The low-risk anomaly, cost of capital and IFRS 9 implementation impact: An analysis of South African banks

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Research dissertation presented for the approval of the University of Cape Town Senate in fulfilment of part of the requirements for the degree of Master of Commerce (Specialising in Financial Reporting, Analysis and Governance) in approved courses and a minor dissertation. The other part of the requirement for this qualification was the completion of a programme of courses.

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Abstract

Purpose

This dissertation investigates the impact of IFRS 9 implementation on capital ratios and the cost of capital of listed South African banks. In order to investigate this impact, the presence of the low-risk anomaly had to be determined for South African banks.

Methodology

This dissertation adapts a methodology that has been used to calculate the change in the cost of capital by both Baker & Wurgler (2015) and Fatouh et al. (2020). It is a modified version of CAPM and the weighted cost of capital which includes an error term for the low-risk anomaly.

Findings

The presence of the low-risk anomaly was discovered in the South African banking equity market. This in combination with a reduction in regulatory capital due to increased credit loss provisions, led to an increase in the cost of capital of South African banks.

Practical implications

This dissertation helps to add to the growing body of literature around the presence of the low-risk anomaly in South Africa. It also provides an assessment of the impact of the implementation of IFRS 9 on banks that regulators can use to gauge future implementations of regulatory and accounting standards. Investors can also take advantage of the low-risk anomaly and “bet against the beta” to gain additional returns as compared to high-risk portfolios.

Value-add

New accounting standards are implemented to improve decision-useful information for investors. This dissertation observes the unintended effects of accounting standard implementation on the banking industry in a developing market. The dissertation uses the initial results of IFRS 9 implementation to measure the impact of the accounting standard on banks’ regulatory capital and cost of capital.

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Introduction

Problem statement

"In the corporate world, sometimes things aren`t exactly black and white when it comes to accounting procedures." – George W. Bush, 2002

Accounting standards dictate information displayed on the financial statements of firms. In doing so, this profoundly influences the way investors perceive those firms. Accounting standards allow for many instances of management discretion which can result in a degree of ambiguity in the information produced. When considering the implementation of new standards, the effect of those standards on the entities that apply them should be investigated.

IFRS 9, an accounting standard that details the measurement of financial instruments, was implemented in 2018. The implications on the banking industry in South Africa are only becoming apparent owing to this recent implementation. Studies around the world have estimated the effect it may have on the banking industry in terms of costs of operation and regulatory consequences, such as the effect on Basel Capital Ratios. Studies have also estimated the impact of IFRS 9 on expected credit losses and retained earnings. This dissertation will use actual results of IFRS 9 implementation to measure the impact of the accounting standard on banks' regulatory capital and cost of capital using a modified CAPM originally established by Baker and Wurgler (2015). Past studies have not considered the impact of transitional agreements published by the South African Reserve Bank (SARB), which slowly phase in additional credit losses as a result of IFRS 9, into regulatory capital levels, which can now be observed as banks opt in or out of the agreements (Nexia SAB&T, 2017). The low-risk anomaly will be tested for in the equity market and has not yet been isolated and tested for the South African banking industry specifically.

Problem background

Banks are a key feature of the financial system and are inherently highly leveraged entities. The five largest banks in South Africa hold 90% of total assets (International Monetary Fund, 2022). This poses a systemic risk if large impairments occur in the industry. This means regulation and monitoring are fundamental to ensure the financial stability of banks, and to protect consumers' and corporations' wealth. In South Africa, the Financial Sector Regulation act 2017, requires the South African Reserve Bank to ensure the financial stability of the financial sector (Coetzer & Naicker, 2021). This is achieved in part, by the implementation of Basel III requirements which dictate, amongst other measures, minimum capital levels. Pressure on banks' profits, places pressure on banks' capital ratios and thereby their financial stability. The implementation of a new accounting standard, namely IFRS 9, may decrease bank profits owing to increased accruals. This could threaten financial stability and thus it is important to investigate the impact of the standard's implementation.

IFRS 9 was developed to replace IAS 39, which measured financial instruments prior to 1 January 2018. This replacement occurred to some extent as a consequence of the financial crisis (G20, 2009). The G20 called for a complete overhaul of the standard, IAS 39. IAS 39's incurred credit loss model was seen as "too little, too late" (Frykström & Li, 2018). Loan assets measured under amortized cost are now subject to additional credit losses with the introduction of expected credit losses. The movement from IAS 39 incurred loss model to the expected loss model under IFRS 9 on 1st January 2018, should see higher rates of loss provisions (Gea-Carrasco, 2015; Gomaa et al., 2019).

Banks are the group most at risk of greater expected credit losses as they hold the largest portfolio of assets measured on amortized cost and fair value through other comprehensive income (loan assets) (Sultanoğlu, 2018). Expected credit losses are seen as the largest expense accruals of financial institutions (Kanagaretnam et al., 2009). This large increase in accruals is expected to reduce the retained earnings of banks, and therefore reduce regulatory capital levels. Retained earnings is a considered high-quality capital, which absorbs impairments immediately (BIS, 2019). Banks will likely have to recapitalize to maintain their current capital levels, especially as banks are subject to minimum capital requirements as a result of Basel III and the SARB. In traditional finance theory, the Capital Structure irrelevance theory proposition II predicts this increase in capital would not result in an increase in the weighted cost of capital, even though equity is "more expensive" than debt. The increase in the proportion of equity to debt would result in lower risk equity that would offset the reduction in the proportion of low-cost debt in the capital structure. Such conditions would only exist in an efficient capital market. Inefficiencies exist in actual capital markets, including the well documented low-risk anomaly, which finds that lower risk shares have proportionally higher returns and therefore a higher cost of equity (Wurgler et al., 2016). This indicates that an increase in the proportion of equity, may result in an increase in the cost of capital for banks that have to recapitalise when retained earnings are eroded.

Importance of the dissertation

This dissertation aims to investigate the effect of the implementation of IFRS 9 on the cost of capital in South African Banks. The increased cost of capital for banks caused by the implementation of IFRS 9, may lead to an inability to generate value from the banks' perspective. An already uncompetitive banking industry may have even higher costs to entry. Increased costs of operating will place additional pressure on an already highly regulated industry, with limited options regarding taking on additional leverage due to regulatory restrictions. This could result in a reduced ability to lend to customers, limiting the amount of money in the economy. It could also place pressure on the financial stability of banks if there are significant decreases in capital ratios. The magnitude of the change in weighted cost of capital and resulting pressure on banks, must be weighed up against the possible asset transparency, financial stability, decision useful information, and countercyclical intentions of IFRS 9. The effect of IFRS 9 on regulatory ratios can also indicate whether the convergence of IFRS 9 and Basel III expected losses has helped to improve financial stability of banks.

The purpose of estimating the low-risk anomaly is to measure the impact of IFRS 9 implementation on the cost of capital. This will help standard setters and regulatory bodies understand their impact on firms and industries when implementing new standards and legislation. Low-risk portfolio investing (Betting against the Beta) could also be used by investors in the South African bank equity market if the anomaly is present, in order to gain abnormal excess returns.

Findings

The dissertation found that the implementation of IFRS 9 resulted in reduction in the regulatory capital due to a reduction in retained earnings. This is as a result of increased provisions and reclassification of loan assets. The reduction in capital should result in a recapitalization by banks in order to maintain regulatory capital levels. The dissertation finds a low-risk anomaly in the equity market for banks. The anomaly was used in order to estimate the increase in cost of capital due to a change in leverage as a result of IFRS 9 implementation. These results indicate that cost of capital, of South African banks, increased due to the implementation of IFRS 9.

Outline of the dissertation

This dissertation follows with a review of literature on the pitfalls of IAS 39, the changes made by IFRS 9 to the treatment of financial instruments, Basel regulations and the impact of IFRS 9 implementation on the banking sector. The methodology applied is then outlined, following which the results are compared to previous expectations and findings. Finally, the dissertation concludes with a summary of findings and areas for further research.

Literature Review

This literature review contextualizes the past and current accounting standards that describe the initial and subsequent measurement of financial assets of banks. It will focus on pitfalls and the method by which these financial assets losses are recognized when asset performance is diminished. Other regulatory measures that govern banks' financial stability such as Basel II and III will also be investigated and compared to the relevant accounting standards. Actual and predicted effects of IAS 39 and IFRS 9, will be explored to ascertain the expected impact of the modifications to credit loss provisioning for financial assets of cost of capital. The interaction between the South African banking industry, Basel regulations and accounting standards will then be examined. Finally, the low-risk anomaly in equity markets and relationship with cost of capital that new accounting standards may result in will be discussed.

Introduction of IFRS 9 and previous accounting models

IAS 39 was the previous model for recognition and measurement of financial instruments. The model allows for credit losses to be recognized only once an impairment event has taken place, and is criticized as being “too little, too late” when recognizing credit losses (Frykström & Li, 2018). It was also found to encourage procyclicality, exacerbating upswings and downswings for companies (Boscia, 2020). A complete overhaul was needed after the financial crisis of 2008, especially considering the risky behaviour IAS 39 encouraged in the banking, which eroded capital and liquidity (Financial Stability Forum, 2009; G20, 2009)

IFRS 9 was developed to right some of IAS 39's failings. The implementation date was set for the 1st of January 2018 (IFRS Foundation, 2014). Credit losses are especially important to banks, as these are banks' largest accrual (Gebhardt & Novotny-Farkas, 2011). IFRS 9 implementation should result in additional credit losses as compared to IAS 39. This increase in credit losses is expected as the transition from IAS 39, which made use of incurred credit losses, to IFRS 9, which makes use of expected credit losses.

Expected credit losses are reflected in the accounting records as a debit to credit losses (expense) and a credit to a loss provision (liability) or directly to a financial asset when impaired. The profits or losses from credit provisions directly increase or reduce retained earnings on the balance sheet of banks. The change from IAS 39 "incurred loss model" to IFRS 9 "the expected losses model" on 1st January 2018, should see higher rates of loss provisions (Gea-Carrasco, 2015; Gomaa et al., 2019). These would be expected to significantly reduce retained earnings and would therefore reduce Common Equity Tier 1 (CET1), which includes shares and retained earnings. Ceteris paribus, this would result in higher leverage.

Only impaired or level 3 assets would have been included in credit loss allowances for IAS 39. Under IFRS 9, however, all financial assets under the amortized cost and fair value through comprehensive income which include level 1 assets (functioning assets), and level 2 assets which have seen a significant increase in credit risk and level 3 assets are assigned credit loss provisions or impairments (IFRS Foundation, 2014). This increase in expenses should result in lower retained earnings, which would impact regulatory capital under Basel III, namely the common equity. Banks have an implicit maximum leverage owing to repurchase agreements and the associated "haircut"[1] effect applied by reserve banks on collateralized assets (Adrian & Song Shin, 2010). This implies that banks would try to maintain pre-IFRS 9 levels of leverage. The increase in leverage should result in a greater proportion of low-risk debt, but in turn, equity should become riskier. To maintain minimum leverage ratios, banks would need to either increase capital held or deleverage their balance sheets. This would reasonably result in banks attempting to hold more equity capital to meet

[1] The difference between the value of the asset and the value of the asset when used as collateral for repurchase agreements from central banks. This is done to avoid any undue risk due to asset impairments (European Central Bank, 2016).

regulatory requirements (Fatouh et al., 2020). Therefore, an increase in the weight of equity is expected, and thus the weighted cost of capital of banks. Banks would have to respond by decreasing leverage in order to meet regulations or attain their target capital levels. This would be achieved by taking on additional capital, resulting in banks choosing a more expensive form of funding, especially considering the possibility of low-risk anomaly.

The expected increase in Credit losses

Expected credit losses under IFRS 9 are defined as “the difference between the present value (PV) of all contractual cash flows and the PV of expected future cash flows. This is often referred to as the ‘cash shortfall’.” (ACCA, 2019). Incurred credit losses are the actual impairment of the financial asset (IASB, 2011). Expected credit losses under IFRS 9 are calculated as “Probability of Default (PD) x Loss Given Default (LGD) x Exposure at Default (EAD)” (IFRS Foundation, 2014). A relatively similar model is used to calculate expected losses under Basel III (Gea-Carrasco, 2015).

Credit losses are recognized at an impairment event under the IAS 39 only, whereas under IFRS 9, a loss provision is immediately simultaneously with the recognition of the corresponding asset. This is specific to amortized cost assets and assets measured by fair value through other comprehensive income (FVTOCI). This is done by estimating the probability of default for a loan asset (IFRS Foundation, 2014). This loss provision is calculated on the expected credit losses in the next 12 months for most financial assets under amortized cost and FVTOCI. Low-risk and productive assets are considered level 1 assets. Level 2 assets require additional impairment through a movement from 12-month expected credit losses to lifetime credit losses, and this occurs when there is a significant change in credit risk, i.e., 30 days of non-payment (IFRS Foundation, 2014). Finally, and similarly to IAS 39, level 3 assets are non-functioning assets that are impaired fully. This newer model change will likely result in additional loss provisions (Gomaa et al., 2019). These loss provisions result in a greater erosion of retained earnings. This is as the scope of loss provisions is increased from only impaired financial assets (level 3) to all amortized cost assets and FVTOCI assets (level 1) as well as additional loss provisions for assets with significant increases in credit risk (level 2) (Fatouh et al., 2020).

Basel Committee and Basel III

The Basel Committee on Banking Supervision (BCBS) is the leading standard setter for the regulation of banks. It comprises of 45 members which include central banks and bank supervisors from 28 jurisdictions (BIS, 2011). Basel III: international regulatory framework (Basel III) is a regulatory framework that provides measures to ensure the financial stability of banks. It was developed by the Basel Committee on Banking Supervision in reaction to the financial crisis of 2007-09 (BIS, 2017). Basel III requirements include minimum capital requirements, which restrict banks' ability to be highly levered. Therefore, any decrease in equity, will be meet with an attempt by the bank to recapitalized or de-risk assets.

South Africa has a highly developed banking sector, especially for a developing nation in Africa (Moyo, 2018). The South African banking industry is made up of 18 registered banks (South African Reserve Bank, 2021). This is dominated by the five largest banks, Standard Bank, Nedbank, Capitec, First Rand, and ABSA, which make up around 90% of total banking assets in South Africa (Nedbank Group, 2020).

Understanding the similarities and dissimilarities between Basel III and IFRS 9 can help to predict the outcome of IFRS 9 implementation. More than 40% of banks surveyed by Moody's Analytics planned to incorporate IFRS 9 into their existing Basel systems (Gea-Carrasco, 2015). This includes the use of existing IRB models and expected loss calculation systems.

Significant differences exist between Basel III and IFRS 9, however the relatively similar calculation and period for which expected losses are measured under Basel III and IFRS 9 may result in a more muted implementation effect in countries that have more robust Basel III applications, such as South Africa.

South African banks have applied the Basel III requirements which may have already impacted their financials and capital adequacy in a similar way to what IFRS 9 implementation may do, owing to the similarities in expected loss models. South African Basel implementation began early in 2008 for Basel II (South African Reserve Bank, 2020b). The SARB (South African Reserve Bank) initiated Basel III implementation as early as 2013 indicating a strong regulatory base in the country (Basel Committee on Banking Supervision, 2015). South Africa was found to be compliant in all aspects of Basel III regulatory requirements and that banking regulation were well aligned as early as 2015.

Comparison of Basel III and IFRS 9

Understanding the similarities and dissimilarities between Basel III and IFRS 9 can help to implementation. For example, as stated above, many firms already plan to integrate IFRS 9 credit lo This includes the use of existing IRB models and expected loss calculation systems.

Table 1: Comparison of IFRS 9 and Basel III Expected credit losses

Comparison of IFRS 9 and Basel III Expected credit losses			
	Key Risk Parameter	**IFRS 9**	**Basel III**
1. Probability of Default (PD) – the likelihood of the default to occur	**Measurement standard**	Most assets are 12 months, except levels 2 and 3 which are lifetime losses (full life of the asset).	Default within 12-months
	Period of measurement	Point in time reflecting expected future economic conditions	Based on long-run average default, which ranges from a point in time to through the cycle

[2] Risk parameters include the assumptions of inputs used in the calculation of expected losses. This column serves to indicate the for IFRS 9 and Basel III

2. Loss Given Default (LGD) – the amount of money expected to be lost	**Intention of estimate**	Forward-looking	Downturn to reflect adverse economic conditions	**Different risk parameter**
	Collection cost	Direct costs	Direct and indirect costs	**Different risk parameter**
	Discount rate	Based on an effective interest rate	Based on the weighted average cost of capital or risk-free rate	**Different risk parameter**
	Period of observation	No specific requirements for an observation period	Five years for retail, seven for sovereign funds, corporate and bank exposures	**Similar/compatible risk parameter**
3. Exposure at Default (EAD) – *the total value of the default*	**Intention of estimate**	Consider all contractual terms over financial asset lifetime	Downturn to reflect adverse economic conditions	**Different risk parameter**
	Period of observation	No specific requirements for an observation period	Five years for retail, seven for sovereign funds, corporate and bank exposures	**Similar/compatible risk parameter**
	Calculation	PD X Present value of cash shortfalls	PD x LGD x EAD	**Same key risk parameter**

Final result: Expected Credit Loss/ Expected Loss	**Economic assumptions**	Unbiased expected value based on all possible outcomes	Reflects the downturn conditions	**Different risk parameter**

Source: (Gea-Carrasco, 2015)

Notable differences exist between Basel III and IFRS 9, however the relatively similar calculation and period for which expected losses as shown above indicate a reduced effect may arise in countries that have stronger Basel III applications.

