is utilised in conjunction with the BCI below as a proxy for the state of the South African economy on a monthly basis. It is considered more likely that higher capitalisation levels would be prevalent during periods of depressed prosperity as banks prepare to absorb higher levels of non-performing loans. During period of high demand for credit banks would also have increased opportunity to lend and as such capitalisation levels could decline.

- Bank specific market activity: All of the banks considered in the study are publically traded entities and are thus subject to market forces. During the period under review there have been a number of significant events in both the global and domestic economies. A number of the banks included in the study have also been subject to market speculation as a result of factors such as: rumours of low levels of liquidity; discussions around potential buy-outs or substantial investment by both local and international entities; speculation around the performance of senior management; concerns with regards the financials performance achieved for a particular period.

University of Cape Town

5. Results and Findings

5.1 Summary Statistics

As is evidenced from figure 2 below, capitalisation levels maintained by South African banks at the end of the study period are, broadly speaking, reported as being marginally higher than those reported at the beginning of the period under review. It is considered likely that the movements in the capitalisation levels reported could potentially be explained by the factors in terms of the model as previously listed.

Initial examination of the data also demonstrates a convergence of capitalisation levels at the beginning of 2008. Although the cause of this remains unclear, it is considered likely to be as a result of the adoption of Basle II and banks conforming to the requirement which created uniformity in capitalisation. We also note that there appears to be a convergence in capitalisation levels taking place towards the end of the period in the study, although the cause remains unclear, increased levels of competition as well as a maturing of the market could be considered as potential causes.

With the exception of ABSA and to a lesser extent FNB, bank capitalisation levels have fluctuated widely between 4% and 8% during the period. Standard, Nedbank and Investec indicate large shifts in capitalisation post the adoption of indirect controls by the SARB in 1999.

With the introduction of IFRS/IAS39 and securitisation in 2002/2004, capitalisation levels for banks included in the study report an increase within a relatively short time period of one another. This increase is reported during a period of rapid economic growth in South Africa when existing bank assets were increasing as a result of the increase in values in the local housing market. The period is characterised by high levels of dividend and bonus payments to employees given the ROE's achieved by the banks. The increase in capitalisation levels could also be attributable to securitisation activities as assets held on balance sheet were moved off

balance sheet. Securitisation also resulted in revenue from assets being recognised earlier than normal, which increased bank profitability levels achieved.

Similarly, there appears to be an upward shift in capitalisation levels during 2008, coinciding with the introduction of Basle II and the requirement to more accurately reflect the risk profile of assets held by the banks. It is however also noted that the increase in capitalisation levels observed, coincides with the international financial crisis. It is as such conceivable that the increase could be attributable to banks seeking to strengthen their capital positions in order to demonstrate a sound financial position during a period of economic uncertainty.

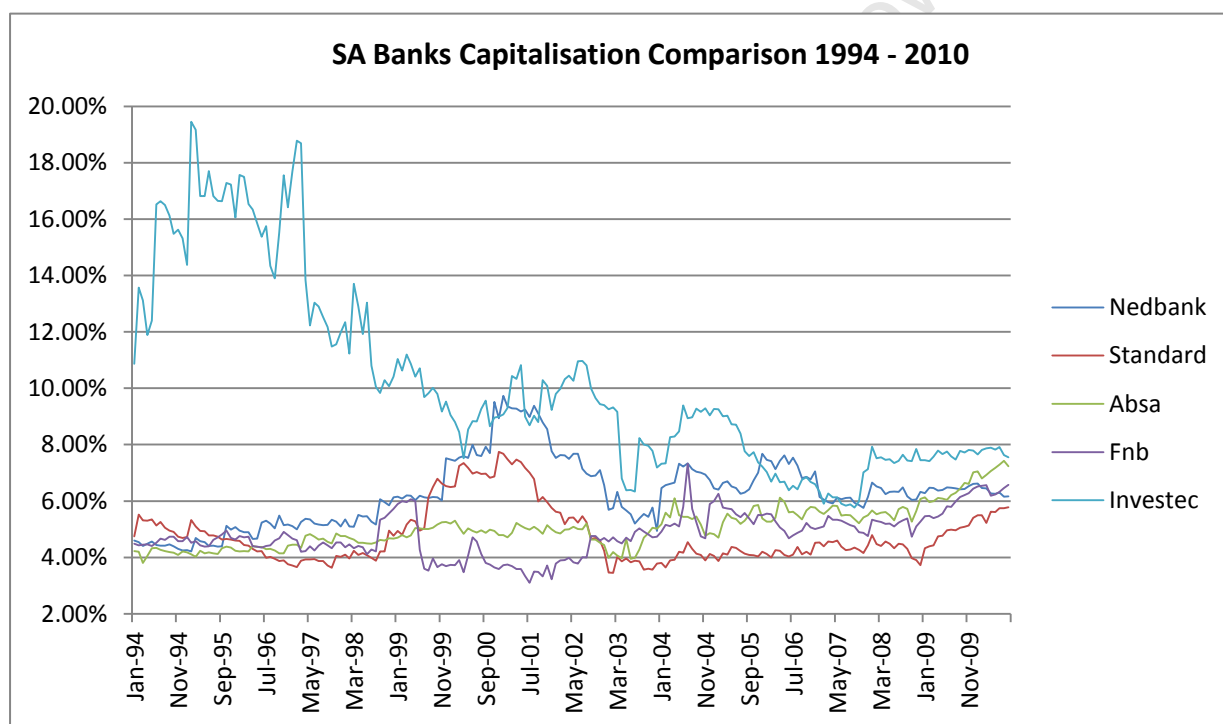


Figure 2: SA Bank Capitalisation 1994-2010

Of particular interest, the figure illustrates an increase in average capitalisation levels between 1999 – 2002 (Investec excluded). We would have expected a decline in capitalisation during this period given the move from direct to indirect controls by the SARB.

By examining asset growth reported by the banking sector, we can illustrate some of the important events impacting on capitalisation levels. Figure 3 illustrates growth in total assets for the major South African banks included in the study during the period under review. Particular note is made with regards to the increase in assets at the beginning of 2003 reported for a number of banks. Continued rapid expansion in assets is evidenced from 2002 until 2008, this coinciding with a period of rapid economic growth and increases in housing prices reported during the same period in South Africa. The increase in assets reported by Nedbank and Standard at the beginning of 2003 can be largely attributed to a change in accounting policy which required the banks to gross up derivative positions on balance sheet.