Expected effect of IFRS 9

Initially, loans valued under amortized cost should be most affected by the change in impairment provisions. The effect of expected credit losses is predicted to be significant as banks' amortized loans are the largest assets on their financials (Çollaku et al., 2021). In the transition effect period (from 2018), it is expected that there will be a reduction in loan assets due to larger expected credit losses as well as a corresponding reduction in profits owing to higher once-off impairments (Çollaku et al., 2021). This reduction in profits will result in reduced retained earnings, meaning banks will have to recapitalize to maintain capital reserves.Banks may increase the cost of capital by investing in more equity to maintain minimum capital ratios in order to meet minimum capital requirements (Çollaku et al., 2021). These impairments would be coupled with larger loss provisions bringing forward future impairments. Therefore, CET1 (Common Equity Tier 1) would be reduced, as lower profits would lead to lower retained earnings (Pulin, 2021). CET1 is a component of Tier 1 capital used by Basel regulations to calculate minimum capital ratios, which indicate financial stability (BIS, 2019). This is considered the highest quality capital and absorbs losses as and when they occur. Additional once-off costs will also be incurred such as those that relate to implementation, including training and hiring additional expertise (Gulyas & Somogyi, 2019). These, however, are unlikely to be as material as credit loss provisions as credit loss provisions are banks largest accrual.

Simulations have predicted that IFRS 9 credit losses may not be higher than IAS 39 during normal economic conditions but will exceed IAS 39 provisions during a financial crisis (Seitz et al., 2018). The effect of the Covid-19 pandemic has had a significant negative financial impact (Deb et al., 2020). Credit provisions under IFRS 9 during this downturn could foreseeably exceed IAS 39 provisions. This effect could be explained by the financial stability of banks and the varying probability of default modelling. Conversely, researchers estimated that credit card providers in China would be expected to see increased impairments of 207%, due to the riskiness of their assets (Chen et al., 2022). China does not make use of IFRS; however, local standards have converged to IFRS, with the release of new CAS 22, which is almost identical to IFRS 9 (Fang et al., 2022). Basel compliance in China is also well implemented (Basel Committee on Banking Supervision, 2013). Unfortunately, China also has a large "shadow banking sector" which includes unregulated financial intermediaries, and places the industry to greater risk of financial instability (Elliott et al., 2015). This may make it difficult to assess the effect of IFRS 9 on Chinese banks and draw any comparisons to the highly regulated South African banking industry.

European banks are predicted to have an increase in expected credit losses of between 13%-18% initially, resulting in a reduction of CET1 by between 45-75 basis points and the total capital ratio by 35-50 basis points (Sultanoğlu, 2018). Turkish banks are predicted to fare better with an increase of 33 basis points in CET1 and 21 basis points in total capital ratio, as expected losses are expected to fall by 4.1%. This unexpected prediction is yet again underpinned by the strong regulation set out by Turkish regulators, with higher-than-normal capital reserve requirements, as well as the regulator is an independent body (Sultanoğlu, 2018).

Groff & Mörec (2021) found that there was a positive day 1 effect on bank assets. They hypothesized that this effect was contrary to earlier predictions and simulations due to country-specific factors, namely that prudent regulation of the sector in some countries had prepared banks for the switch to a more onerous standard (Groff & Mörec, 2021). The study also found that impairments and losses reduced, and equity was consequently positively affected. This would indicate that IFRS 9 may be susceptible to market conditions and therefore is cyclical like IAS 39, which may be highlighted by an economic downturn such as the Covid-19 pandemic. Groff and Mörec (2021) examined Slovenia which was experiencing above-average growth, which could explain the effects that were contrary to predictions. Conversely, Fatouh et al. (2020) found that there was a slight increase in the cost of equity and cost of capital from reduced retained earnings because of greater expected credit losses. This was the case in five of six countries (all Organisation for Economic Co-operation and Development countries) analysed, however France experienced the opposite effect, much like Slovenian banks (Fatouh et al., 2020). This could be the result of improved asset quality transparency, which may reduce the cost of equity (Fatouh et al., 2020; Novotny-Farkas, 2016).

Groff & Mörec (2021) found that there was a positive effect on implementation date on bank assets. They hypothesized that this effect was contrary to earlier predictions and simulations due to country-specific factors, namely that prudent regulation of the sector in some countries had prepared banks for the switch to a more onerous standard (Groff & Mörec, 2021). The study also found that impairments and losses fell, and equity was consequently positively affected. This would indicate that IFRS 9 may be susceptible to market conditions and therefore is cyclical like IAS 39. This may be highlighted by an economic downturn such as the Covid-19 pandemic. Groff and Mörec (2021) examined Slovenia which was experiencing above-average growth, which could explain the effects that were contrary to predictions. Conversely, Fatouh et al. (2020) found that there was a slight increase in the cost of equity and cost of capital from reduced retained earnings because of greater expected credit losses. This was the case in five of six countries (all Organisation for Economic Co-operation and Development countries) analysed. However, France experienced the opposite effect, much like Slovenian banks. This could be the result of improved asset quality transparency, which may reduce the cost of equity (Fatouh et al., 2020; Novotny-Farkas, 2016).

Effect of Covid-19 on Expected Credit Losses

The effect of the Covid-19 pandemic is relatively unexplored on expected credit losses and would be expected to have a significant effect on the credit risk of banks' loan portfolios. Accounting institutions such as the IASB stressed than expected credit losses should be based on long-term estimations to limit the impact of large write-offs (Barnoussi et al., 2020). The EU applied transitional arrangements to smooth the effect of expected credit losses and eliminate the effect on CET1 (Abad & Suarez, 2020). The effect of the pandemic on IFRS 9 implementation was approached differently in South Africa. No provision was made for South African banks as the Prudential Authority released guidance on the treatment of loan assets indicating Covid-19 should not be an automatic indicator to upgrade an asset to level 2 or 3 respectively (South African Reserve Bank, 2020a). IFRS 9 credit loss provisions were required to not be calculated on a procyclical basis, and therefore the longer-term estimates should be emphasized. 2020 loss provisions were found to be significantly higher than the previous year, however, earnings were not reduced by this (Cohen et al., 2021). This could be explained by strong capital positions due to prudent regulation, mitigating the negative effects of the increase in credit risk.

Cost of capital, IFRS 9 implementation and the low-risk anomaly

Finance theory purports that higher risk results on average in higher returns (Markowitz, 1952). Markowitz (1952) asserted that the risk of a portfolio, is the volatility of the return, and investors will attempt to maximize their return given their portfolio risk. Sharpe (1964) helped to develop the CAPM (Capital Asset Pricing Model) which predicted the return of an asset in relation to its degree of volatility to the market.

$$Ra = Rf + \beta a(Rm - Rf)$$

Ra is the return of the asset, *Rf* is the risk-free rate and *βa* is the beta of the asset to the market portfolio and Rm is the return of the market. CAPM describes the weighted returns from equity and debt. This model implies a positive relationship between risk and return. Past and present research finds that this assumption has not held in equity markets. Fama & French (1992) suggested that there may be a negative relationship between systemic risk and returns. Other risks measures such as downside risk and Value at Risk (VaR) also found a similar negative relationship between risk and excess returns (Shahzadi & Foroghi, 2022; Yang & Ma, 2021). Another author found an anomaly that equity betas and excess returns resulted in a negative quadratic relationship (Badhani, K & Ali, 2021).

According to capital structure irrelevance theory, an increase in the equity capital would not change the weighted cost of capital (Modigliani & Miller, 1958). This would mean IFRS 9 implementation should have no effect (assuming that capital structure irrelevance theory holds), despite the increased costs from expected credit losses and need to subsequently recapitalise. Capital structure irrelevance theory predicts that the lower cost of equity and debt offsets the greater proportion of equity in the capital structure, meaning the cost of capital should remain the same[3]. Imperfections in the market mean that the actual capital market does not reflect the proposition (Modigliani & Miller, 1958). If we assume that all other assumptions remain the same for the proposition and look at the low-risk anomaly in isolation, the effect on the cost of capital can be isolated using the modified CAPM above. The low-risk anomaly is a systematic imperfection. It occurs when the cost of equity is higher for shares with lower betas

[3] The theory will hold making the following assumptions: Perfect capital markets, Symmetric information, Equal access, and Given investment strategies (Culp, 2015).

(Fatouh et al., 2020). This implies that lower levels of leverage are not proportionally related to a lower cost of equity. The above suggests that an increase in the equity portion of the capital structure will result in an increased cost of capital under the low-risk anomaly. Evidence shows that higher-risk assets do not result in proportionally higher returns (Wurgler et al., 2016). The low-risk anomaly was found to be stronger in banks than in other types of firms (Baker & Wurgler, 2013). Most observations of the low-risk anomaly are in developed economies; however, evidence of the low-risk anomaly is present in emerging nations such as India (Badhani, K & Ali, 2021). South African equity markets have also had numerous observations of the low-risk anomaly (Khuzwayo, 2014; Seetharam, 2021; Steyn & Theart, 2019). These papers made use of numerous proxies for risk including Betas and the Sharpe ratio. The mispricing caused by the low-risk anomaly could be due to behavioural effects, such as representative bias inducing investors to purchase higher volatility assets as opposed to low risk, lowly represented shares (Steyn & Theart, 2019). The presence of the low-risk anomaly in a market in which IFRS 9 is implemented, may mean that decreased retained earnings result in a higher cost of equity (Fatouh et al., 2020).

CAPM can be adjusted to account for the low-risk anomaly as follows:

Before accounting for the low-risk anomaly:

$$Re = Rf + \beta e(Rm - Rf) \qquad (\mathbf{1.1})$$

$$Rd = Rf + \beta d(Rm - Rf) \qquad (\mathbf{1.2})$$

After accounting for the low-risk anomaly:

$$Re = \alpha + Rf + \beta e(Rm - Rf) \qquad \textbf{(2.1)}$$

$$Rd = Rf + \beta d(Rm - Rf)^{*} \qquad \textbf{\textit{(2.2)}}$$

Re = Cost of equity, βe = Equity beta, Rf = Risk-free rate, Rm = Market return, α = Low-risk anomaly, Rd = Cost of debt.

***The formula and dissertation assumes no anomaly exists in debt markets**

The above is substituted into the weighted cost of capital equation as follows:

$$WACC = e.Re + (1-e).Rd \text{ (Original equation)} \quad \textbf{(3)}$$

$$WACC = Rf + \beta a.Rp + \beta a.\gamma - \gamma[e + (1 - e).\beta d(e)] \text{ (Modified version)} \quad \textbf{(4)}$$

βa = Asset Beta, *Rp* = Excess return on portfolio, γ = magnitude of low-risk anomaly,e = leverage ratio.

This is used to derive the equation which measures the change in the weighted cost of capital (refer to equation **(9)** and **(13)** below).

Methodology

Research objectives

The study aims to find whether the low-risk anomaly exists in the South African banking industry to measure the impact of IFRS 9. It aims to calculate the effect of IFRS 9 expected credit losses on capital ratios and the cost of capital of South African banks using the magnitude of the above anomaly.

The key questions to be addressed in the research

Firstly, does the low-risk anomaly exist in the South African banking sector? The dissertation will then look to implementation reports as to how the introduction of IFRS 9 affects the regulatory capital of South African banks. Once the magnitude of the low-risk anomaly is calculated and the change in regulatory capital is quantified, the introduction of IFRS 9 effects on the cost of capital of South African Banks can be established. From that point, it can be observed if the partial alignment of IFRS 9 and Basel III result in a more muted effect on the cost of capital, when IFRS 9 was implemented in 2018.

Hypothesis

An increase in leverage should result in a greater proportion of low-risk debt, but in turn, equity, should become riskier. To maintain minimum leverage ratios after the impact of IFRS 9 on capital levels, banks would need to either increase capital held or by deleveraging their balance sheets. This would reasonably result in banks attempting to hold more equity capital to meet regulatory requirements. IFRS 9 should result in additional credit loss provisions, hence eroding bank capital. Therefore, an increase in the cost of equity is expected, and thereby the cost of capital of banks.

Methodology

The low-risk anomaly breaks down the traditional relationship between risks and returns. Traditional finance theory proposes that returns are positively associated with risk, and that high-risk investments result in higher returns. The low-risk anomaly results in a negative relationship between returns on equity and systematic and idiosyncratic risk. Therefore, an increase in the share of equity, should result in a proportionally higher weighted cost of capital. This dissertation adapts a methodology to calculate the change in the cost of capital from Baker & Wurgler (2015) and Fatouh et al. (2020). It is a modified version of CAPM and the weighted cost of capital which includes an error term to account for the effect of the low-risk anomaly:

Original Weighted cost of capital equation:

$$WACC = e.Re + (1-e).Rd$$ **(Original equation)** **(3)**

Substitute the *Re* and *Rd* from equation (2.1) and (2.2) respectively.

$$WACC = e.[\gamma.(\beta e - 1) + Rf + \beta e.Rp] + (1-e).[Rf + \beta d.Rp]$$

$$WACC = Rf - e.\gamma + e.\beta e.(\gamma + Rp) + \beta d.Rp - e.\beta d.Rp$$ **(simplification)**

Substitute βe from equation (12):

$$WACC = Rf - e.\gamma + (\beta a - (1-e).\beta d).(\gamma + Rp) + \beta d.Rp - e.\beta d.Rp$$

For given level of βa, as βd is a function of leverage:

$$WACC = Rf + \beta a.Rp + \beta a.\gamma - \gamma[e + (1-e).\beta d(e)]$$ (Modified version) **(4)**

The dissertation makes use of a modified version of CAPM (as above) that has adjusted to include an error term that accounts for the presence of a low-risk anomaly.

1. In order to find the low-risk anomaly, equity alphas and betas are calculated for banks in the South African Banking Industry. Equity beta is the measure of the historic risk of banks, whereas the alphas are used to represent historical excess returns. Both alphas and betas will be calculated raw and risk-adjusted (using the risk-free rate). These variables will allow for a regression which will

measure the relationship between risk and return for banks, as well as help to derive the magnitude of the anomaly.

2. Using a Top-Bottom analysis of the relevant alphas and betas, an estimation of the magnitude of the low-risk can be calculated.
3. This can be used to measure the change in the cost of capital assuming that a change in leverage (due to the implementation of IFRS 9) results in a change in the cost of equity.

Data

Most data points will be collected from the Bloomberg terminal. Equity alphas (intercepts) and equity betas (slopes) shall be calculated from the data provided on the Bloomberg terminal, namely share and index returns. From these calculations, the low-risk anomaly can be calculated for the banking industry.

Currently, South Africa has 13 locally controlled banks, of which 11 are listed or form part of a group that includes a listed holding company. Seven banks have appropriate disclosures of regulatory leverage ratios and expected credit losses for appropriate analysis. These include ABSA, Capitec, FirstRand, Investec, Nedbank, Sasfin, and Standard Bank. Leverage ratios were collected to calculate the asset beta, as well as calculate the change in the cost of capital. Share prices and index information will also be collected from Yahoo finance in order to test the robustness of Bloomberg returns. Changes in capital ratios, expected credit losses, and other IFRS 9 relevant information will be collected from implementation Investec, Standard Bank, FirstRand, Capitec, and annual financial statements for ABSA, Nedbank, and Sasfin.

Calculation of the individual company Betas and Alphas

Equity risk

The equity beta is the volatility of a portfolio or share in relation to the market. This will be used to measure equity risk, denoted as βe, and underlying returns from the index and individual shares will be from the Bloomberg terminal.

Actual returns are calculated using the daily closing share price of the companies in the sample using the following equation:

$$Actual\ Returns = \frac{Share\ Price\ Old - Share\ Price\ New}{Share\ Price\ Old} \quad \textbf{(5)}$$

Returns on the market will be calculated using the same formula as above. These will be regressed against one another to calculate equity betas and alphas.

Expected returns will be estimated using the following formula:

$$Re = Rf + \beta e(Rm - Rf) \qquad \textbf{(1.1)}$$

Both raw and risk-adjusted betas and alphas (Jensen's Alpha) will be calculated for analysis. Jensen's alpha has been found to be an important metric to investors and evidence does point to the existence of the measure in the equity markets, making an appropriate returns measure (Phuoc, 2018). A simple adjustment to the CAPM beta calculation needs to be made in order to calculate Jensen's alpha. The risk-free rate is subtracted from both share returns, and market returns and regressed to produce a risk-adjusted alpha and beta.

(*Ri*[4] – *Rf*) is regressed against (*Rm-Rf*).

Equity betas are going to be calculated using daily and monthly returns over a five-year estimation period. The five-year period is in line with typical calculations of equity beta calculations. Additionally, an estimation period of 20 years will be used for robustness using both daily and monthly returns. The extended period is to test whether the anomaly persists over a longer period in the equity market and mirrors what was performed in Fatouh et al. (2020) which used a 20-year period from 2017-2022.

Additionally, daily return periods are to be calculated to provide greater statistical significance for the sake of robustness as these tests have additional data points. Daily returns only form part of robustness testing to avoid regression bias of betas towards one (Albert, 1992; Blume, 1975). Whereas monthly returns with a shorter estimation period produce a less volatile beta for analysis and provides the more typical return interval used (Bradfield, 2003).

[4] Ri = Return of individual company share

The table below summarises the various return intervals, estimation periods, and number of total observations (return data) in each sample.

Table 2: Equity Beta estimation periods and return intervals

Period and return interval	Banks	Start Date	End Date	Risk-free rate	No. of Observations
5-year period – Monthly returns	7	31/08/2017	31/08/2022	10-year South African Government Bond Yield (monthly)	420
5-year period – Daily returns	7	31/08/2017	31/08/2022	10-year South African Government Bond Yield (daily)	8757
20-year period – Monthly returns	7	31/08/2002	31/08/2022	10-year South African Government Bond Yield (monthly)	1673
20-year period – Daily returns	7	31/08/2002	31/08/2017	10-year South African Government Bond Yield (monthly)	34993

The risk-free rate (Rf) used is the 10-year South African long-term government bond yield[5]. This will be collected from Investing.com and is calculated from Government

[5] This is not a specific bond, but rather an index of bond yields.

data as well as other data providers for bonds. The risk-free rate will be used to calculate abnormal excess returns on the risk-adjusted alphas.

In order to calculate the beta, a market return must be selected. The market return (Rm) will be the JSE Financial & Industrial 30 Index (JFNDI). The JFNDI is a market capitalization-weighted index and therefore this should provide a closer proxy to an equally weighted index (Bradfield, 2003). It includes the 30 largest industrial and financial companies on the Johannesburg Stock Exchange (JSE). The JSE All share index was not used in order to avoid excess noise, as some practitioners argue that it is more appropriate to separate the Financial and Industrial sector from the from the overall market (Bradfield, 2003). This is consistent with Seetharam (2021) who also made use of the FINDI as well as the Resources index to calculate the anomaly respectively.

The ideal length of the estimation period testing is five years. Five years provides enough data points but is not too long a period to ensure a stable beta is calculated. The 20-year estimation period will be used in order to test whether the low-risk anomaly persisted over a longer period, and mirrors tests performed by Fatouh et al. (2020) and Baker & Wurgler (2015).

A return interval on a monthly basis is to be used which is consistent with other research (Baker & Wurgler, 2015; Bradfield, 2003). In addition, daily return intervals will also test in order to have a test with a greater degree of data points and provide robustness. Jensen's alpha has also found to be more robust for daily returns data (Phuoc, 2018).

Portfolios: Weightings

Individual bank betas and alphas will be grouped into portfolios based on risk measured by beta. All portfolios will be created for analysis of the low-risk anomaly and are ranked on the basis of equity betas calculated for the relevant beta estimation period and return interval. This means all portfolios will be risk-ranked. Alphas and Betas shall be calculated as a weighted average for each risk category (low, medium, or high). The risk categories are split into a 30%/30%/40% split between low, medium, and high-risk categories respectively.

Individual company share betas and alphas

In order to test the robustness of the presence of a low-risk anomaly and possible factors that influence returns in the South African banking market, numerous types of portfolios will be created for the sample.

When using individual shares for the analysis of the anomaly, it does not provide a clear picture of what constitutes low and high risk in the sample as banks betas and alphas can vary significantly. This also ignores the size and value of banks in the South African industry. Baker & Wurgler (2015) make use of both equal-weighted portfolios as well as value portfolios for when testing for the low-risk anomaly. This is especially important when considering the inclusion of Investec Ltd and Sasfin Ltd, which are considerably smaller than the systemic banks in the industry.

Equal-weighted portfolios

Although equal-weighted portfolios can allow for low, medium, and high-risk shares to be grouped together, it still ignores the size and value of banks. This allows for analysis that would depict an anomaly that is not dependent on size or value, for example capitalization which is positively correlated with beta and negatively correlated with idiosyncratic risk (Baker & Wurgler, 2013).

Market capitalisation

Smaller-cap firms should have higher returns (Banz, 1981; Kashif et al., 2018). This is commonly referred to as the "size effect". Weighting portfolios using market capitalisation would consider the size of banks in the portfolio. Returns will be proportional to the size of the company within the risk category and therefore the portfolios better represent the returns at a market level. Using market capitalisation should ensure smaller firms in the sample do not have a disproportionate effect on excess returns in each portfolio when attempting to assess the risk-return relationship.

Price-to-book ratios

Using market capitalization may lead to over-priced shares being over-weighted and under-price shares being under weighted if there is noise in the market (Hsu, 2004). This may produce a natural negative alpha for the portfolios. Therefore, using other value weightings such as Price-to-book (P/B ratio) ratios may be appropriate. These are seen as a benchmark for bank value (European Central Bank, 2019). Using P/B ratios to weight portfolios will help account for any affect high value/overvalued banks or banks with growth potential have on returns. Higher bank capital rates are also linked to lower P/B ratios, indicating a possible link between value and capital levels (European Central Bank, 2019).

Using a wide variety of portfolio weights allows for a more robust observation of the low-risk anomaly. The weightings used are those from the start of each estimation period, as these are the most reflective of conditions and risks present for each company during the estimation period.

Plotting of Alphas and Betas and calculation of the low-risk anomaly

In order to assess the relationship between risk and return, portfolio alphas and betas are plotted. A line of best fit is plotted, which indicates the estimated relationship between risk and return. A negative or flattened relationship may indicate the presence of the low-risk anomaly in the market.

In order to assess the impact of the low-risk anomaly on the cost of capital, the magnitude (size or strength) of the anomaly must be calculated.

γ is the denotation of the magnitude of the low-risk anomaly.

The anomaly can be represented in the following equation:

$$\alpha = \gamma . (\beta e - 1) \qquad \textbf{(7)}$$

A simple “Top-Bottom" or “High-Low” will be used to calculate γ by subbing the lowand high-risk alphas into the following equation to produce an estimate of the magnitude of the low-risk anomaly. This is denoted by the following equation:

$$\gamma = \mathrm{d}\alpha / \mathrm{d}\beta e. \qquad \textbf{(8)}$$

For robustness, the dissertation will calculate the magnitude of the anomaly for both raw returns and using Jensen’s alphas for each of the portfolios as well as individual share samples. This will result in 24 separate tests of the presence of the anomaly, four of which will be considered the primary tests of the anomaly.

Change in cost of capital

Once the magnitude of the low-risk anomaly has been determined, the impact on the cost of capital can be calculated. This dissertation assumes that bank debt is riskless or in a second scenario, that debt is risky, but it is not sensitive to changes in leverage. Additionally, both scenarios assume that no government subsidiary exists, as well as equity and debt markets are not integrated. The table below lists the assumptions made in the dissertation for two separate cases. These assumptions include the riskiness of debt, pricing of assets, integration of markets, and government subsidies. It also provides the equations which will be used to calculate the change in the cost of capital. These assumptions will have to be made in order to calculate the cost of capital without testing the low-risk anomaly in debt markets, as well as not having to account for the possible presence of government subsidies and the integration of South African equity markets.

Table 3: Assumptions regarding the Capital Market

Scenario	Bank Debt				Change in WACC formula
	Risk	**Pricing**	**Integrated markets**	**Government Subsidy**	
One	Risk Free	Correctly priced	No	No	γ(e-e*)
Two	Risky	Low Beta anomaly Y=γd	No	No	γ(e-e*). (1-βd)

Source: (Baker & Wurgler, 2013)

Change in the cost of capital due to IFRS 9: Scenario one – Riskless Debt

The first scenario assumes that debt is riskless. The low-risk anomaly has been observed in debt markets; however, the effect is very small, and the study will assume that no low-risk anomaly exists, and that debt is riskless (Wurgler et al., 2016). The reasonability of that assumption will be tested by calculating asset betas. Asset betas for each individual bank will be calculated across all return intervals and estimation periods in order to test this assumption, as it is expected that debt betas are significantly lower than asset betas (Fatouh et al., 2020). Consequently, if asset betas are close to zero, the assumption of riskless debt will be reasonable.

The equation below will be used to calculate the impact on the cost of capital due to the implementation of IFRS 9.

$$\triangle\ in\ Weighted\ cost\ of\ capital =\ \gamma(e - e\ *). \qquad \textbf{(9)}$$

γ is the magnitude of the low-risk anomaly, whilst *e* and *e** is the change in leverage ratios due to the implementation of IFRS 9. The effect of IFRS 9 can be isolated. Extensive IFRS 9 implementation reports are available for four banks in the sample.

ABSA, Sasfin, and Nedbank do not have separate reports on the Impact of IFRS 9 but do provide some information on implementation. These contain the impact of IFRS 9 on day one of implementation (1st January 2018 or the company's financial year end). The full effect can be measured, as well as the actual effect which takes into the transition agreement with the SARB.

Change in the cost of capital due to IFRS 9: Scenario two – Risky Debt

The same process as above can be followed for the scenario in which debt riskiness is assumed. Asset betas above can be used to estimate the debt beta. The methodology assumes that the asset beta is a weighted average of the debt and equity beta and therefore the following equations can be used to derive the debt beta. The first equation is the asset beta, which assumes the weighted average of debt and equity betas. This can be rearranged into the second equation to calculate the debt beta.

$$\beta a = e.\beta e + (1 - e).\beta d \qquad \textbf{(10)}$$

$$\beta d = \frac{Ba - e.Be}{1 - e} \qquad \textbf{(11)}$$

$$Be \;=\; 1/e.\beta a \;-\; (1/e \;-\; 1).\beta d \qquad \textbf{(12)}$$

$$\Delta \; in \; Weighted \; cost \; of \; capital = \gamma(e - e *).(1 - \beta d) \qquad \textbf{(13)}$$

Leverage ratios

South African banks produce semi-annual leverage ratios in order to comply with Basel regulations and monitor their financial stability. These ratios will be used to measure the change in the proportion of equity in the banks' balance sheets after the implementation of IFRS 9. The following ratios will be collected to calculate asset betas.

Leverage ratios denoted as *e and e**, and are calculated as follows:

$$\frac{Total \; equity \; (as \; per \; balance \; sheet)}{Total \; assets} \quad \textbf{(Leverage ratio)} \qquad \textbf{(14)}$$

The above ratio is a simple accounting measure of leverage and is not a regulatory ratio.

$$\frac{Tier\ 1\ capital}{Risk-weighted\ assets}$$ **(Tier 1 Capital Ratio) (15)**

According to Bloomberg, the Tier 1 Capital consists of common equity, non-cumulative preferred equity and minority interests.

$$\frac{Total\ risk\ based\ capital}{Risk-weighted\ assets}$$ **(Capital adequacy ratio) (16)**

Total-risk based capital includes Tier 1 Capital as well as Tier 2 Capital which contains additional capital including perpetual debt and mandatory convertible securities, qualifying senior and subordinated debt, limited life preferred stock and qualifying allowance for credit losses.

$$\frac{Common\ equity\ Tier\ 1}{Risk-weighted\ assets}$$ **(CET1 Ratio) (17)**

According to Bloomberg, the Tier 1 Capital consists of common equity, non-cumulative preferred equity and minority interests. Common equity Tier 1 (CET1) excludes additional Tier 1 Capital non-cumulative preferred equity and minority interests. CET1 ratio is the most appropriate measure of financial stability and is the often disclosed in banks' financial statements and reports and therefore will be the preferred capital ratio for analysis of the impact of implementation of IFRS 9.

Results

Calculation of the individual company Betas and Alphas

Firstly, share and index returns were calculated in order to calculate equity betas and alphas. These were calculated using equation **(5)** for individual share returns and index returns respectively. These outputs were regressed in order to produce individual share betas and alphas. Both raw and risk-adjusted betas and alphas (Jensen's Alpha) were calculated for analysis. The tables below contain raw return betas and alphas as well as risk-adjusted alphas and betas (denoted as Beta excess and Alpha excess respectively). R-squared was also calculated to observe the strength of the modelling of each risk-adjusted beta. The number of returns and index returns observations are included in the final column of each of the two graphs below.

The following table depicts a 5-year estimation period beta with a monthly return.

Table 4: Individual company 5-year monthly betas and alphas

Bank	Raw Beta	Alpha	Beta excess	Alpha Excess	R^2	SE - Beta	SE – Alpha	Observations
Sasfin	0.51	-0.4503	0.51	-0.0082	0.0242	0.4288	0.0174	60
Capitec	0.76	1.6879	0.76	0.015	0.1122	0.2839	0.0115	60
Standard Bank	0.82	0.0240	0.83	-0.0011	0.1801	0.2329	0.0094	60
FirstRand	0.87	0.4437	0.87	0.0034	0.1729	0.2509	0.0102	60
ABSA	1.49	0.6559	1.49	0.0102	0.3137	0.0967	0.0042	60
Nedbank	1.54	0.2936	1.54	0.0070	0.3282	0.2903	0.0118	60
Investec Ltd	1.55	0.5907	1.55	0.0101	0.3871	0.2575	0.0104	60

When adjusted for the risk-free rate, alphas are far closer to zero than unadjusted returns. This is to be expected under an efficient market when using excess returns (Correia, 2019). If the alpha is persistent, it would indicate price-inefficiency. R-squares are low for the betas within the sample. This may indicate high idiosyncratic risk within the sample. This is especially prevalent for the lower-risk banks and some of the medium risk banks including Sasfin, Capitec, Standard Bank and FirstRand Group.

The following table depicts a 20-year estimation period beta with a monthly return.

Table 5: Individual company 20-year monthly betas and alphas

Bank	Raw Beta	Alpha	Beta excess	Alpha Excess	R^2	SE - Beta	SE - Alpha	Observations
Sasfin	0.67	0.3764	0.68	0.0015	0.0818	0.1492	0.6563	239
Capitec	0.91	2.4547	0.90	0.0239	0.1769	0.9098	0.0239	239
Standard Bank	0.92	-0.1044	0.92	-0.0016	0.4512	0.0853	0.3751	239
FirstRand	0.98	0.2563	0.98	0.0025	0.3137	0.0901	0.3959	239
Nedbank	1.01	-0.4181	1.01	-0.0041	0.3346	0.0984	0.4325	239
ABSA	1.02	-0.0347	1.02	-0.0002	0.3387	0.0968	0.0042	239
Investec Ltd	1.29	1.2936	1.29	-0.0016	0.3134	0.0931	0.4089	239

Betas moved closer to one with a greater number of observations. All models seem to provide similar levels of explanatory value judging from relatively similar R-squares. In most cases, betas provided a model with some degree of predictability, however, in the case of Sasfin, betas' predictability was very weak with such low R-squares. This could indicate a high degree of unsystematic risk for the share. 5-year and 20-year betas with a daily return interval were calculated for robustness. The resulting betas and R-squares were relatively similar to the calculation above[6].

Plotting of Alphas and Betas and calculation of the low-risk anomaly

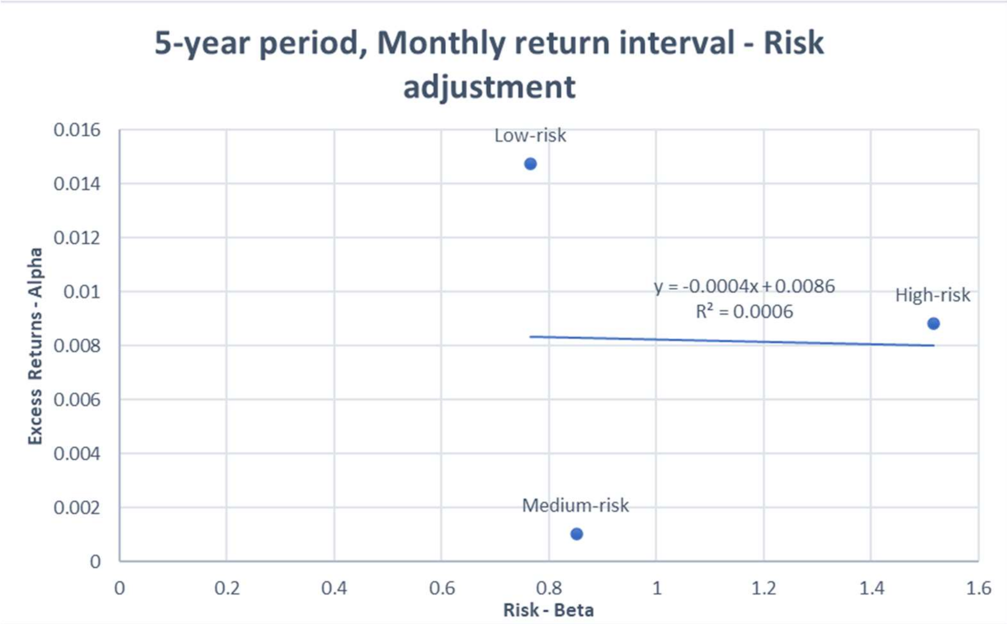
Many portfolio betas and alphas were calculated for robustness purposes; however, greater emphasis is placed on a handful of the tests performed. Below is a graph of individual share alphas and betas adjusted for the risk-free rate.