Although South Africa was to a large degree shielded from the effects of the global economic recession witnessed from 2008 onwards, the graph below illustrates the impact of the decline in asset prices on the banks' balance sheets.

Investec appears to have lagged behind the other banks in terms of the rate of asset growth achieved. This finding is in line with the higher levels of capitalisation reported by the bank during the same period. Although the causes of this somewhat stunted growth remain speculative, Investec could have potentially been curtailed by an inability to participate in larger transactions given its smaller balance sheet, as well as the bank's focus on the smaller higher end of the retail market where lower volumes are present.

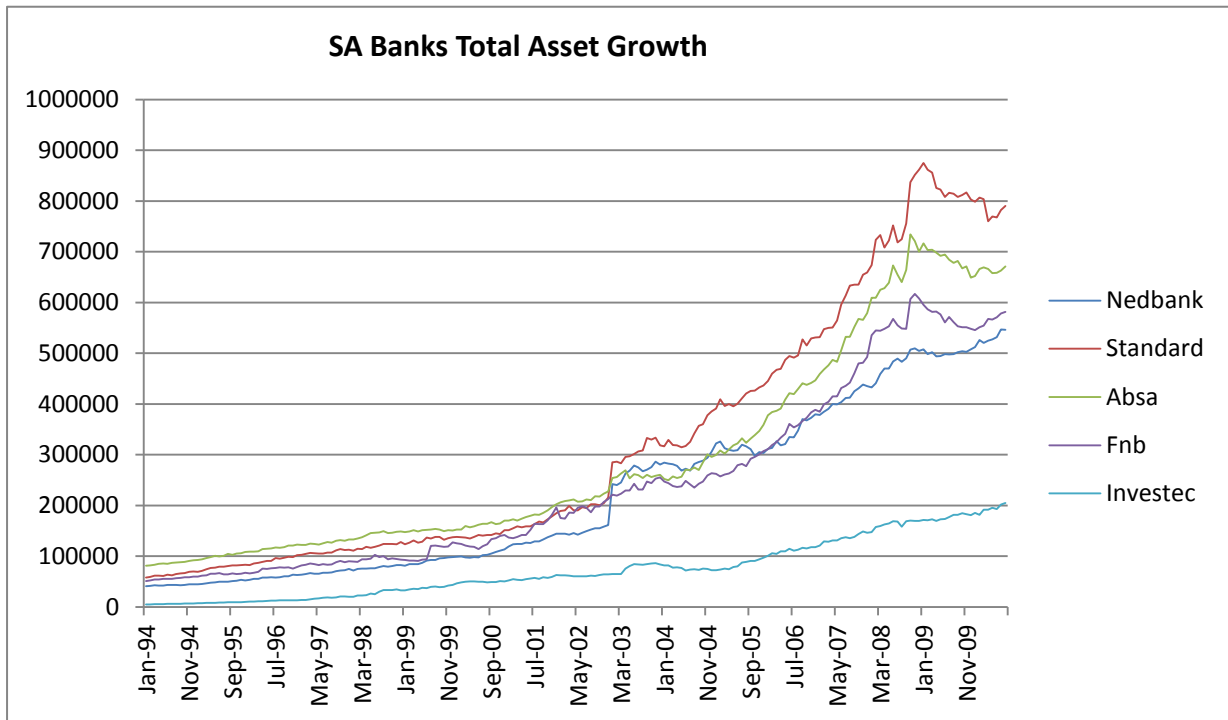


Figure 3: South African Bank Total Assets

From the analysis of the summary data, we are able to establish that there have indeed been changes in capitalisation levels during the period under review, and that these changes appear to coincide with the introduction of the factors considered in the study. These initial observations indicate that there have been a number of major events during the period under review and that the banking environment has changed substantially, both as a result of direct factors influencing banks and indirect economic factors as well.

5.2 Removing Investec

As is evidenced from the average capitalisation levels of the banks in the study, Investec has reported a higher level of capitalisation for the majority of the period under review. It is also evidenced that there have been periods of rapid increases as well as a rapid decrease in capitalisation levels reported by Investec as the bank has continued to grow and adjust its balance sheet. Figure 4 below illustrates the observations witnessed when monthly capitalisation levels are differenced for all of the banks in the dataset.

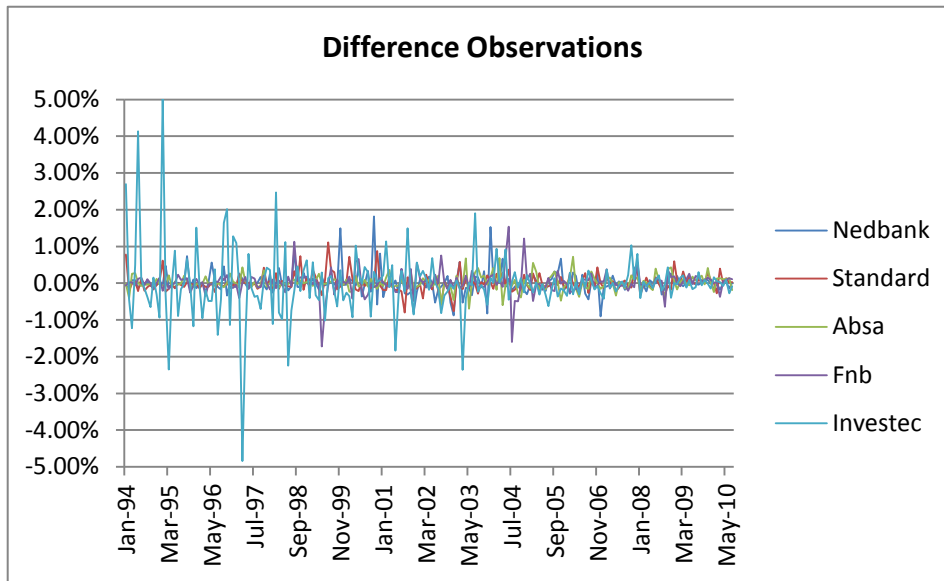


Figure 4: Differencing process observations (Total dataset)

As is illustrated by figure 4, observations for Investec indicate higher level of volatility in capitalisation levels for the majority of the study period. This is especially prevalent during the first half of the study. Given this volatility, a high average level of capitalisation, as well as the relatively small size of the bank's balance sheet in comparison to the other banks included in the study, Investec has been excluded from the average bank analysis completed. By excluding Investec we are able to more closely examine changes in the remaining four banks' capitalisation levels as a large portion of the extreme movements in capitalisation have been removed. Figure 5 illustrates changes in individual bank capitalisation levels in comparison to the average level reported for the period, with the exclusion of Investec.