Certain betas calculated were deemed as more robust (Tests 1-4), and therefore more appropriate for analysis. The following betas are deemed as the core analysis of this dissertation: 5-year monthly market capitalization, 5-year monthly P/B ratio, 20-year monthly market capitalization, and, 20-year monthly P/B ratio. The tests avoid using daily returns as this may cause too much noise in the sample.

Test 1: 5-year monthly return: Market capitalization

5-year monthly betas were calculated. These were grouped into risk-ranked portfolios as described above and weighted by market capitalization. This was considered the most appropriate test, as the five-year period is in line with typical calculations of equity beta calculations as well as the monthly returns. Additionally, the weighting by market capitalization allows for a better depiction of the proportion of returns from low, medium, and high-risk assets. Lastly, the risk adjustment for the risk-free rate reflects abnormal excess returns, isolating the effect of the anomaly. Below is a graph of the portfolio alphas and betas.

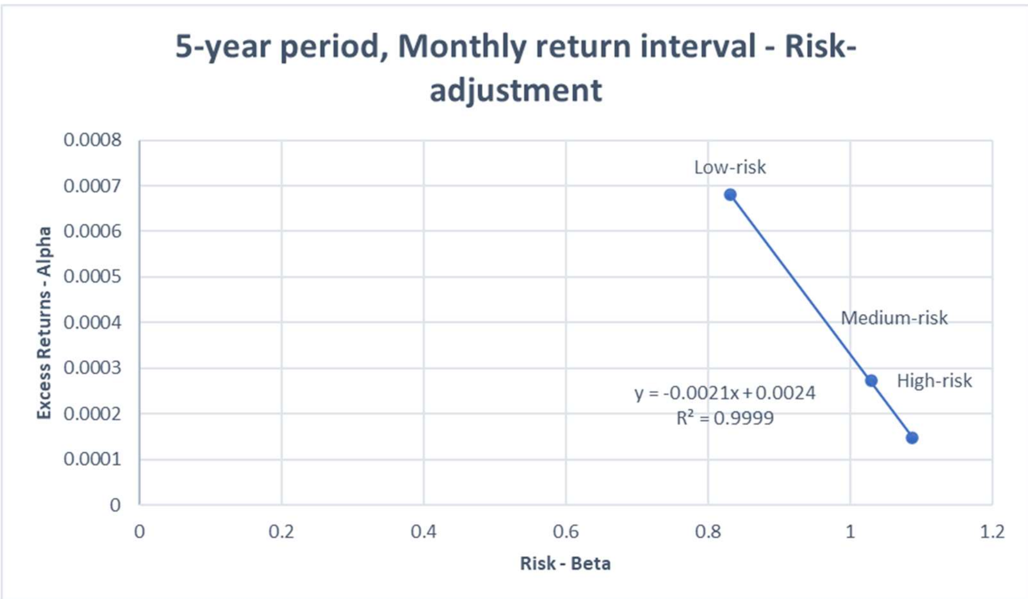
[6] Tables are detailed in Appendix one



The explanatory value is extremely close to zero with such a low R-squared. The relationship between risk and return is not clear, however, a flattened risk-return relationship may indicate a low-risk anomaly may exist in the market, as the low R-squared limits the ability to judge the results. Notwithstanding this, the low-risk portfolio has the largest alpha and therefore performed the best in the period.

Test 2: 5-year monthly return: P/B ratio

Additionally, accounting for the value of banks using P/B ratios to weight portfolios can help with mitigating the effects of high value/overvalued banks or smaller banks with growth potential on returns. The graph below represents the same estimation period and return interval as the test above; however, the portfolio is weighted using P/B ratio.



The above is a much clearer result with a very high explanatory value, showing the model explains relationship between risk and return is negative. This indicates a low-risk anomaly may be present in the market.

Test three: 20-year monthly return – Market capitalization

Focus was also placed on the results of the same portfolios using market capitalization over the long-term period of 20 years.

The very high R-squared indicates a good fit for the model. The negative relationship between risk and returns depicted by the gradient of the line of best fit indicates the presence of a low-risk anomaly in the market. The x-value is close to zero indicating a relatively flat relationship. The high-risk portfolio also offers a negative alpha, indicating that shares over the period resulted in negative excess returns for investors.

Test four: 20-year monthly return – P/B ratio

Lastly, betas calculated over a 20-year period with a monthly return were plotted and weighted according to the Price-to-book ratio of banks in the sample.

Again, a high R-squared indicates a good fit for the model, as the above gradient is negative, indicating a negative relationship between risk and return. The gradient is still a small value, however larger than above, and may indicate a larger magnitude for the anomaly. A negative alpha is also present as above for test 3.

In both cases, the long-run test yields a clear result of the relationship between risk and return being negative, indicative of the low-risk anomaly's presence.

The four tests as well as additional robustness testing performed in the appendices indicate that the traditional relationship between risk and return may not hold in the South African banking industry. Observing the graphed results indicate that the low-risk anomaly is likely to be present in the South African Bank equity market. In calculating a negative γ for the four tests as shown below, we confirm the existence of the low-risk anomaly.

Change in the cost of capital due to IFRS 9: Scenario one – Riskless Debt

Estimation of the magnitude of the low-risk anomaly

In order to estimate the magnitude (γ) of the low-risk anomaly, alphas and betas for individual banks in the study. Portfolios were ranked using the equity beta (risk) and subsequently were plotted in order to estimate γ. These values were calculated using equation **(7)** and **(8)**.

In order to contextualize the results, the dissertation draws a comparison to the estimated cost of equity of banks in South Africa. The estimated cost of equity in the

South African bank market is 13.043%. The table beneath displays the Cost of Capital of the sample banks as well as the cost of equity.

Table 6: Cost of Capital and equity of South African Banks

Bank	**Period: 2021**	
	Cost of capital (%)[7]	**Cost of equity (%)**[8]
ABSA	7.6	10.8
Capitec	13	13.1
FirstRand	12.3	12.9
Investec	10.1	15.6
Nedbank	10.9	14.5
Sasfin	7.6	10.8
Standard Bank	9	13.6
Average	**10.071**	**13.043**

The magnitude of the anomaly varied greatly. Tests 1-4 yielded an estimate of the anomaly to be between 3-129bps when annualized and adjusted for the impact of the risk-free rate. This would indicate that a 1% change in the proportion of equity in the capital structure of a bank would result in an increase of 0.23%-9.89%[9] in the cost of capital. European banks would be expected to see an increase of around 1.61-1.63% change in the cost of capital when the weighting of equity changes (Fatouh et al., 2020). South African banks may have a considerably larger γ than European banks, resulting in costlier equity and thereby costlier capital.

As indicated in Appendix four and above, the low-risk anomaly appears to be present in the South African Banking industry using both raw and risk-adjusted returns. An additional 20 robustness tests were performed to deduce the magnitude of the low-risk anomaly. Of the 24 tests (including tests 1-4)[10] performed, 23 found the presence

[7] Estimated WACC according to Bloomberg.
[8] Estimated Cost of equity according to Bloomberg
[9] (0.03%/13.043 = 0.23% and 1.29%/13.043% = 9.89%)
[10] Appendix four lists all 24 portfolios calculated and tested for the presence of the low-risk anomaly.

of a low-risk anomaly. The remaining test produced a γ>0, which indicates a "high-risk" anomaly, which would result in proportionally higher returns for high-risk shares as compared to low-risk ones. Of the 24 tests performed, 12 returns were adjusted for the impact of the risk-free rate. 11 of 12 of these risk-adjusted betas (using Jensen's Alpha) resulted in a low-risk anomaly. Results vary significantly regarding the size of anomaly returns magnitude is greater in the short-run and lessens in the long-run, whereas monthly returns are weakened in the short-run and strengthen over time.

The estimated annual magnitude of the low-risk anomaly (all tests)

The table below shows the anomaly estimated when using the equations **(7)** and **(8)** to determine the relationship between risk and return. The table below includes γ values that have been annualized to be comparable to one another. The values presented below are raw returns and do not account for the effect of the risk-free rate. Results are presented in terms of basis points. Results are split into return and estimation periods as well as what type of portfolio weighting was used.

Table 7: Low-risk anomaly annualized – Raw returns (Basis Points)

Return interval and period	**Risk based portfolio**			
	Equally weighted	Market cap	Price-to-book	Average
5-year monthly	-142,06	**-2345,97***	**-1216,82***	**-1234.9**
5-year daily	-2562,62	-19642,08	-8508,76	**-7429.93**
20-year monthly	-4307,35	**-13539,19***	**-2212,94***	**-6686.49**
20-year daily	-4588,27	-6216,96	-2653,66	**-4486.29**
Average	**-2900,07**	**-10436,05**	**-3648,04**	**-4959.42**

***Tests 1-4**

The effect of the low-risk anomaly seems to be very large, especially when using market capitalization as a weight for portfolios. When focusing on the most robust tests mentioned above, all four provide evidence that the low-risk anomaly is present in the banking market and seems to grow in magnitude from the short to the long-run.

Table 8: Low-risk anomaly annualized – Risk Adjusted returns (Basis points)

Return interval and period	**Risk based portfolio**			
	Equally weighted	Market cap	Price-to-book	Average

5-year monthly	7,63	**-9,46***	**-3,13***	**-1.65**
5-year daily	-16,68	-186,26	-76,04	**-67.90**
20-year monthly	-55,74	**-129,53***	**-24,45***	**-69.91**
20-year daily	-37,31	-53,59	-17,96	**-36.29**
Average	**-25,53**	**-94,71**	**-30,40**	**-43.94**

***Tests 1-4**

When accounting for the impact of the risk-free rate the size of the anomaly reduces significantly. This could be explained by alphas moving closer to zero when adjusted for the risk-free rate, and thereby isolating the return due to the riskiness of assets. When focusing on the tests 1-4, the same outcome is achieved, with the low-risk anomaly present in the short-run and growing in magnitude over the long-run. The results in Table 8 highlighted in grey indicate a “high-risk” anomaly, which denote that high-risk (high-volatility) shares yield proportionally greater returns than low-risk shares. This result is what would be expected to be in line with the traditional finance theory proposed by Sharp and Lintner under CAPM (Cederburg & Doherty, 2016).

The evidence above points to a low-risk anomaly within the banking sector. No clear reason presents itself as to why the anomaly is present in the South African banking industry. The presence of the low-risk anomaly in the market could be explained by leverage limitations and required margins for investors, which result in investors choosing higher beta shares, which in turn returns proportionally lower returns (Frazzini & Pedersen, 2014). It could also be explained by overconfidence and lottery preferences held by investors (Baker & Wurgler, 2015). The above could be explained by a combination of the two suggestions.

Change in cost of capital

Once having derived γ, we can assess the impact of IFRS 9 on the cost of capital on South African banks. This can be calculated by multiplying the annualized anomaly by the average impact of IFRS 9 on capital ratios. The impact has been compiled from various bank reports and financial statements.

South African banks disclosed or presented the day 1 impact of IFRS 9 implementation on credit losses and regulatory capital. The table below summarizes the isolated impact of the transition. Banks focussed on disclosing the impact on expected credit losses (loss provisions) and reductions in CET1 (Common equity Tier 1 ratio).

Table 9: Impact of IFRS 9 on banks' credit losses and regulatory capital

Bank	**Increase** in expected credit losses	**Decrease in CET1 (Equation 17)**	**CET1 – IAS 39**	**CET1 – IFRS 9**
ABSA	7.00%	0.07%	12.30%	12.23%
Capitec	15.21%	0.60%	33.90%	33.30%
FirstRand	73.31%	0.20%	12.70%	12.50%
Investec Ltd	43.26%	0.20%	10.20%	10%
Nedbank	11.60%	0.25%	12.60%	12.30%
Sasfin	49.04%	0.98%	14.03%	13.06%
Standard Bank	32%	0.20%	13.50%	13.30%
Average	**33.06%**	**0.36%**	**15.60%**	**15.24%**

The increase in expected credit losses reflects the impact of IFRS 9 implementation. This increase was predicted to occur and thereby reduce retained earnings (Çollaku et al., 2021; Pulin, 2021). The variation between companies in the sample could be as a result of varying levels of preparation for IFRS 9 or lower or higher quality assets at greater or lesser risk to impairment or reclassification. It could also be explained by management discretion enabling smoothing of income or reducing the effect of the implementation of the standard (Al-Sakini et al., 2021; Jean-François et al., 2019). This shows that expected credit losses will be greater than IAS 39 incurred losses, even during normal economic conditions, which contradicts the predictions of Seitz et al. 2018. This increase in these accruals reduced the retained earnings and therefore resulted in a reduction in the regulatory capital of banks. This is represented by the decrease in CET1 column in Table 9. The column represents e-e* (change in leverage) that is used in calculating the impact of implementing IFRS 9 on the cost of capital. The final two columns show the difference in regulatory capital as at 1 January 2018 under IAS 39 and IFRS 9, respectively.

Expected credit losses increased by an average of 33.06% due to the implementation of IFRS 9. Sasfin's large increase of 49.04% could be attributed to the bank not applying the transitional arrangements which allow some of this increase to be offset to later years. This also led to the largest reduction in regulatory capital in the sample of 0.98%, which would be expected as this larger accrual would erode retained earnings by a more sizeable proportion. Other banks however not take this option, instead applying transitional arrangements and therefore ostensibly shielding their capital ratios from IFRS 9 implementation. It seems that expected credit losses increased across the board despite this. Credit losses are banks' largest accrual and the effect on profits and capital appears to be significant considering the above. However, the average reduction in regulatory capital is small, although it is statistically significant (see p-value below).

Table 10: Statistical significance of change in regulatory capital

t-Test: Paired Two Sample for Means		
	Absolute value CET1 - PRE	***Absolute value CET1 Post***
Mean	0.1560	0.1524
Variance	0.0066	0.0064
Observations	7	7
Pearson Correlation	0.9993	
t Stat	3.0374	
P(T<=t) one-tail	0.0114	
P(T<=t) two-tail	0.0228	

Despite this, South African banks still have ample capital to absorb future impairments, and the need to recapitalize is not urgent. The SARB requires a 7.375% CET1 ratio, with sample banks' average ratio being at least double that figure. This figure is already conservative considering Basel's recommendation of CET1>4.5% (BIS, 2019). Higher capital levels in banks have been found to be linked to lower P/B ratios as noted above (European Central Bank, 2019). South African banks are well-capitalized compared to regulatory minimums and may be undervalued by the market. CET1 ratios in European were expected to decline by around 45-75 basis points (European Banking Authority, 2017; Sultanoğlu, 2018). This is well above South Africa's average of 36 basis points, and mirrors predictions of the Turkish banking industry, which was expected to have a decrease of 33 basis points in the CET1 ratio. Turkey also has a robust regulator and regulations regarding banking and is has a more comparable economy to South Africa than more developed European countries. This may explain the similar change to capital ratios.

Estimated impact of IFRS 9 implementation on the cost of capital

The table below shows the possible impact of IFRS 9 on cost of capital of banks in South Africa. The magnitude of the anomaly calculated in Appendix four and change in leverage represented by the change in the CET1 ratio in table two.

These values were calculated using equation **(9)**.

Table 11: Impact of IFRS 9 on the cost of capital – Raw returns and riskless debt

Return interval and period	**Risk based portfolio**			
	Equally weighted	Market cap	Price-to-book	Average
5-year monthly	0.51%	**8.37%***	**4.34%***	**4.41%**
5-year daily	9.14%	70.07%	30.35%	**26.50%**
20-year monthly	15.36%	**48.30%***	**7.89%***	**23.85%**
20-year daily	16.37%	22.18%	9.47%	**16.00%**
Average	**10.34%**	**37.23%**	**13.01%**	**17.69%**

***Tests 1-4**

The larger magnitude of the anomaly without accounting for the risk-free rate results in more sizable increases in cost of capital. In tests 1-4, increases in the cost of capital range from 4.34% to 48.3%. With current WACC levels this would result in an increase of between 0.56% and 6.29%. An increase in the cost of capital of 6.29% would imply significant constraints on capital projects banks could subsequently invest into to generate positive returns, thereby possibly destroying bank value. This would imply the impact of IFRS 9 would be quite negative on banks in the country.

These were calculated using equation **(9)**.