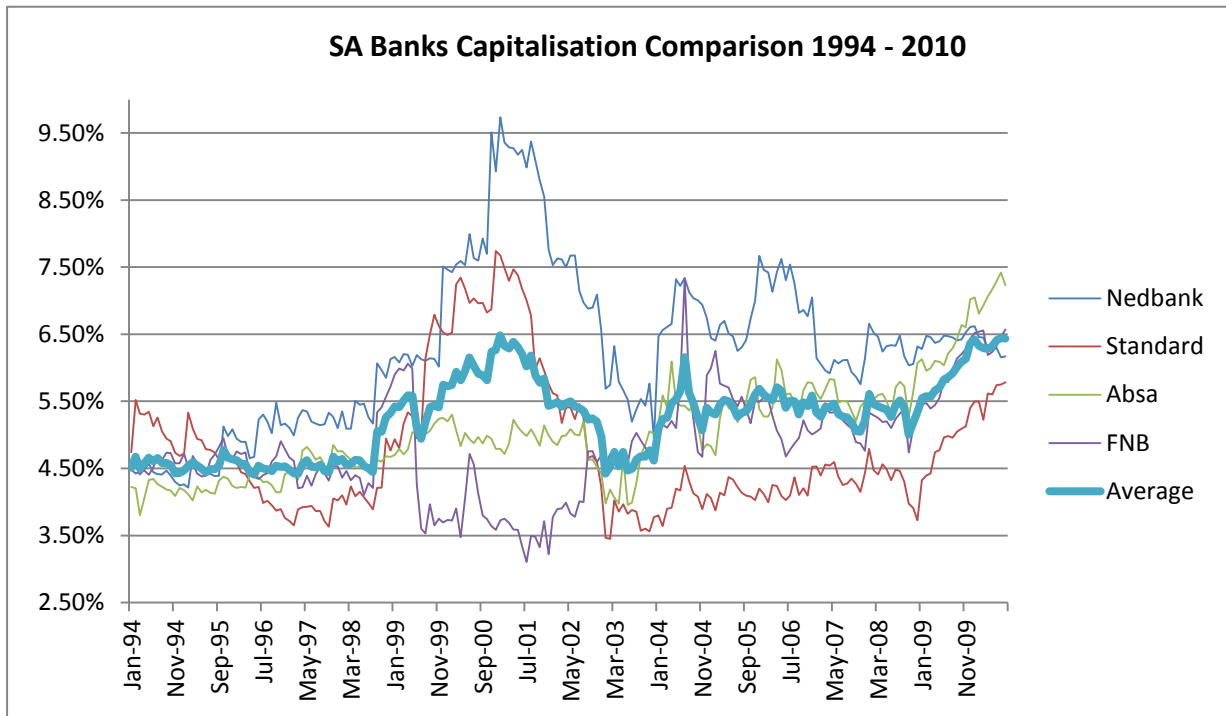


Figure 5: SA Bank Capitalisation 1994-2010 (Investec excluded)

It is interesting to note that the patterns of changes in capitalisation for the banks appear to be broadly the same, excluding FNB for the period from 1999 to 2003 and Standard from 1994 to 1999.

Note is made of the increases in capitalisation levels reported by both Nedbank and Standard from the middle of 1999, until they returned to more normal levels around March 2003. The increases appear to coincide with the take-over bid that was made by Nedbank for Standard. During the same period FNB reported a marked decrease in capitalisation levels, as a result of a capital restructuring program undertaken during the year, R2bn was raised in the form of a convertible loan which increased Tier 2 capital and FNB was able to reduce Tier 1 capital holdings. ABSA reports the most consistent level of capitalisation from the sample group, with only a short period of decline in 2003 and marked increase from the end of 2008.

Figure 6 below illustrates in more detail the average level of capitalisation for the period under review. The graph illustrates that average capitalisation levels have remained between 4.50%

and 6.50% for the entire period, whilst since 2004 average capitalisation is higher at around 5.50% than previously reported.