Table 12: Impact of IFRS 9 on the cost of capital – Risk adjusted and riskless debt

Return interval and period	**Risk based portfolio**			
	Equally weighted	Market cap	Price-to-book	**Average**
5-year monthly	-0.03%	**0.03%***	**0.01%**	**0.01%**
5-year daily	0.06%	0.66%	0.27%	**0.24%**
20-year monthly	0.20%	**0.46%***	**0.09%***	**0.25%**
20-year daily	0.13%	0.19%	0.06%	**0.13%**
Average	**0.09%**	**0.34%**	**0.11%**	**0.16%**

***Tests 1-4**

As seen above, IFRS 9 may have a small effect on the cost of funding when considering the risk-free rate, assuming the presence of a low-risk anomaly in the market.

The effect of IFRS 9 implementation in European banks was more impactful on capital ratios, with an average reduction of 0.45% on CET1 (European Banking Authority, 2017). Notwithstanding this, cost of capital was only increased by between 0.003%-0.06% due to IFRS 9 implementation (Fatouh et al., 2020). This is because of a larger low-risk anomaly, and not banks' preparedness. South African banks appeared to be well prepared for IFRS 9 and are well-capitalized.

The result highlighted in grey is a scenario in which the change in leverage resulted in a decrease in the cost of capital. This is as $\gamma>0$ in this case.

When calculating the average impact of IFRS 9 on the cost of capital using risk adjusted portfolios the effect is weakened further. Accounting for the size or value of firms does seem to increase the magnitude of the anomaly, and thereby the effect on the cost of capital due to a change in leverage.

The decrease in capital ratios should induce banks to recapitalize, resulting in a greater proportion of equity in the capital structure, and thereby an increase in the cost of capital. As seen by the average impact of IFRS 9, this would result in an increase in the cost of capital by an average of 0.1475% for tests 1-4 and would only result in an increase in the weighted cost of capital by an absolute value of 0.019% for South African banks.

Change in the cost of capital due to IFRS 9: Scenario two – Risky Debt

Estimation of asset betas

In order to test the robustness of the assumptions of riskless debt and debt that is unresponsive to changes in leverage, the dissertation calculated asset and debt betas for South African banks. The assets betas were calculated using the leverage ratio of banks as an input.[11]

[11] Average (1999-2021) leverage ratios and capital ratios for South African Banks are included in Appendix three, table 4.

Table 13: Average Asset betas for sample

Capital Ratio	5-year monthly Beta	5-year daily Beta	20-year monthly Beta	20-year daily Beta
Leverage ratio (equation 14)	0,1429	0,1280	0,1911	0,1365

As seen above, asset betas are quite low, as these figures are close to zero. Asset betas in South African banks seem to be slightly higher than those of European banks. European asset betas ranged between 0,06 and 0,10 (Fatouh et al., 2020). The assumption that the asset beta is a weighted average of the debt and equity beta indicates that the debt beta must be very small due to the above, indicating that the assumption that debt is riskless, or unresponsive to changes in leverage is a valid assumption for this sample.

Table 14: Average Debt betas for sample

Capital Ratio	5-year monthly Beta	5-year daily Beta	20-year monthly Beta	20-year daily Beta
Leverage ratio (equation 14)	-0,0746	-0,0788	-0,1621	-0,1658

When estimating debt betas, it was found that in all cases debt betas are close to zero and are in fact negative. This is despite Capitec having a notably higher average asset and debt beta of 0,4541 and –0,5234 respectively. Capitec's abnormal result is due to the very high level of capital present in the capital structure, especially in the early 2000s when the bank was listed on the JSE (Johannesburg Stock Exchange). This further enhances the decision to assume the debt is riskless or unresponsive to changes in leverage.

The following table provides the impact on the cost of capital due to IFRS 9 implementation when using raw returns and taking into account the effect of the average debt beta for the sample.

These figures were calculated using equation **(13).**

Table 15: Impact of IFRS 9 on the cost of capital – Raw returns and risky debt

Return interval and period	**Risk based portfolio**			
	Equally weighted	Market cap	Price-to-book	Average
5-year monthly	0.54%	**8.99%***	**4.66%***	**4.73%**
5-year daily	9.86%	75.59%	32.74%	**28.59%**
20-year monthly	17.86%	**56.13%***	**9.17%***	**27.72%**
20-year daily	19.08%	25.86%	11.04%	**18.66%**
Average	**11.84%**	**41.64%**	**14.40%**	**19.93%**

***Tests 1-4**

The cost of capital would increase more when considering banks' debt betas. This is as debt betas were negative. The change from riskless to risky debt resulted in an increase in the original increase in the cost of capital by between around 7.5% to 16.5% depending on the estimation period and return interval.

The following table provides the impact on the cost of capital due to IFRS 9 implementation when using risk-adjusted returns and taking into account the effect of the average debt beta for the sample.

These figures were calculated using equation **(13).**

Table 16: Impact of IFRS 9 on the cost of capital – Risk adjusted and risky debt

Return interval and period	**Risk based portfolio**			
	Equally weighted	Market cap	Price-to-book	**Average**
5-year monthly	-0.03%	**0.04%***	**0.01%***	**0.01%**
5-year daily	0.06%	0.72%	0.29%	**0.24%**
20-year monthly	0.23%	**0.54%***	**0.10%***	**0.25%**
20-year daily	0.16%	0.22%	0.07%	**0.13%**
Average	**0.11%**	**0.38%**	**0.12%**	**0.16%**

***Tests 1-4**

When adjusting for the risk-free rate, the increase in the cost of capital remains small, even when negative debt betas exacerbate the impact of IFRS 9 on the cost of capital.

An increase in the cost of capital by average of 0.1725% for tests 1-4 would result in an increase in banks WACC of around 0.02%.

Implications for banks

The low-risk anomaly seems to be present in the South African bank equity market. The magnitude of the anomaly seems to vary depending on the beta estimation period selected and weighting used. When looking to tests 1-4, the magnitude of the anomaly is more sizable as compared to developed nations' equity markets. The minimal impact of IFRS 9 on regulatory capital meant that the effect on the cost of capital was very small. This may show that South African banks were adequately prepared for the implementation of IFRS 9. The SARB's efforts to ensure Basel II and III were effectively in place to guarantee the financial stability of South African banks may have also allowed banks to avoid greater expected credit losses due to IFRS 9. Transition agreements were also applied by all but one bank, thereby reducing the pressures of IFRS 9 on the cost of capital.

The IFRS foundation has recently released the post-implementation review in December 2022 (IFRS Foundation, 2022). According to their review, the standard provides useful information to users of the financials and no unexpected costs arose when implementing and applying the standard.

Despite this, some responses to the review noted very high costs in the transition from IAS 39 to IFRS 9, and that relief mechanisms were not sufficient. In South Africa, this does not seem to be the case, as transition arrangements seem to have been sufficient to mute the impact of expected credit losses for those banks that opted in.

Conclusion

The dissertation set out to examine the impact of IFRS 9 implementation on capital ratios and the weighted cost of capital. In order to achieve this, the dissertation would use a modified version of CAPM and the traditional equation for the weighted cost of capital which was initially developed by Baker & Wurgler (2015). An estimation of the magnitude of the low-risk anomaly in the equity market would be required to be calculated for this methodology.

Equity alphas and betas were used as a measure of return and risk. These were used to graph the risk-return relationship and subsequently calculate γ, the magnitude of the anomaly. In addition, the likelihood of the low-risk anomaly in debt markets was tested by calculating estimated assets betas for each bank in the sample. Asset betas close to zero were calculated, indicating that the likelihood of a low-risk anomaly in debt markets is doubtful. This confirmed the reasonability of the assumption made in the dissertation of riskless debt. These results agree with a previous test of the low-risk anomaly in debt markets (Wurgler et al., 2016). The presence of the low-risk anomaly was detected and the magnitude of which was calculated using multiple beta estimation periods and portfolio weightings. This indicated that when holding all else equal, when leverage changed, the cost of capital changed. It also indicated that the relationship between abnormal excess returns and risk was flattened and negative, which contradicted the traditional view that higher risk resulted in proportionally higher returns. The result was similar to that of international tests which found the low-risk anomaly's presence in the equity markets of banks (Baker & Wurgler, 2015; Fatouh et al., 2020). Results also added to the South African body of knowledge that had found the presence of the anomaly across the entirety of equity market (Khuzwayo, 2014; Steyn & Theart, 2019).

Numerous researchers found that IFRS 9 decreased retained earnings and capital ratios (Al-Sakini et al., 2021; Fatouh et al., 2020; Pulin, 2021). The paper calculated the impact of IFRS 9 on bank capital levels and ratios and found that the accounting standard led to a small reduction in retained earnings. A consequence of this was a reduction in high-quality regulatory capital. This was a result of increased credit loss provisions and asset reclassifications owing to the switch from IAS 39 to IFRS 9. The move from incurred credit losses to expected losses caused greater credit losses. IFRS 9 resulted in an average reduction of 0.45% on CET1 in Europe (European Banking Authority, 2017; Sultanoğlu, 2018). The South African sample was considerably less than this, at 0.36%. Results in the change in the cost of capital of European banks saw increases ranging around 0.003%-0.06% (Fatouh et al., 2020). South African banks had a larger increase in cost of capital of 0.1475%. This was because of a larger magnitude of the low-risk anomaly in South Africa as compared to European markets. The results above confirms that IFRS 9 implementation increased the cost of capital due to an increase in credit loss provisions as a result of the switch from the incurred to expected loss model. The smaller reduction in capital ratios in South Africa confirms the presence of a strong reserve bank and regulatory framework supplemented by Basel requirements. Despite the larger low-risk anomaly in the market as compared to European markets, banks have not been significantly affected by the move from IAS 39 to IFRS 9, as prudent banking regulations have muted the effect.

IFRS 9 was devised to provide more decision useful information as prior standards that dealt with financial instruments, such as IAS 39. The usefulness of the standard is still up for debate; however, unintended consequences of the standard seem to be limited. This may be a result of the robustness of Basel regulations, especially in wake of the 2008 financial crisis. The limited affect may also signify that the adoption of a new standard has not resulted in additional useful information as intended by the IASB.

The dissertation has shown that the impact on bank capital was not drastic, and therefore the impact on the cost of capital was minimal. It has confirmed the presence of the low-risk anomaly in the bank equity market as well as assessing the unintended effects of IFRS 9 on South African banks. In conclusion, banks' ability to create value and banks financial stability has not been significantly impacted by the implementation of IFRS 9.

Limitations and Further Research

The dissertation assumed that capital markets were segmented. South African capital markets do have a significant degree of integration with international capital markets, as well as a high degree of global informational efficiency (Boamah, 2017, 2022). The dissertation also assumed that debt was riskless or had risk that was not sensitive to changes in leverage. Further research could test the implications of a low-risk anomaly in debt market in South Africa.

Long-term impacts of IFRS 9 should be investigated. The recent implementation of the standard means that the long-term impact is only now becoming relevant, especially the effect on capital ratios. Additional focus on the long-term impacts of the standard is even more relevant with the release of the post-implementation review of the standard by the IFRS foundation.

Other possible actions by banks to de.al with the implementation of IFRS 9 were not considered. This includes changes in dividend policy and payment behaviour, which could counteract smaller changes in capital.

The dissertation was also limited to the use of a seven-bank sample. In South Africa, there are 13 locally controlled banks, of which 11 are listed. The banks that were not included did not have appropriate capital ratio disclosures or share data. Further research of other African markets with more listed banks could provide a more robust test of the impact of IFRS 9 on African banks.

Reference list

Abad, J., & Suarez, J. (2020). *IFRS 9 and COVID-19: Delay and freeze the transitional arrangements clock* (A. Benassy-Quere & B. di Mauro (eds.)). VOX EU; CEPR. https://cepr.org/voxeu/columns/ifrs-9-and-covid-19-delay-and-freeze-transitional-arrangements-clock

Al-Sakini, S. A., Awawdeh, H. Al, Awamleh, I. Al, & Qatawneh, A. M. (2021). Impact of IFRS (9) on the size of loan loss provisions: An applied study on Jordanian commercial banks during 2015-2019. *Accounting*, *7*(7), 1601–1610. https://doi.org/10.5267/j.ac.2021.5.010

Albert, C. (1992). The intervalling effect bias in beta: A note. *Journal of Banking and Finance*, *16*(1), 61–73. https://www.sciencedirect.com/science/article/pii/037842669290078E

Badhani, K, N., & Ali, A. (2021). Beta - Anomaly: Evidence from the Indian Equity Market. *Asia-Pacific Financial Markets*, *28*(1), 55–78. https://doi.org/10.1007/s10690-020-09316-2

Baker, M., & Wurgler, J. (2013). Do Strict Capital Requirements Raise the Cost of Capital? Banking Regulation and the Low Risk Anomaly. In *National Bureau of Economic Research Working Paper Series* (No. 19018). http://www.nber.org/papers/w19018

Baker, M., & Wurgler, J. (2015). Do Strict Capital Requirements Raise the Cost of Capital? Bank Regulation , Capital Structure , and the Low-Risk Anomaly. *The American Economic Review*, *105*(5), 315–320. https://www.jstor.org/stable/43821900

Banz, R. W. (1981). The Relationship between Return and Market Value of Common Stocks. *Journal of Financial Economics*, *9*, 3–18. https://stoicinvesting.com/resources/Banz_sizeeffect_1980.pdf

Barnoussi, A. el, Howieson, B., & van Beest, F. (2020). Prudential Application of IFRS 9: (Un)Fair Reporting in COVID-19 Crisis for Banks Worldwide?! *Australian Accounting Review*, *30*(3), 178–192. https://doi.org/10.1111/auar.12316

Basel Committee on Banking Supervision. (2013). *Basel Committee on Banking Supervision Regulatory Consistency Assessment Programme (RCAP) Assessment of Basel III regulations – China* (Issue September, pp. 1–74). BIS. https://www.bis.org/press/p130927.htm

Basel Committee on Banking Supervision. (2015). *Assessment of Basel III risk-based capital regulations - South Africa* (Issue June). https://www.bis.org/bcbs/publ/d322.pdf

BIS. (2019). *Definition of capital in Basel III – Executive Summary*. Financial Stability Institute. https://www.bis.org/fsi/fsisummaries/defcap_b3.htm#:~:text=Regulatory capital under Basel III,the components of regulatory capital.

Blume, M. E. (1975). Betas and Their Regression Tendencies. *The Journal of Finance*, *30*(3), 785–795. https://www.jstor.org/stable/2326858#metadata_info_tab_contents

Boamah, N. A. (2017). The global financial market integration of selected emerging markets. *International Journal of Emerging Markets*, *12*(4), 683–707. https://doi.org/10.1108/IJoEM-11-2015-0241

Boamah, N. A. (2022). Segmentation, business environment and global informational efficiency of emerging financial markets. *The Quarterly Review of Economics and Finance*, *84*, 52–60. https://doi.org/10.1016/J.QREF.2022.01.010

Boscia, R. M. (2020). *Expected Credit Losses and Regulatory Capital: Effects and Implications of Adopting IFRS 9 for the Capital of European Banks* [Brasilia University]. https://repositorio.unb.br/bitstream/10482/41439/1/2020_ManuelaRodriguesBos cia.pdf

Bradfield, D. (2003). Investment Basics XLVI . On estimating the beta coefficient. *Investment Analysts Journal*, *57*, 47–53. https://doi.org/10.1080/10293523.2003.11082448

Bush, G. W. (2002). *President Urges Congress to Support Nation’s Priorities*. https://georgewbush-whitehouse.archives.gov/news/releases/2002/07/20020708-5.html

Cederburg, S., & Doherty, M. S. O. (2016). Does It Pay to Bet Against Beta? On the Conditional Performance of the Beta Anomaly. *The Journal of Finance*, *LXXI*(2), 737–773. https://doi.org/10.1111/jofi.12383

Coetzer, J., & Naicker, M. (2021). *In brief: banking regulatory framework in South Africa*. South African Regulation Journal. https://financialregulationjournal.co.za/2021/05/26/in-brief-banking-regulatory-framework-in-south-africa/

Cohen, B. H., De Araujo, D., & Pogliani, P. (2021). *Bank loan loss provisioning during the Covid crisis*. BIS Quarterly Review. https://ddd.bis.org/publ/qtrpdf/r_qt2103w.htm

Çollaku, B., Ahmeti, S., & Aliu, M. (2021). IFRS 9 Transition Effect on Financial Stability of Kosovo Commercial Banks. *Prizren Social Science Journal*, *5*(1), 1–10. https://doi.org/10.32936/pssj.v5i1.191

Correia, C. (2019). *Financial Management* (9th ed.). Juta and Company.