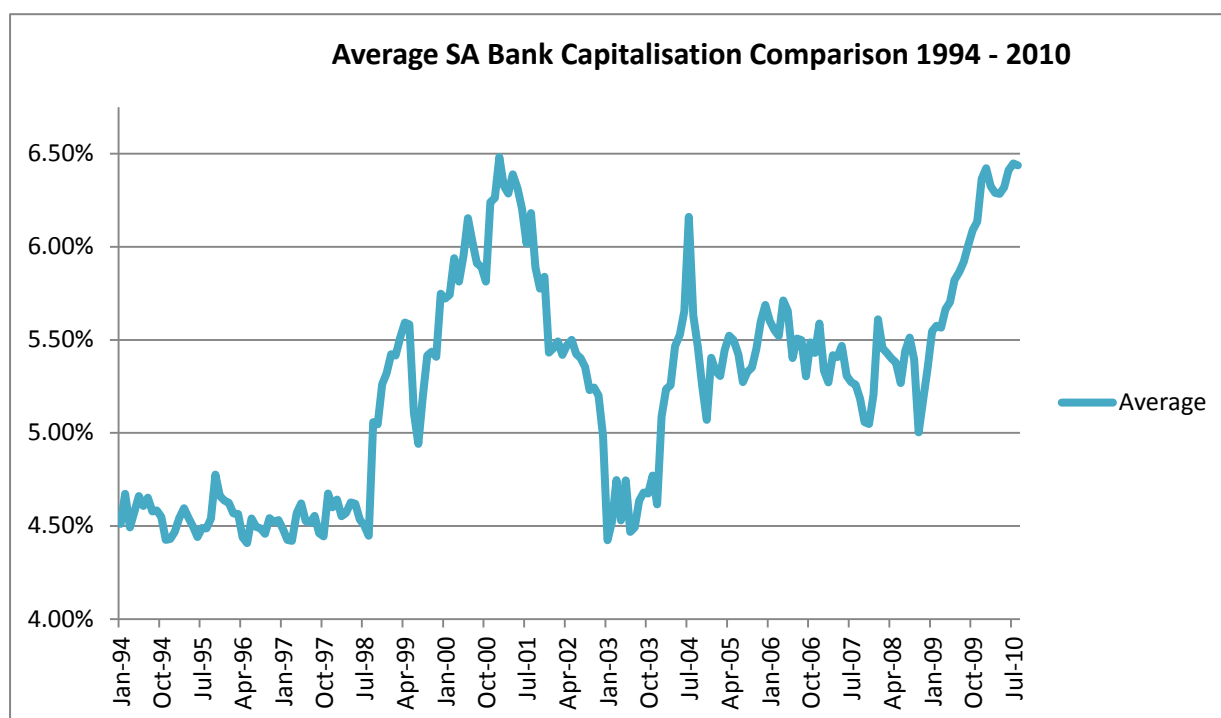


Figure 6: Average SA Bank Capitalisation 1994-2010

As is illustrated, there are a number of periods that can be considered to be significant:

- 1998 (September) – From September 1998 until June 1999 there was a short of rapid increase in average capitalisation levels. This period of expansion coincides with the bid by Nedbank for Standard Bank.
- 2001 (September) – Average capitalisation levels reached their peak at this date during the period under review. September 2001 also marks the beginning of a fairly rapid decline in capitalisation until January 2003, when capitalisation levels reached those last seen in 1998. September 2001 coincides with the 9/11 attacks on the USA as well as, ironically, a period of rapid economic growth in South Africa which resulted in increased lending by banks and a subsequent decline in capitalisation.
- 2003 (January) – The majority of the banks included in the study have backdated their financial results to this date to include the effects of the introduction of IFRS. January

2003 signals the end to the decline in capitalisation from September 2001, although capitalisation remains at a similar level until January 2004 when perhaps the full impact of IFRS is seen.

- 2004 (July) – July 2004 indicates the peak of a period of growth in capitalisation levels, post this period capitalisation declines again, although on average it remains above those levels previously reported. This time coincides with the introduction of IFRS and IAS39 to the South African market. FVA under IFRS allows banks to revalue their assets and recognise the increases in values through the income statement, however, the increased asset values result in capitalisation levels being lowered.
- 2008 (October) – With the beginning of the global financial crisis banks globally sought to demonstrate their stability through increases in capitalisation levels.

5.3 Means Testing

In order to ascertain the statistical significance of the factors considered by the study, the means for each sample period were compared to one another on an aggregate basis, as well as for each bank individually. The tests were conducted using the T-statistic Test with a 95% confidence interval and unequal variances between the samples assumed. The test results are presented prior to the dataset being adjusted for potential data integrity problems such as autocorrelation and being non-stationary. Although initial examination indicates that the data could potentially be considered to be non-stationary, this is not considered to be as a result of a trend in the data, and as such there is still value to be gained when comparing the results obtained from the local data.

Table 3 below summarises the results of the T-tests completed. ($H_0 = S_1 = S_2 = S_3 = S_4$).

Table 3: Means difference analysis results

	Variable 1	Variable 2	T-Critical	P	T-Stat	Result
Aggregate	S1	S2	1.9809922	0.0007832	3.4513480	Reject H0
	S2	S3	1.9858018	0.0000065	4.7826254	Reject H0
	S3	S4	2.0017175	0.0000630	4.3146079	Reject H0
Nedbank	S1	S2	1.9925435	0.0000000	12.4579221	Reject H0
	S2	S3	1.9896863	0.0072290	2.7558572	Reject H0
	S3	S4	2.0017175	0.0002146	3.9495248	Reject H0
Standard	S1	S2	1.9912544	0.0000000	6.8498602	Reject H0
	S2	S3	2.0075837	0.0000000	13.5002395	Reject H0
	S3	S4	2.0226909	0.0000000	6.8902412	Reject H0
ABSA	S1	S2	1.9821734	0.0000000	9.1397332	Reject H0
	S2	S3	1.9837309	0.0000000	9.3568255	Reject H0
	S3	S4	2.0195409	0.0000001	6.3516914	Reject H0
FNB	S1	S2	1.9872898	0.0062527	2.8015710	Reject H0
	S2	S3	1.9825972	0.0000000	8.5608752	Reject H0
	S3	S4	1.9983405	0.0011485	3.4071106	Reject H0

As is evidenced from the table, we are able to reject H_0 at a 95% confidence level for all of the tests conducted. That is to say, the means of the sample periods are considered to differ

statistically significantly from one another. Thus we are able to conclude that the factors did indeed result in a material shift in capitalisation levels reported between the sample periods. The relatively low P values indicate the probability of the shift in capitalisation being as a result of another external factor being relatively small. The findings of the analysis are considered to be in line with the initial observations made.

5.4 Data Integrity

In order to ensure the integrity of the data utilised for the study, normality tests were conducted. The table below indicates data statistics per bank for the entire period in terms of capitalisation levels.

Table 4: Individual bank data statistics

Total Observations (Capitalisation)							
	N	Mean	Median	Min	Max	Std Dev	Variance
Nedbank	200	6.28%	6.25%	4.21%	9.74%	0.01215	0.000148
Std	200	4.81%	4.49%	3.45%	7.74%	0.0101	0.000102
ABSA	200	5.07%	4.99%	3.80%	7.42%	0.00746	0.000056
FNB	200	4.83%	4.74%	4.21%	7.33%	0.00784	0.000061

All of the banks reported a large disparity between their minimum and maximum capitalisation levels during the period. The capitalisation distributions for the banks are illustrated below. All of the banks, with the exception of FNB, demonstrate a distribution that is not considered to be normal.