Culp, C. L. (2015). *Structured Finance and Insurance: The Art of Managing Capital and Risk*. 778–787. https://doi.org/10.1002/9781119201243.app1

Deb, P., Furceri, D., Ostry, J. D., & Tawk, N. (2020). *The Economic Effects of COVID-19 Containment Measures*. https://isni.org/isni/0000000404811396

Elliott, D., Kroeber, A., & Qiao, Y. (2015). Shadow banking in China: A primer. *The Brookings Institution*, *13*(March), 1–7. http://www.brookings.edu/~/media/research/files/papers/2015/04/01-shadow-banking-china-primer/shadow_banking_china_elliott_kroeber_yu.pdf

European Banking Authority. (2017). *Eba Report on Results From the Second Eba Impact*. *July*, 3–47. https://www.eba.europa.eu/documents/10180/1720738/EBA+Report+on+results+from+the+2nd+EBA+IFRS9+IA.pdf

European Central Bank. (2016). *What are haircuts?* https://www.ecb.europa.eu/ecb/educational/explainers/tell-me-more/html/haircuts.en.html#:~:text=In financial markets%2C a haircut,of only €0.8 million.

European Central Bank. (2019). Financial Stability Review - May 2019. In *Financial Stability Review* (Vol. 110, Issue February). http://www.eestipank.info/pub/en/dokumendid/publikatsioonid/seeriad/finantsvahendus/_2004_1/fsy_504.pdf

Fama, F., & French, K. R. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance*, *XLVII*(2), 427–465. https://www.jstor.org/stable/2329112#metadata_info_tab_contents

Fang, X., Guo, Y., Mei, B., & Ye, J. (2022). Implementation costs of IFRS 9 for non-financial firms : evidence from China. *Accounting & Finance*, *62*(1), 2781–2805. https://doi.org/10.1111/acfi.12889

Fatouh, M., Bock, R., & Ouenniche, J. (2020). Impact of IFRS 9 on the Cost of Funding of Banks in Europe. In *Staff Working Paper* (Issue 851). https://doi.org/10.2139/ssrn.3520669

Financial Stability Forum. (2009). *Report of the Financial Stability Forum on Addressing Procyclicality in the Financial System*. *April*, 1–29. https://www.fsb.org/wp-content/uploads/r_0904a.pdf

Frazzini, A., & Pedersen, L. H. (2014). Betting against beta. *Journal of Financial Economics*, *111*(1), 1–25. https://doi.org/10.1016/j.jfineco.2013.10.005

Frykström, N., & Li, J. (2018). *Economic Commentaries IFRS 9 – the new accounting standard for credit loss recognition* (Issue 3). https://www.riksbank.se/globalassets/media/rapporter/ekonomiska-kommentarer/engelska/2018/ifrs-9--the-new-accounting-standard-for-credit-loss-recognition.pdf

G20. (2009). *London Summit - Leader's Statement*. 1–9. https://www.imf.org/external/np/sec/pr/2009/pdf/g20_040209.pdf

Gea-Carrasco, C. (2015). IFRS 9 Will Significantly Impact Banks' Provisions and Financial Statements. *Moody' Analytics Risk Perspectives*, *5*(May 2015), 1. https://www.moodysanalytics.com/risk-perspectives-magazine/risk-data-management/regulatory-spotlight/ifrs-9-will-significantly-impact-banks-information#:~:text=IFRS 9 – Aligns the measurement,soon as it is originated.

Gomaa, M., Kanagaretnam, K., & Mestelman, S. (2019). Testing the Efficacy of Replacing the Incurred Credit Loss Model with the Expected Credit Loss Model. *European Accounting Review*, *28*(2), 309–334. https://doi.org/10.1080/09638180.2018.1449660

Hsu, J. C. (2004). Cap-Weighted Portfolios are Sub-Optimal Portfolios. In *Research White Paper* (Issue WP5401). https://doi.org/10.2139/ssrn.647001

IASB. (2011). *IAS 39: Financial instruments: Recognition and measurement*.

IFRS Foundation. (2014). *IFRS 9: Financial instruments*.

IFRS Foundation. (2022). *Post-implementation Review IFRS 9 Financial Instruments—Classification and Measurement*. *December*, 3–35. https://www.ifrs.org/content/dam/ifrs/project/pir-ifrs-9/pir-ifrs9-feedbackstatement-portrait-dec2022.pdf

International Monetary Fund. (2022). South Africa Financial Stability Assessment. In *Financial Sector Assessment Program* (Vol. 22, Issue 39, pp. 1–63). https://www.imf.org/en/Publications/CR/Issues/2022/02/11/South-Africa-Financial-Sector-Assessment-Program-Financial-System-Stability-Assessment-513014

Jean-François, C., Christophe, L., & Eric, P.-B. (2019). The Implementation of the IFRS 9 in Banking Industry. *EUFIN 2019 : The 15th Workshop on European Financial Reporting*, 1–21. https://hal.archives-ouvertes.fr/hal-02405140/document

Kashif, M., Ilyas, A., Rehan, R., & Chhapra, I. U. (2018). Asset pricing and the size effect: Empirical evidence from Karachi Stock Exchange (KSE). *Academy of Accounting and Financial Studies Journal*, *22*(6), 1–17.

Khuzwayo, B. (2014). *Understanding The Low Volatility Anomaly in The South African Equity Market* [University of Cape Town]. Understanding The Low Volatility Anomaly in The South African Equity Market.

Markowitz, H. (1952). Portfolio selection. *The Journal of Finance*, *7*(1), 77–91. https://www.jstor.org/stable/2975974

Modigliani, F., & Miller, M. H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*, *48*(3), 261–297. https://www.jstor.org/stable/1809766#metadata_info_tab_contents

Moyo, B. (2018). An analysis of competition , efficiency and soundness in the South African banking sector. *South African Journal of Economic and Management Sciences*, *21*(1), 1–14. https://ideas.repec.org/p/rza/wpaper/747.html

Nedbank Group. (2020). *Integrated Report For The Year Ended 31 December 2020*. *December*. https://www.nedbank.co.za/content/dam/nedbank/site-assets/AboutUs/Information Hub/Integrated Report/2021/2020 Nedbank Group Integrated Report (High Res single page).pdf

Nexia SAB&T. (2017). *IFRS 9 Impairments – Interim and Transitional arrangements applicable to Banks*. SAB&Tips. https://www.nexia-sabt.co.za/sabtips/ifrs-9-impairments-interim-and-transitional-arrangements-applicable-to-banks/

Phuoc, L. T. (2018). Jensen ' s Alpha Estimation Models in Capital Asset Pricing Model. *Journal of Asian Finance, Economics and Business*, *5*(3), 19–29. https://doi.org/10.13106/jafeb.2018.vol5.no3.19

Pulin, A. (2021). *A Detailed Analysis on the Overall Changes due to the Introduction of IFRS 9* [University of Padua]. https://thesis.unipd.it/bitstream/20.500.12608/21031/1/Pulin_Alberto.pdf

Seetharam, Y. (2021). Investigating the low-risk anomaly in South Africa. *Review of Behavioral Finance*, *14*(2), 277–295. https://doi.org/10.1108/RBF-07-2020-0167

Seitz, B., Dinh, T., & Rathgeber, A. (2018). Understanding Loan Loss Reserves under IFRS 9: A Simulation-Based Approach. *Advances in Quantitative Analysis* of *Finance and Accounting*, *16*(January), 311–375. https://doi.org/10.6293/AQAFA.201812

Shahzadi, M., & Foroghi, D. (2022). Analysis of the Persistence of the Negative Relationship between Downside Risk and Expected Excess Returns in Future. *Journal of Asset Management and Financing*, *10*(1), 1–24. https://amf.ui.ac.ir/article_25634.html?lang=en

South African Reserve Bank. (2020a). *Guidance Note 6* (pp. 1–4). South African Reserve Bank. https://www.resbank.co.za/content/dam/sarb/publications/prudential-authority/pa-deposit-takers/banks-guidance-notes/2020/9967/Guidance-Note-6-of-2020.pdf

South African Reserve Bank. (2020b). *South Africa's Implementation of Basel II and Basel III*. Sector Data. https://www.resbank.co.za/en/home/what-we-do/Prudentialregulation/Sector_data/south-africa-s-implementation-of-basel-ii-and-basel-iii

South African Reserve Bank. (2021). *Selected South African banking trends - November 2021*. https://www.resbank.co.za/Lists/News and Publications/Attachments/6158/05 May 2014.pdf

Steyn, J. P., & Theart, L. (2019). Are South African equity investors rewarded for taking on more risk? *Journal of Economic and Financial Sciences*, *12*(1), 1–10. https://doi.org/10.4102/jef.v12i1.448

Sultanoğlu, B. (2018). Expected Credit Loss Model By IFRS 9 and its Possible Early Impact on European and Turkish Banking Sector. *Muhasebe Bilim*, *20*(3), 476–506. https://doi.org/10.31460/mbdd.422581

Wurgler, J., Hoeyer, M. F., & Baker, M. (2016). *The Risk Anomaly Tradeoff of Leverage* (No. 22116; NBER Working Paper). https://papers.ssrn.com/sol3/Delivery.cfm/nber_w22116.pdf?abstractid=2755388

Yang, B., & Ma, Y. (2021). International Review of Financial Analysis Value at risk , mispricing and expected returns. *International Review of Financial Analysis*, *78*(July), 1–13. https://doi.org/10.1016/j.irfa.2021.101902

Appendices

Appendix one: Individual betas and alphas

The two tables below include betas and alphas calculated using daily returns. These were calculated for robustness testing in addition to portfolios that made use of monthly returns. Both raw and risk-adjusted betas and alphas (Jensen's Alpha) were calculated for analysis. The tables below contain raw return betas and alphas as well as risk-adjusted alphas and betas (denoted as Beta excess and Alpha excess respectively). R-squared was also calculated to observe the strength of the modelling of each risk-adjusted beta and identify the degree to which each share has idiosyncratic risk. The number of returns and index returns observations are included in the final column of each of the four graphs below.

Table 1: Individual company 5-year daily betas and alphas

Bank	Raw Beta	Alpha	Beta excess	Alpha Excess	R^2	SE - Beta	SE - Alpha	Observations
Sasfin	0.1993	0.0095	0.1993	-0.0001	0.0047	0.0820	0.0011	1251
Capitec	0.9618	0.0851	0.9618	0.0008	0.2405	0.0483	0.0006	1251
Investec Ltd	1.0077	0.0291	1.0077	0.0002	0.3130	0.0422	0.0005	1251
ABSA	1.0559	0.0299	1.0559	0.0003	0.3112	0.0444	0.0005	1251
Standard Bank	1.0714	0.0026	1.0713	4.4E-05	0.3996	0.03715	0.0005	1251
FirstRand	1.0938	0.0214	1.0938	0.0002	0.4042	0.0375	0.0005	1251
Nedbank	1.0997	0.0108	1.0996	0.0001	0.3184	0.0455	0.0006	1251

Table 2: Individual company 20-year daily betas and alphas

Bank	Raw Beta	Alpha	Beta excess	Alpha Excess	R^2	SE - Beta	SE - Alpha	Observations
Sasfin	0.2096	0.0472	0.2097	0.0003	0.009429	0.03041	0.0003	4999
Capitec	0.5651	0.1385	0.5650	0.0013	0.083711	0.0264	0.0003	4999

Standard Bank	1.0225	0.0045	1.0224	5.07E-05	0.365251	0.0168	0.0002	4999
FirstRand	1.0394	-0.0181	1.0394	-0.0002	0.36706	0.0176	0.0002	4999
ABSA	1.1128	-0.0077	1.1127	-5.05E-05	0.464659	0.0191	0.0002	4999
Nedbank	1.1298	-0.0034	1.1298	-4.12E-06	0.398831	0.0193	0.0002	4999
Investec Ltd	1.1351	0.01138	1.1351	0.0001	0.451972	0.0196	0.0002	4999

Despite the increased observations, the R-squares remain fairly low, again indicating high unsystematic risk in the sample. Alphas are far closer to zero than monthly returns, however, this is to be expected considering the considerably lower return interval. Betas seem to have moved closer to one for most in the sample, except for Sasfin and Capitec, which persistently have very low R-squares, indicating limited explanatory value of their respective betas. Capitec and Sasfin's low beta in the 20-year estimation period may also be explained due to under-pricing, as both listed close to the beginning of the estimation period.

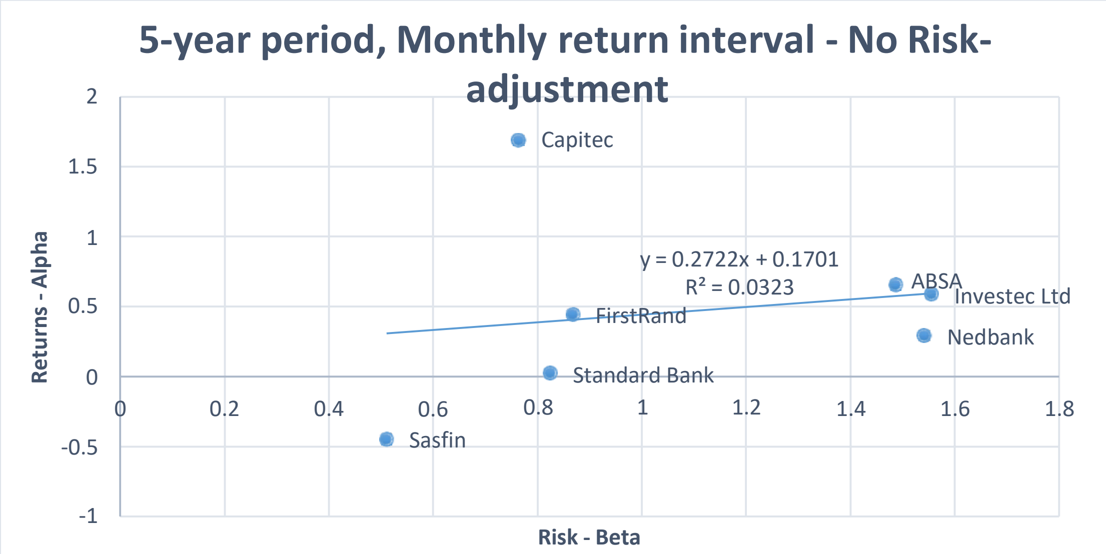
Appendix two: Plots of Alphas and Betas

This appendix contains all plots of every set of betas and alphas calculated. This includes 32 different results, 24 of which are portfolios used to calculate the magnitude of the anomaly and 8 graphs of individual shares' betas and alphas. The 24 graphs can be subdivided into 12 raw return betas as well as 12 corresponding risk-adjusted betas were calculated in order to provide robust evidence of the low-risk anomaly. Plots of alphas and betas are grouped by estimation period and return interval. These groups are divided by portfolio weighting and further divided by raw returns and risk-adjusted returns. The y-axis is represented by returns (alpha) and the x-axis is represented by risk (equity beta).

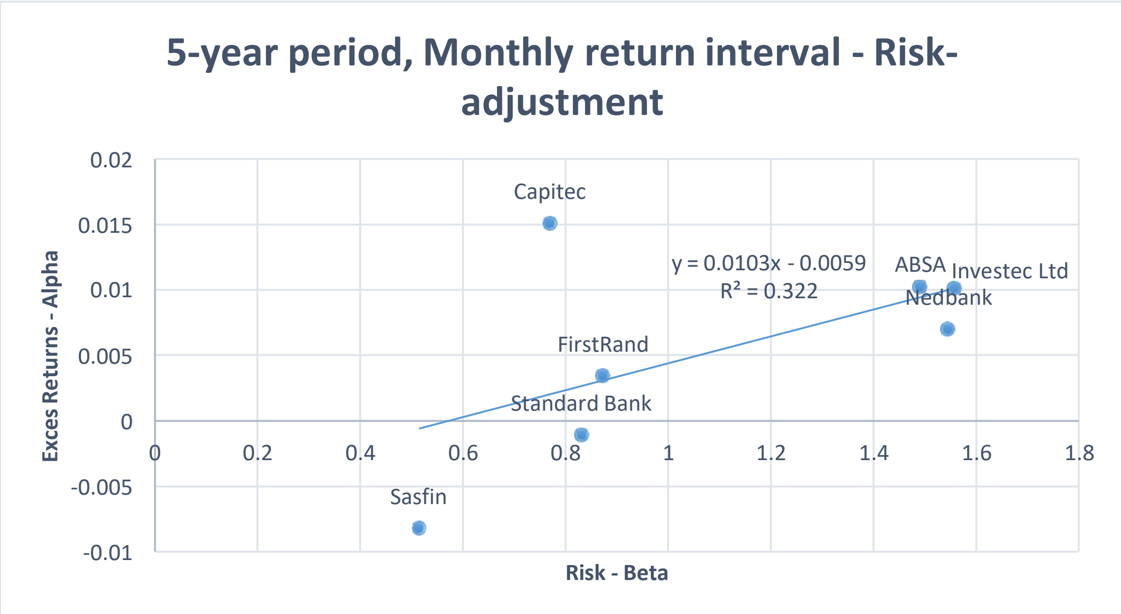
5-year estimation period, monthly return interval

Individual shares

Individual shares: Raw Returns

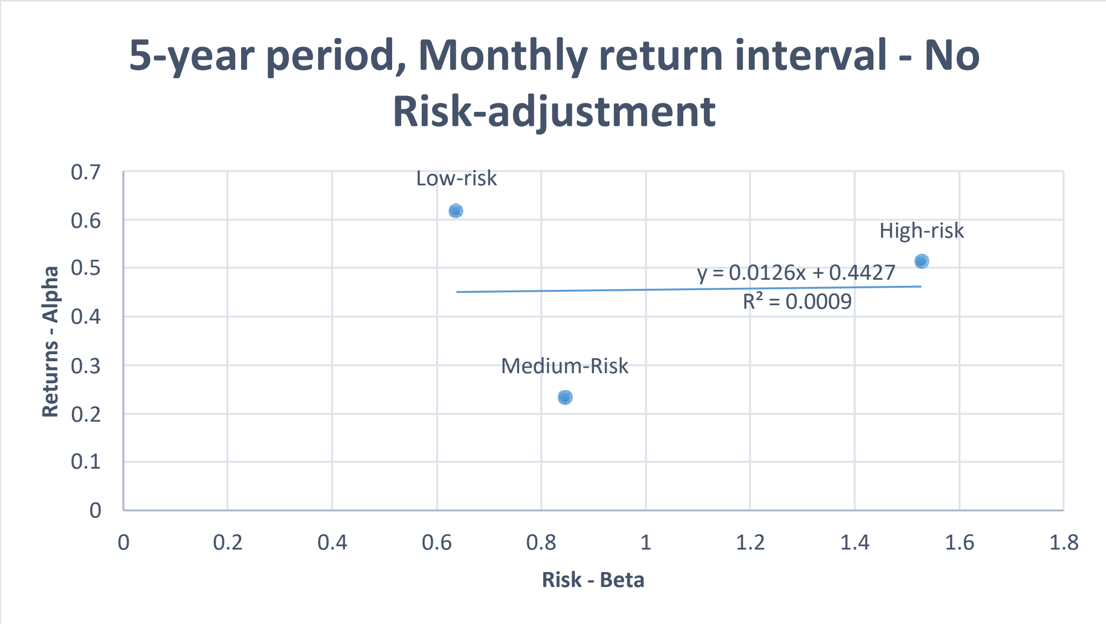


Individual shares: Risk-adjusted returns

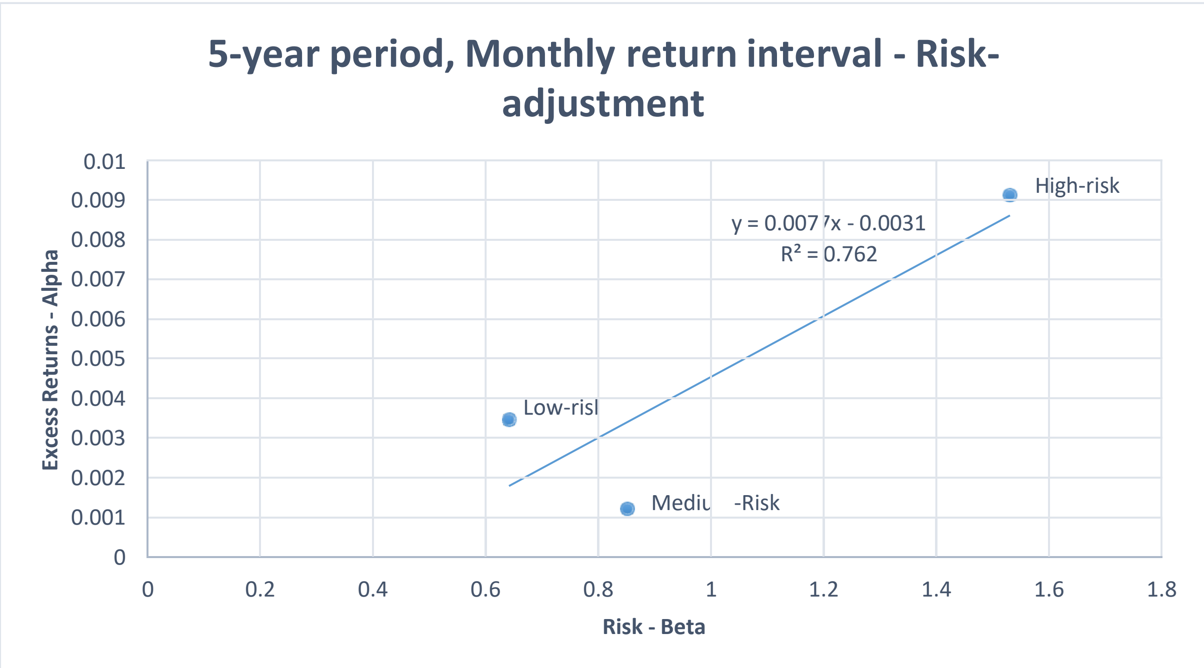


Equally weighted

Equally weighted: Raw Returns

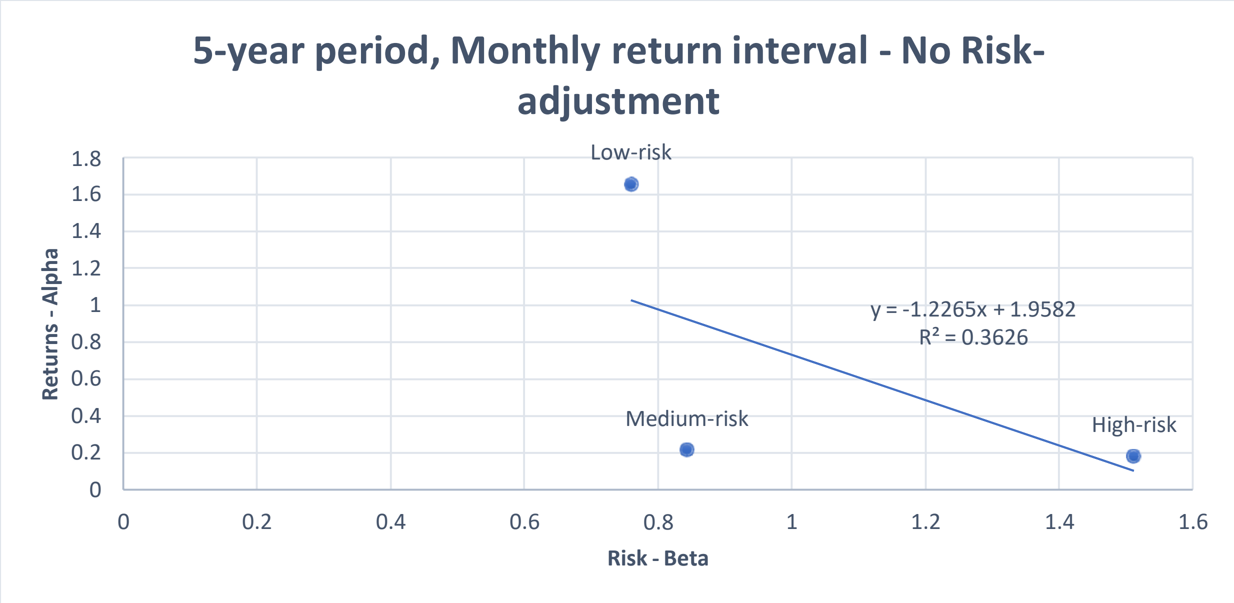


<u>Equally weighted: Risk-adjusted returns</u>

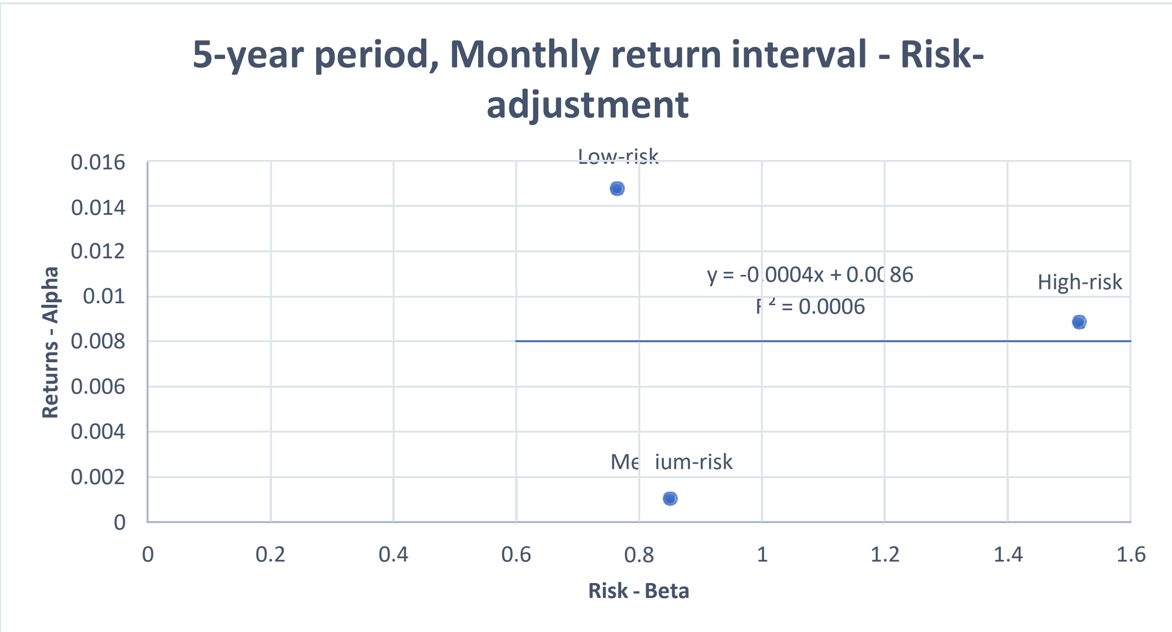


Market capitalization

<u>Market capitalization: Raw Returns</u>

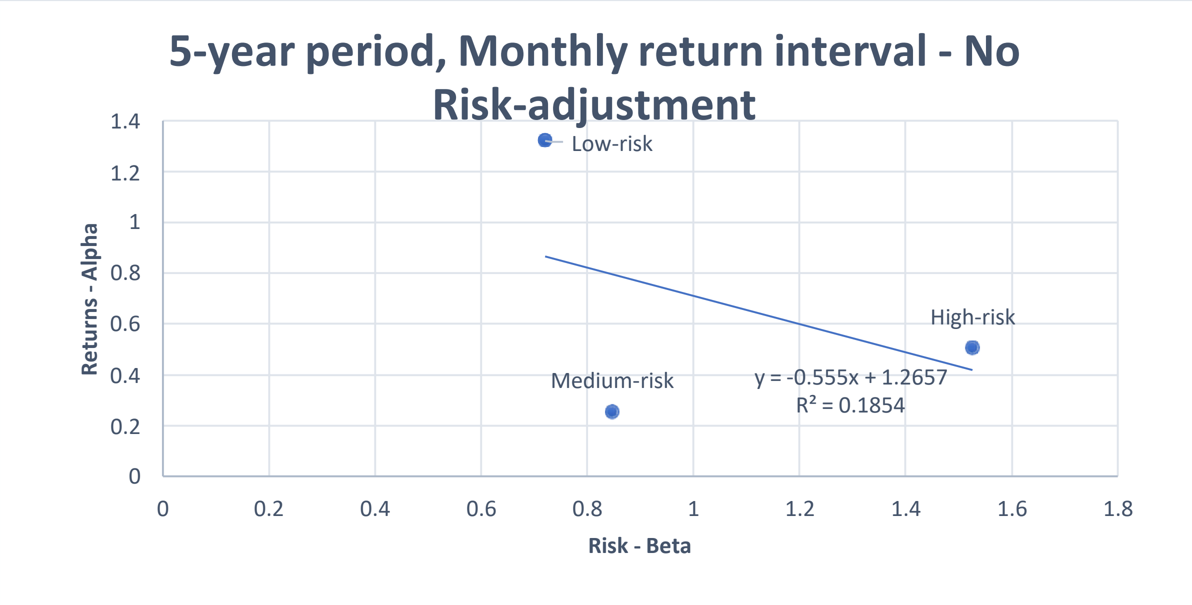


Market capitalization: Risk-adjusted returns

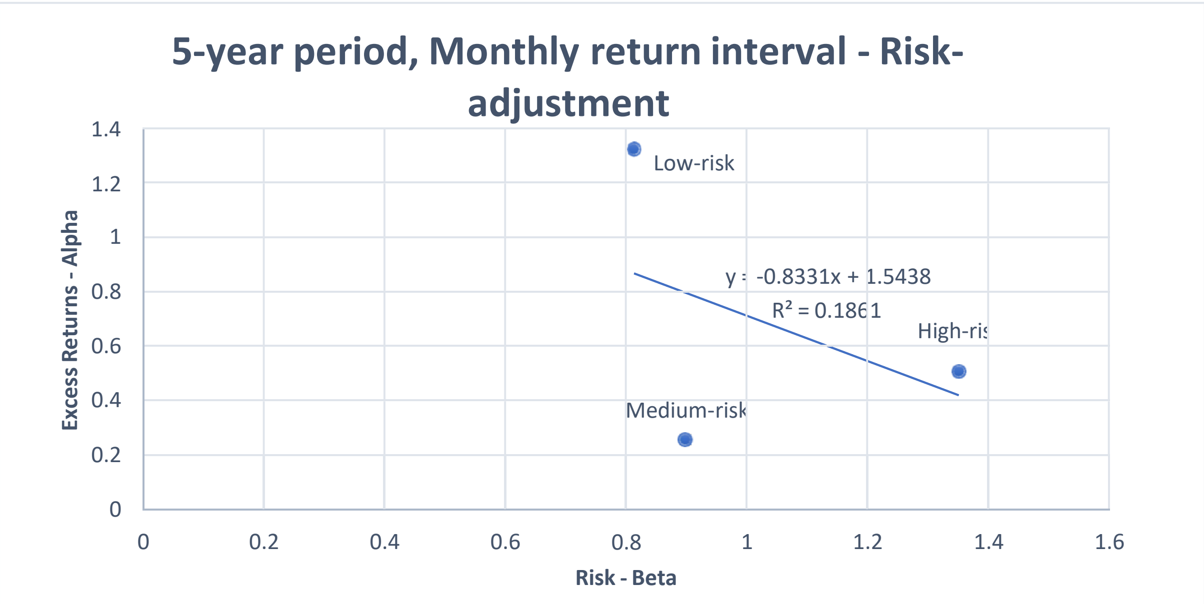


Price-to-book ratios

Price-to-book: Raw Returns



Price-to-book: Risk-adjusted returns

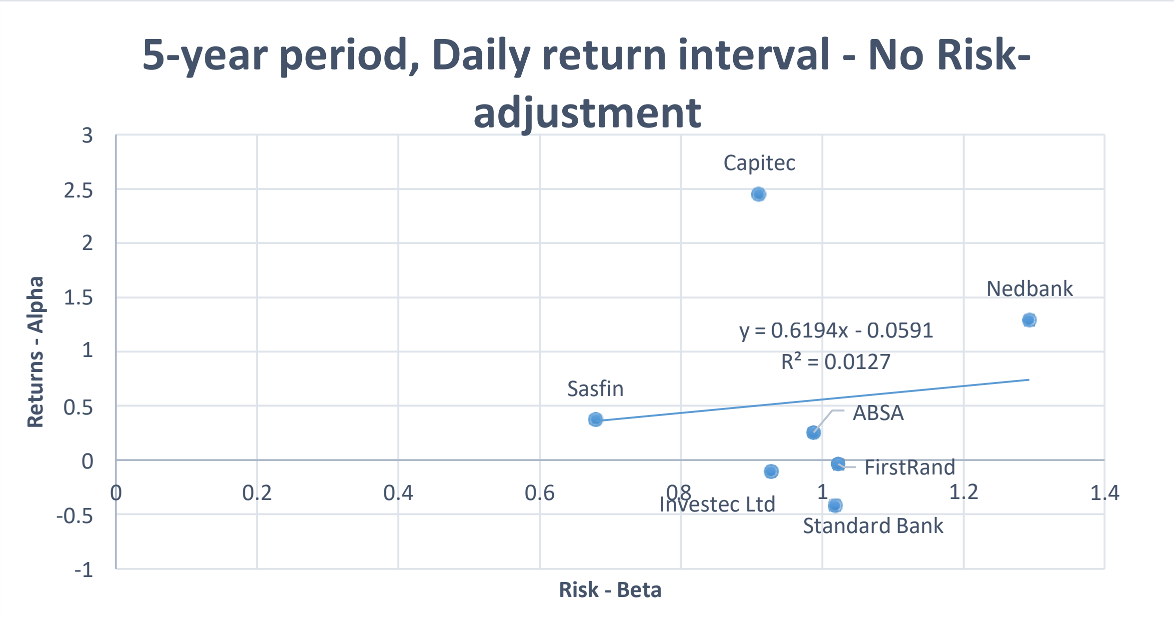