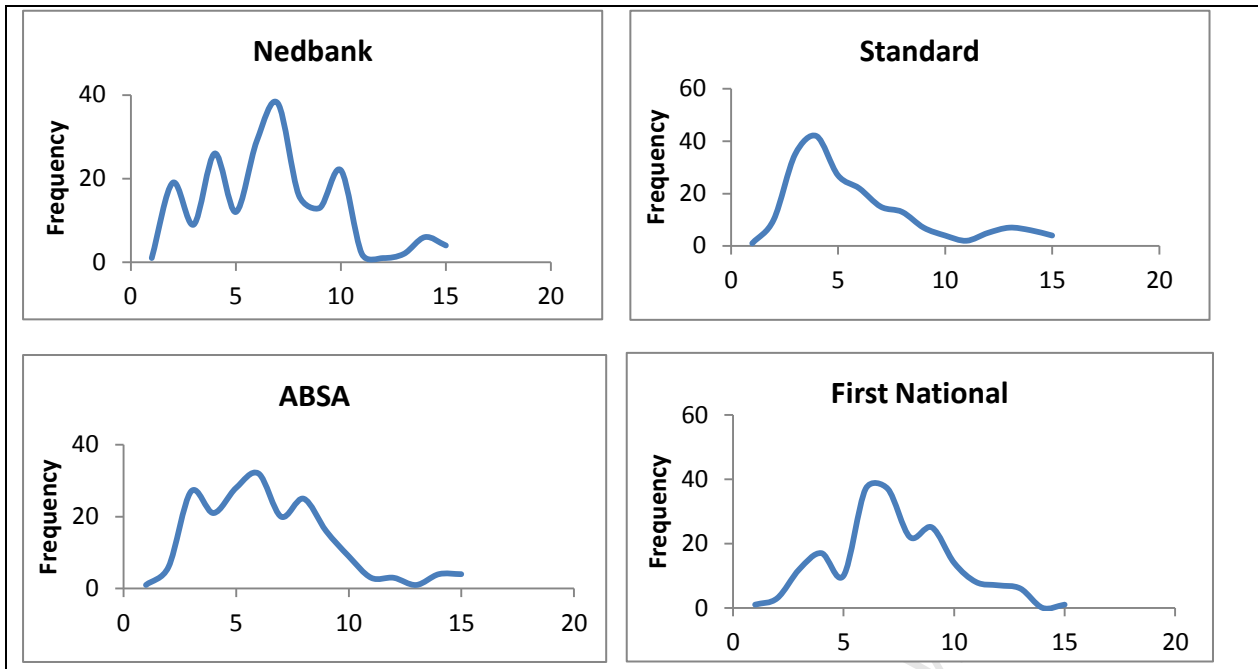


Figure 7: Capitalisation distribution

Examination of the dataset indicates that there is a probability of the data being non-stationary. Stationary tests conducted on the dataset supported the suspicion of non-stationary data at a 95% confidence level.

The data has thus been adjusted for being non-stationary through a differencing process. This adjustment is made in order to ensure data integrity and in order to avoid model variables indicating a potential relationship where one does not exist. Post adjustment analysis indicated that the dataset had successfully been transformed to stationary data. Note is made that one observation is lost through the differencing process, although comfort is taken given the large number of observations in the dataset which ensures that statistical relevance remains intact.

5.5 Differencing process observations and analysis

Figure 8 below is a graphical representation of the observations obtained from the differencing process. The graph serves to illustrate the occurrences where a particular bank reported a sudden increase or decrease in capitalisation from one month to the next.

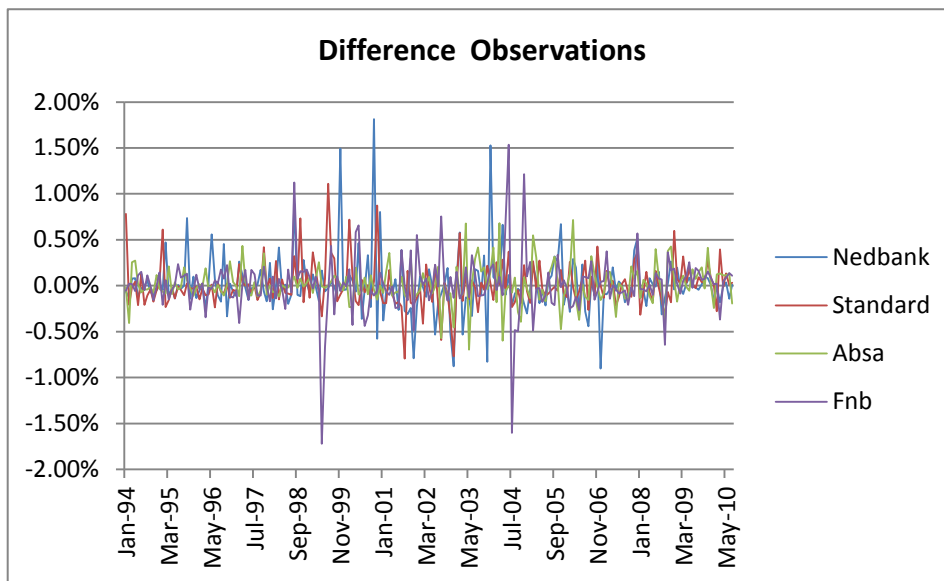


Figure 8: Differencing process observations (Investec excluded)

From examination of figure 8, when read in conjunction with figure 5 which illustrates bank capitalisation levels, the following events are highlighted by the large differences observed:

- FNB 1999 (June) – FNB reported a sudden decrease in capitalisation levels at this point. The bank maintained a suppressed capitalisation ratio following this event until the end of 2002. The decrease is considered to be as a result of a capital restructuring programme whereby R2bn was raised as a convertible loan, which permitted the bank to decrease Tier 1 capital.
- Nedbank, Standard 1999 (December) and 2000 (November) – Following news of the potential takeover of Standard, there were a number of large increases in both banks capitalisation levels, which lead to a period of increased capitalisation for both banks.
- Nedbank 2004 (January) – Nedbank raised R5.15bn of Tier 1 capital in 2004 which it utilised to balance Tier 1 and Tier 2 whilst at the same time repaying R2.5bn of subordinated debt previously raised.
- FNB 2004 – During 2004 FNB reported a number of marked changes in capitalisation levels. These are considered to be most likely as a result of the banks adoption of IFRS from this date on and the changes in the capital structure maintained as a result.

Analysis was conducted on the observations obtained from the differencing process using the ANOVA Model in order to test for equality of variances between the sample periods. The tests were conducted using the Bartlett, Levene and Brown-Forsyth tests. The results of these tests indicated that volatility exists in terms of the rate of change in capitalisation levels between the sample periods. It is interesting to note that the variances reported increase from S(1) to S(2), with the maximum variance being reported in S(3). Although slightly lower than S(3), S(4) reports a variance very much in line with that reported for S(3). This finding is potentially explained through the formal adoption of IAS39 at the beginning of S(3), and the resulting increase in volatility of earnings and capital. The sustained increase in volatility in S(4) is thus expected and sustained higher volatility levels should continue to be reported as long as the accounting standard remains in place. These findings are in line with those of Barth et al (1995).

Further analysis was also completed to test the equality of the variances between each sample period for the banks on an individual basis. Results obtained for the individual banks mirrored those of the aggregate bank results.

It is interesting to note the differences in the absolute levels of the test values attained between the different banks. Nedbank and Standard both reported high test statistics, which we would have expected given the large movements in capitalisation. However, the high score achieved by ABSA is unexpected and can potentially be explained by the increase in capitalisation towards the end of the period. FNB has reported the lowest variance in capitalisation levels at half of those of Nedbank and Standard. The low level of volatility of FNB's capitalisation is perhaps as a result of relatively stability in the banks' corporate and capital structure throughout the period under review.

Further statistical analyses of the observations achieved from the differencing process was then conducted in order to test the relationship between the rate of change in capitalisation levels of the sample periods on both an aggregate and individual bank basis. These tests were performed in order to establish whether a particular sample period could be credited with causing the volatility in capitalisation evident in the entire test period.

The results of the T-tests conducted are presented as per the table below:

Table 5: Means difference test – Differencing process observations

	Variable 1	Variable 2	T-Critical	P	T-Stat	Result
Aggregate	S1	S2	1.9900634	0.6608268	0.44041146	Accept Ho
	S2	S3	1.9847231	0.7617795	0.30399945	Accept Ho
	S3	S4	1.9847231	0.7617795	0.71249019	Accept Ho
Nedbank	S1	S2	1.9869787	0.4784064	0.71187125	Accept Ho
	S2	S3	1.9825972	0.5536431	0.59420193	Accept Ho
	S3	S4	1.9949454	0.6706264	0.42711369	Accept Ho
Standard	S1	S2	1.9837309	0.7340869	0.34063364	Accept Ho
	S2	S3	1.9855234	0.5408614	0.61375238	Accept Ho
	S3	S4	2.0009954	0.6730398	0.42409373	Accept Ho
ABSA	S1	S2	1.9842169	0.9548454	0.05676673	Accept Ho
	S2	S3	1.9869787	0.9278717	0.09077963	Accept Ho
	S3	S4	1.9912544	0.3975805	0.85068769	Accept Ho
FNB	S1	S2	1.9858018	0.4398738	0.77573489	Accept Ho
	S2	S3	1.987290	0.834478	0.20958243	Accept Ho
	S3	S4	1.9965644	0.5418909	0.61314016	Accept Ho

As is evidenced from the above table, we are able to accept H0 for each bank in all of the periods as well as for the banks in aggregate. This finding indicates that the rate of change in capitalisation levels between the periods did not differ materially between the sample periods. This leads us to conclude that, as has been established from the means average tests previously conducted, there is a material difference in the means between the sample periods, however the rate of increase or decrease in capitalisation does not differ materially between the samples at a 95% confidence interval. The findings also serve to provide some comfort as to the stability of the South African banking sector. Although we are able to conclude that the

factors considered in the model likely resulted in a change in capitalisation levels, the rate of change that has occurred is similar between the sample periods. These findings could also be considered as being indicative of a mature banking sector as collaboration between the banks and various regulators has ensured that new regulations are smoothly implemented so as to not cause disruptions in the market.

5.6 Regression estimation

Further analysis of the differences data is conducted utilising the regression methodology. The regression is conducted using the least squares method for the entire sample period.

The estimated regression equation is considered to follow the following format:

$$\text{capital ratio} = \text{constant} + \text{capital ratio}(-1) + \text{dummy}(1) + \text{dummy}(2) + \text{dummy}(3) + \varepsilon$$

Table 6: Estimated Regression Results

Variable	Coefficient	Std Error	T-statistic	Prob
C	0.004605	0.002042	2.254896	0.0253
Average Cap (-1)	0.926752	0.034302	27.01745	0.0000
Dummy (1)	-0.001118	0.000536	-2.08703	0.0382
Dummy (2)	-0.000699	0.000358	-1.95072	0.0525
Dummy (3)	-0.000525	0.000393	-1.33472	0.1835
R-squared	0.931368			
Adjusted R-squared	0.929953			
F-statistic	658.1637			

We find that the fit of the model is considered to be significant with an F-statistic of 658.16 as well as a significant p-value. The regression model achieves an adjusted R-squared of 0.9299 indicating that it is a fairly close fit to the observed value.

The strong coefficient for the previous instance of the capitalisation ratio observed of 0.926752 is supportive of the previous discussion around the cumulative nature of capital. The

coefficient indicates that the majority of the next capital ratio observation is explained through the previous capitalisation observation. The significance of this finding is supported by the high T-statistic of 27.01 and small p-value < 0.0000 . The relatively low coefficients recorded for the sample periods S(1), S(2), S(3) and S(4) are again indicative of the reliance of the capital ratio of the previous observation, this finding is also substantiated by the high p-values for the sample periods. From the T-statistics observed for the sample periods, we can state that S(1), S(2) and S(4) are considered to be significant at a 95% confidence interval, whilst S(3) is not considered to be significant at this level. Samples S(1), S(2) and S(3) all report a negative coefficient, which is supportive of the initial findings of S(4) maintaining the highest level of capitalisation amongst the sample periods.

Analysis of the residuals observed as a result of the estimated regression is conducted in order to establish the degree to which the model is considered to be a good fit. The residuals resulting from the regression estimation are tested to ensure that they are stationary. The results of these tests indicate that the residuals are found to be stationary at a 95% confidence level. Further analysis conducted indicates that autocorrelation between the residuals is not found to be significant, whilst heteroskedasticity is found to be present.

The distribution of the residuals is not found to be normal. Figure 9 below illustrates the residual distribution observed.

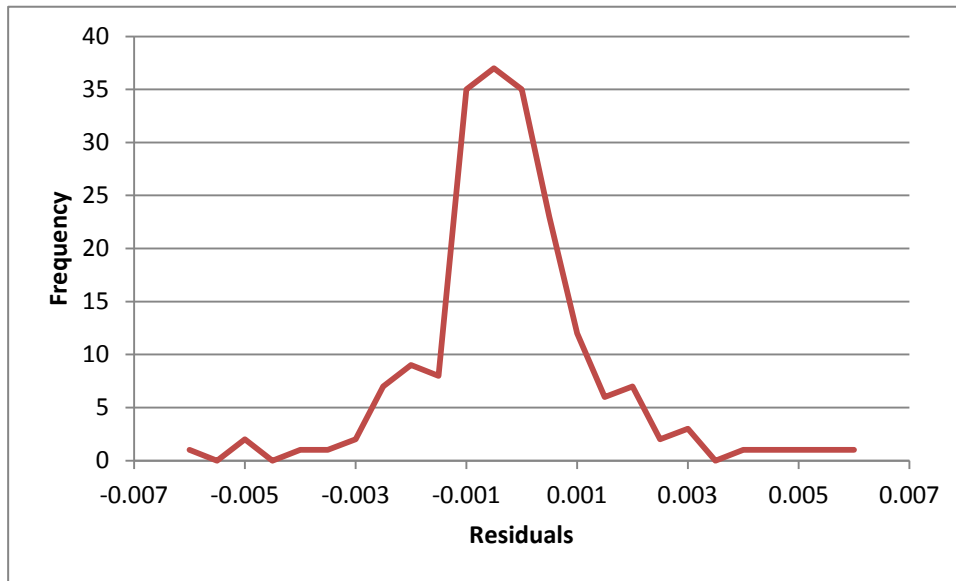


Figure 9: Regression residuals distribution

Analysis of the residuals observed indicates the presence of outliers. These outliers are thought to contribute to the distribution of the residuals not being normal, as well as impacting on the closeness of fit of the estimated regression. The regression demonstrates an R-squared value of 0.9299 before adjustments made for residual outliers. An examination of the residuals excluded from the analysis indicates that the following data points can be identified as outliers (table 7):

Table 7: Extreme residual observations excluded

Date	Capitalisation	Change	Error
Sep-98	0.0506	0.0061	0.005850
Jun-99	0.0511	-0.0047	-0.004570
Nov-00	0.0624	0.0043	0.004600
Dec-01	0.0543	-0.0041	0.003730
Jan-03	0.0442	-0.0056	0.005860
Jan-04	0.0509	0.0047	0.004000
Jul-04	0.0616	0.0051	0.005140
Aug-04	0.0563	-0.0053	-0.004890
Dec-04	0.0540	0.0033	0.003000
Jan-08	0.0561	0.0040	0.003230
Oct-08	0.0500	-0.0039	-0.004530

As could be expected, the highest residuals observed occur at the same points in time when marked changes in average capitalisation levels occur. Residuals with a value larger than (+/-) 0.003 have been excluded and the regression estimated again using the adjusted dataset.

The adjusted estimated regression indicates an improvement in the closeness of fit of the equation with an adjusted R-squared of 0.9603 and an increase in the F-statistic to 1096.43. A summary of the results of the adjusted regression are presented below.

Table 8: Adjusted Estimated Regression Results

Variable	Coefficient	Std Error	T-statistic	Prob
C	0.004268	0.001798	2.374056	0.0187
Average Cap (-1)	0.934712	0.030027	31.12937	0.0000
Dummy (1)	-0.001249	0.000480	-2.601889	0.0101
Dummy (2)	-0.000610	0.000302	-2.024390	0.0444
Dummy (3)	-0.000705	0.000324	-2.178777	0.0307
R-squared	0.961207			
Adjusted R-squared	0.960331			
F-statistic	1096.429			

We are able to observe that S(1), S(2) and S(3) retain the previously observed negative correlations with the constant term, although for samples S(1), S(2) and S(3), the absolute value of the coefficient has increased. It is also noted that all of the samples coefficients are now significant at a 95% confidence interval, where previously S(3) was not considered to be significant at this level.

The residuals observed from the regression estimated on the adjusted dataset are found to be stationary at the 95% confidence level from the analysis completed. The distribution of the residuals from the adjusted regression equation is found to follow a normal distribution. Figure 10 below illustrates the distribution observed.

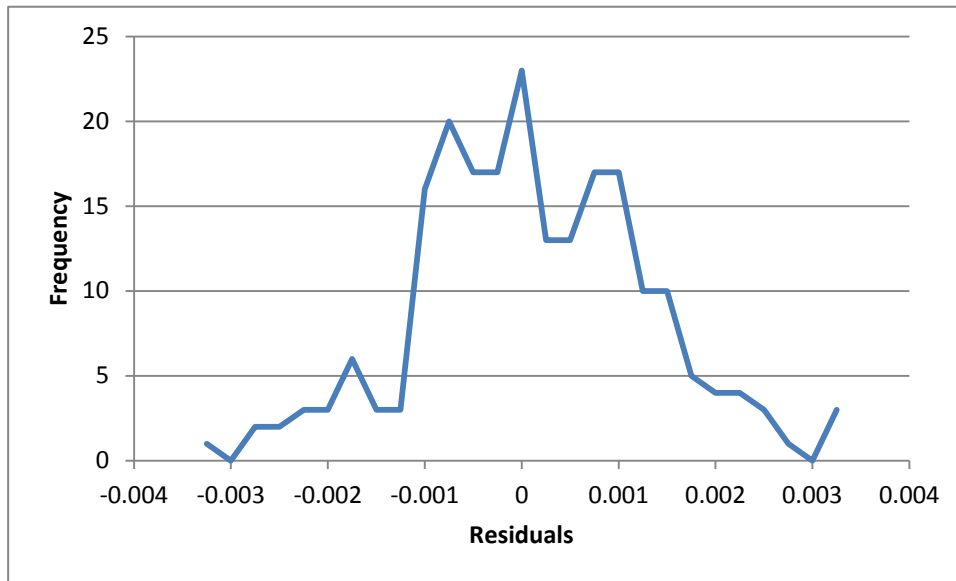


Figure 10: Distribution of adjusted regression residuals

The findings of the analysis completed utilising the estimated regression are considered to be significant. All of the sample period means considered on the average data are found to differ significantly from one another once the data set has been adjusted to ensure that it is stationary and extreme observations are removed. This finding is in line with the analysis completed on the level data through the means testing process as well as with the initial observations made with regards to the changes in capitalisation levels observed during the research period.

5.7 Summary of results from statistical analysis

The statistical analysis completed yielded a number of interesting results. The findings of analysis are summarised below:

- The original data was found to be non-stationary, although this is not as the result of a trend being present.
- The banks included in the study have demonstrated consistent growth in asset levels, although there are a number of events that have caused significant fluctuations in total assets, both in terms of an increase and decrease in total assets maintained.
- Investec's initially high level of capitalisation and variance reported has lead to it being excluded from the statistical analysis. The exclusion allows for increased granularity in the analysis conducted as well as fewer outliers in the dataset.
- Results of the T-tests conducted indicate that there are significant statistical differences present in the means for all of the banks across the sample periods at a 95% confidence level. We are thus able to conclude that the factors considered did result in changes in capitalisation levels.
- Capitalisation levels are not considered to be normally distributed for the banks in the sample.
- Stationary tests indicated that the data is non-stationary. The data is thus adjusted through a difference model to ensure that it is stationary for further testing.
- T-tests on the differenced stationary data demonstrate that there is no statistical difference between the means the sample periods. This allows us to conclude that the rate of increase or decline in capitalisation levels remains constant between the samples.
- The observations from the differenced data are tested for equality in variance. We find that there is significant inequality in the variance between the sample periods, with volatility increases in the latter half of the sample period.
- A regression equation is estimated on the differenced data and an R-squared of 0.9299 is obtained. The regression is found to be significant.

- Sample periods S(1), S(2) and S(4) are found to be significant.
- Sample periods S(1), S(2) and S(3) have a negative coefficient, this supports our previous observations that S(4) has the highest level of capitalisation. The coefficients for the sample periods are small in relation to that of the previous level of capitalisation observed (0.926752).
- The residual outliers are identified and found to match against significant moves in the level of average capitalisation.
- Regression analysis conducted having removed the residual outliers results in an R-squared of 0.9603 which is found to be significant.
- All the sample periods are found to be significant.
- The observed residuals of the adjusted estimated regression are considered to be stationary and follow a normal distribution.
- We are able to conclude that the estimated regression supports the initial finding that there exists statistically significant differences in capitalisation levels between the sample periods.

6. Conclusions and areas for further study

There have been a number of significant events that have impacted on banks operating in South Africa during the period 1994 to 2010. The extent to which these events have had a significant impact on capitalisation levels forms the basis of the study undertaken.

The study examines the capitalisation levels of a sample group of banks on a monthly basis and the impact of key events identified on capitalisation levels. The use of monthly data permits the study to more accurately identify events impacting on capitalisation levels. Four sample periods which have been established in line with key factors impacting capitalisation levels are utilised to conduct testing on the dataset.

Initial analysis conducted indicates that there have been a number of significant changes in both individual bank and average capitalisation levels during the period under review. Further analysis highlights a number of key dates where events resulted in either a significant increase or decrease in capitalisation levels. These findings support the assumption made that capitalisation levels differ between the sample periods. As a result of the initial analysis conducted, Investec is seen to maintain a much higher level of capitalisation and a higher level of volatility than the other banks in the study; as such Investec is excluded from subsequent analysis.

From the statistical tests conducted on the level data, we are able to conclude that there exists a significant statistical difference in the mean capitalisation between the sample periods for the average bank capitalisation as well as all of the banks individually. Although level data has been utilised, as no trend is evident, it is believed that the findings contribute to the research.

The data is differenced to ensure that it is stationary, and analysis conducted indicates that although there is no significant statistical difference between the variations in capitalisation between the sample periods, the variances between the periods are considered to differ

significantly. We are thus able to conclude that capitalisation levels have increased in volatility during the period under review, a finding that is in line with that of other studies conducted on the volatility that the introduction of FVA leads to in banks' earnings and capitalisation levels.

Observations resulting from the differenced data are then utilised in order to estimate a regression. Analysis of the residuals resulting indicates that extreme observations result in sample period 3 not being significant. Once these extreme observations are removed from the data set, a much tighter fit is obtained and the residual distribution is considered to be normal. All of the sample periods are also significant with the removal of the extreme observations. The estimated regression indicates that the majority of observed capitalisation is explained through the previous observation, this as a result of the cumulative nature of capital. The regression model also supports our initial findings that capitalisation during the period S(4) is the highest on average. Furthermore, the findings of the estimated regression support the findings of the means comparative tests conducted on the level data, and allow us to conclude that significant changes in capitalisation levels did occur in line with changes in the factors identified.

As a result of the study undertaken a number of potential areas for future research have been identified. With the pending introduction of Basle 3 into the local market, the impact of the new accord on bank capitalisation levels should be fully understood. This research goes some way in describing the impact that Basle I and Basle II have had on capitalisation, however the impact of Basle III will require additional analysis in order to quantify. Further analysis of the dataset collected would enable researchers to develop a model to estimate the factors in the model played the more significant role in explaining capitalisation levels. This kind of analysis, when utilised in conjunction with economic forecasts could provide valuable insights into potential changes in capitalisation levels.

The study contributes to the literature available regarding the significance of the impact of the events considered on South African bank capitalisation levels during the period 1994 to 2010 on a monthly basis.

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