5-year daily return interval

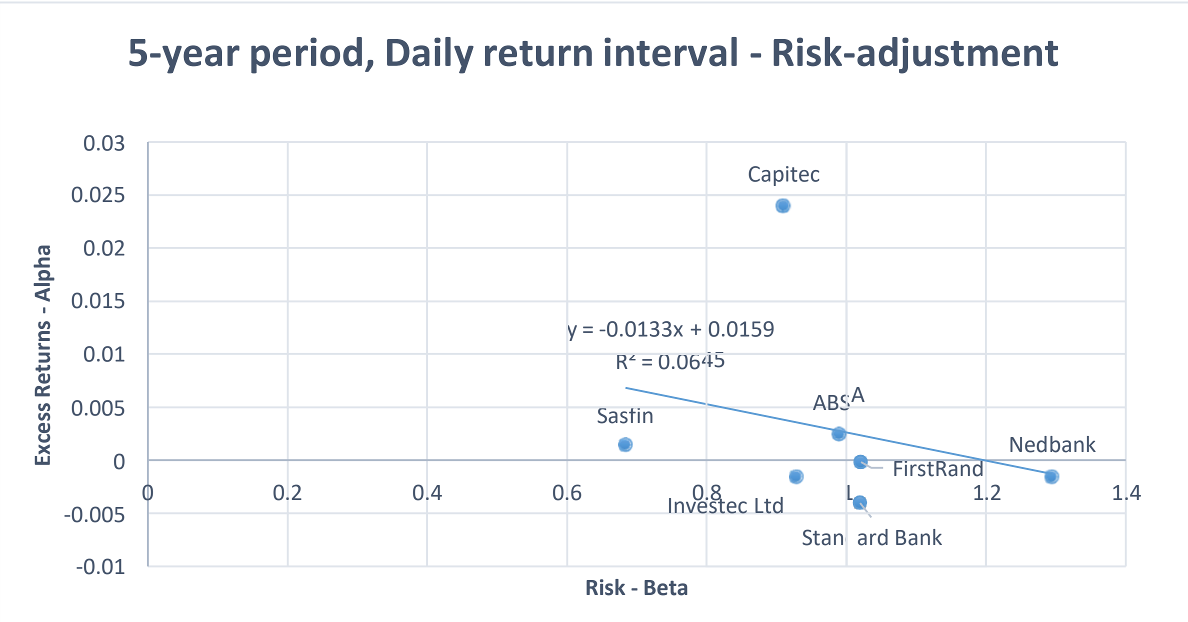
Weightings

Individual shares

Individual shares: Raw returns

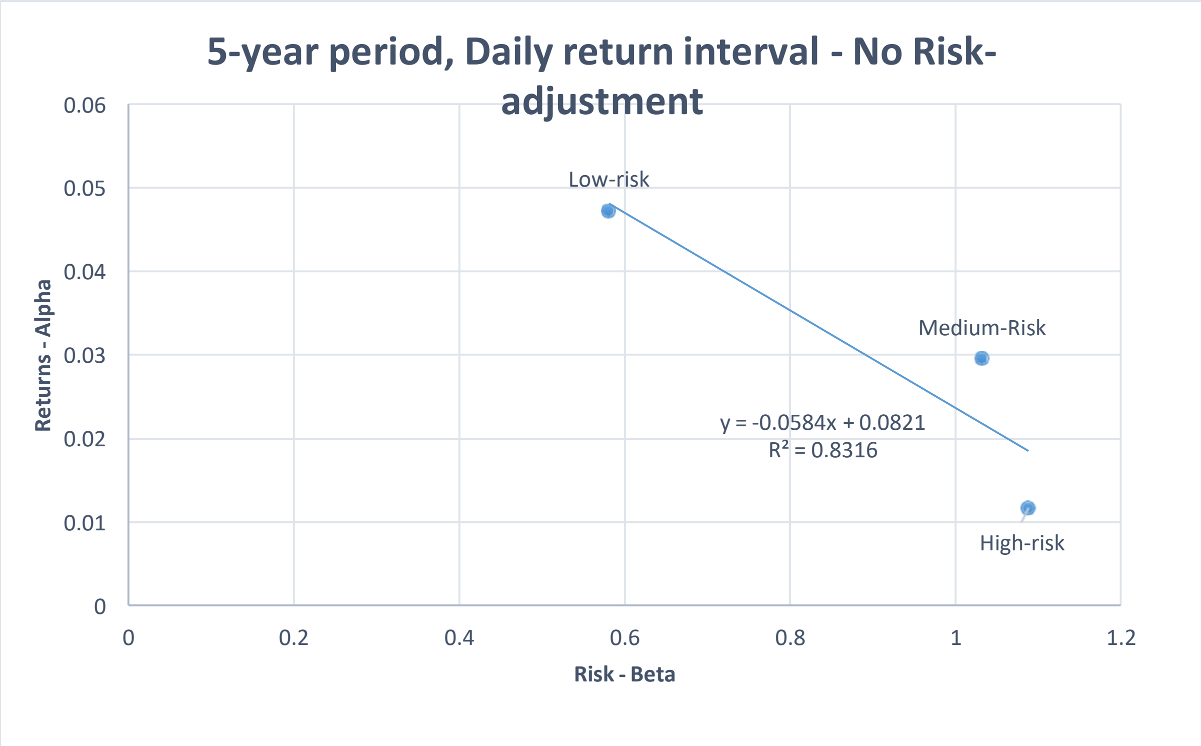


Individual shares: Risk-adjusted returns

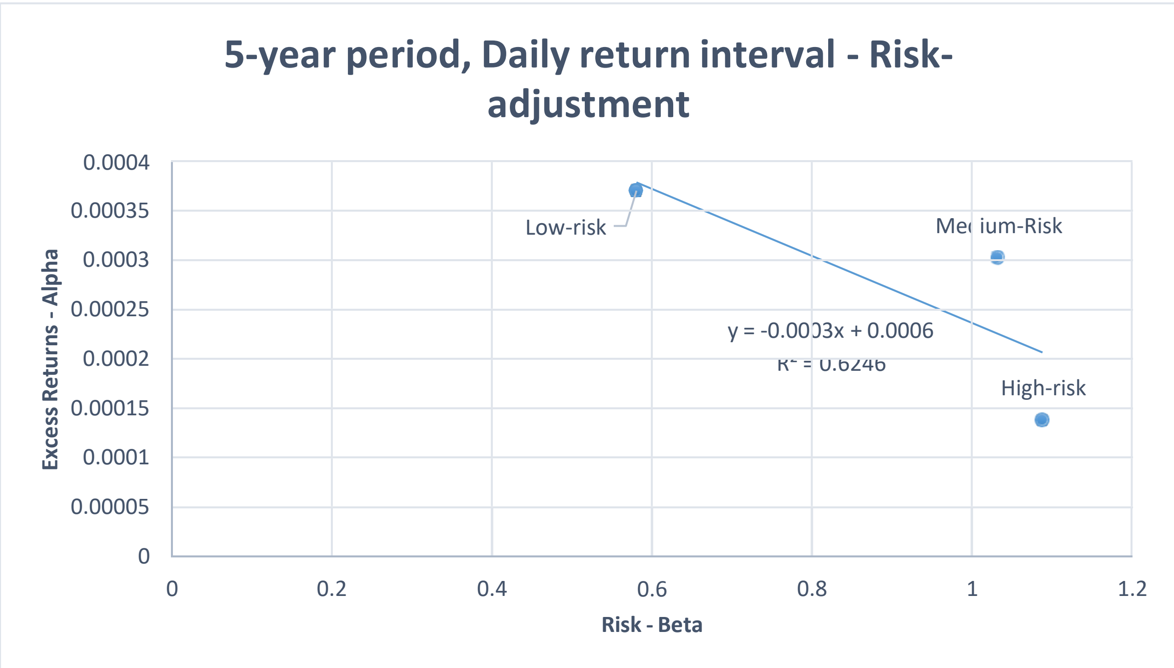


Equally weighted

Equally weighted: Raw returns

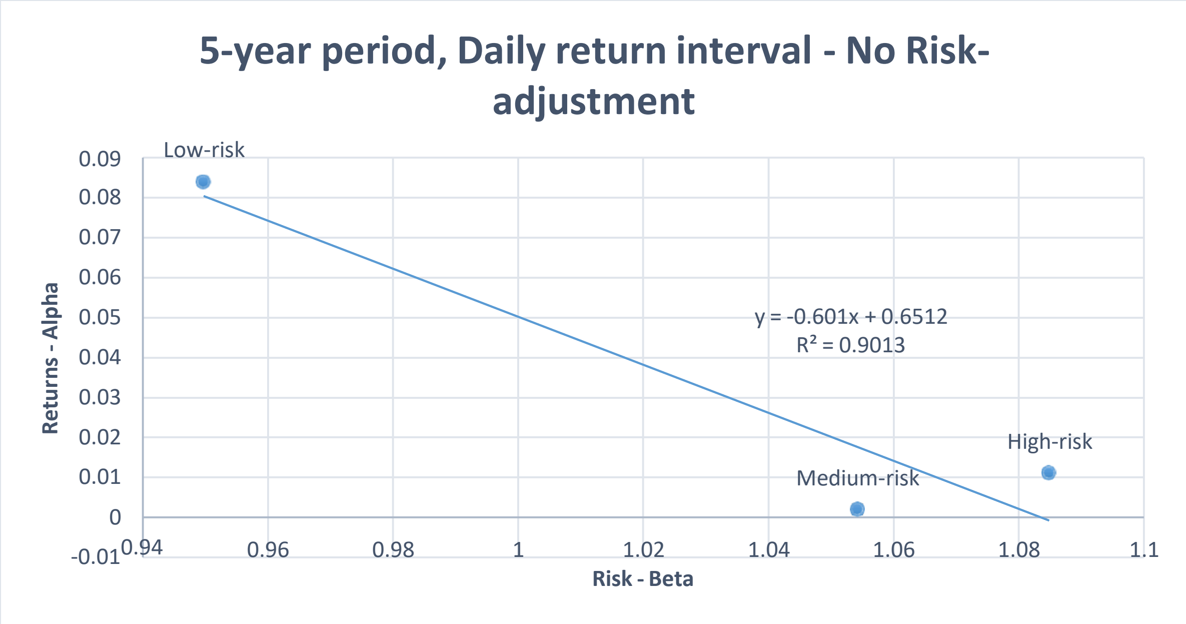


Equally weighted: Risk-adjusted returns

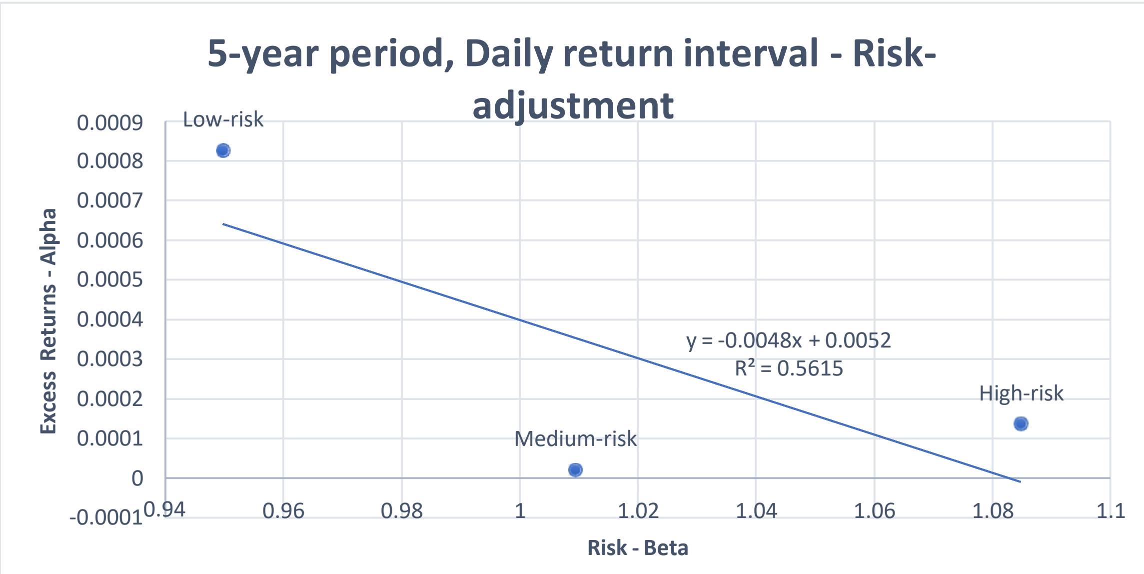


Market capitalization

Market capitalization: Raw Returns

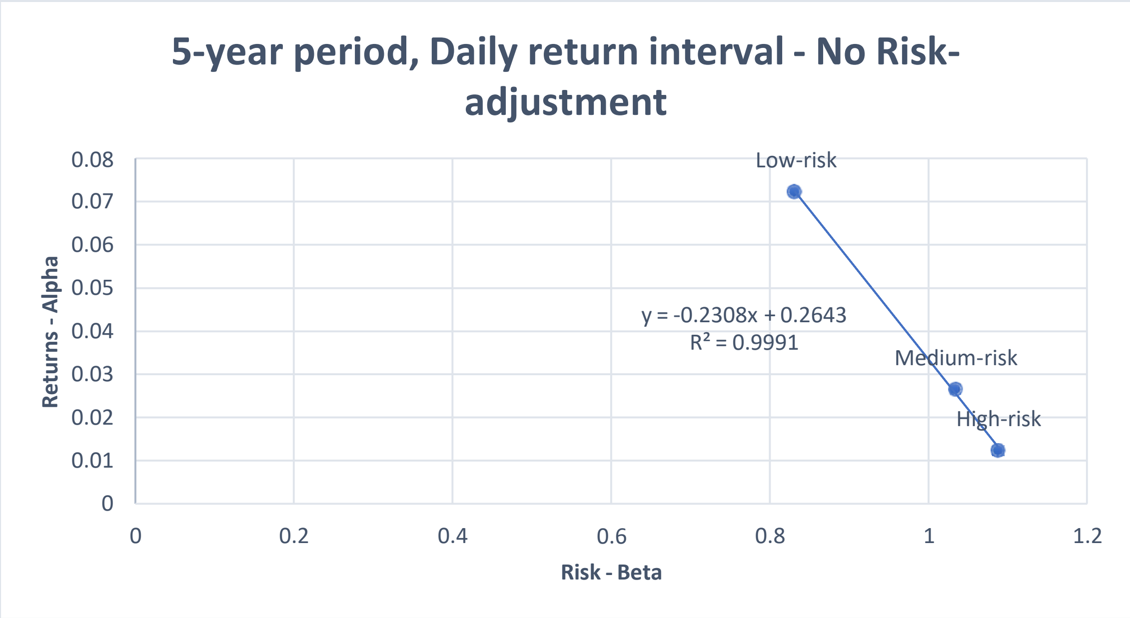


Market capitalization: Risk-adjusted returns

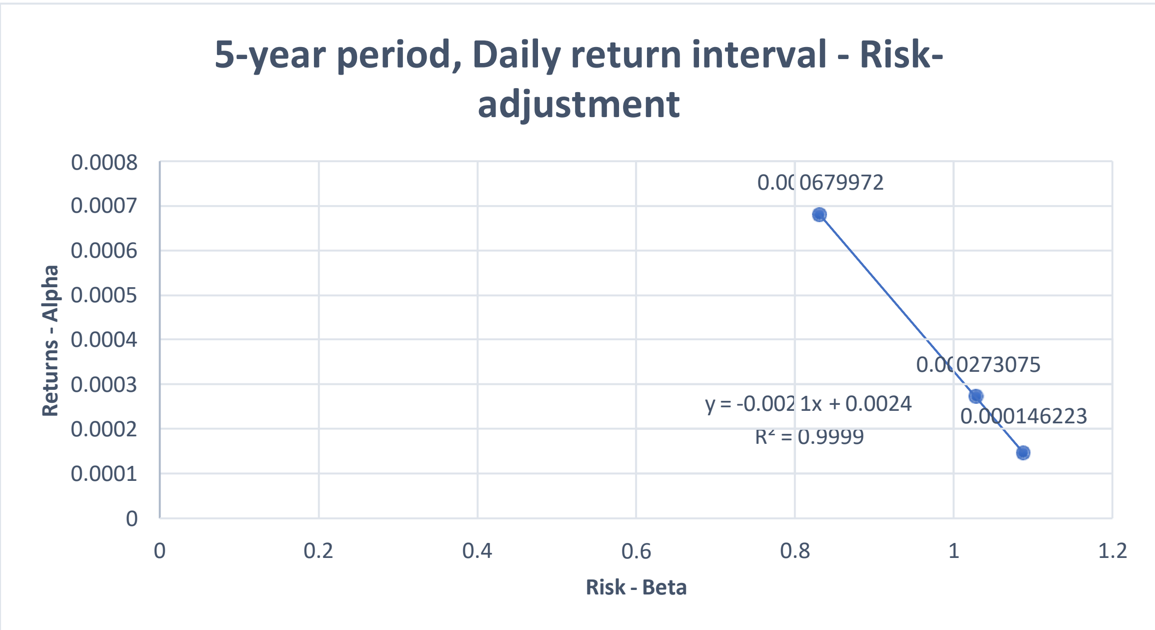


Price-to-book ratios

Price-to-book: Raw returns



Price-to-book: Risk-adjusted returns



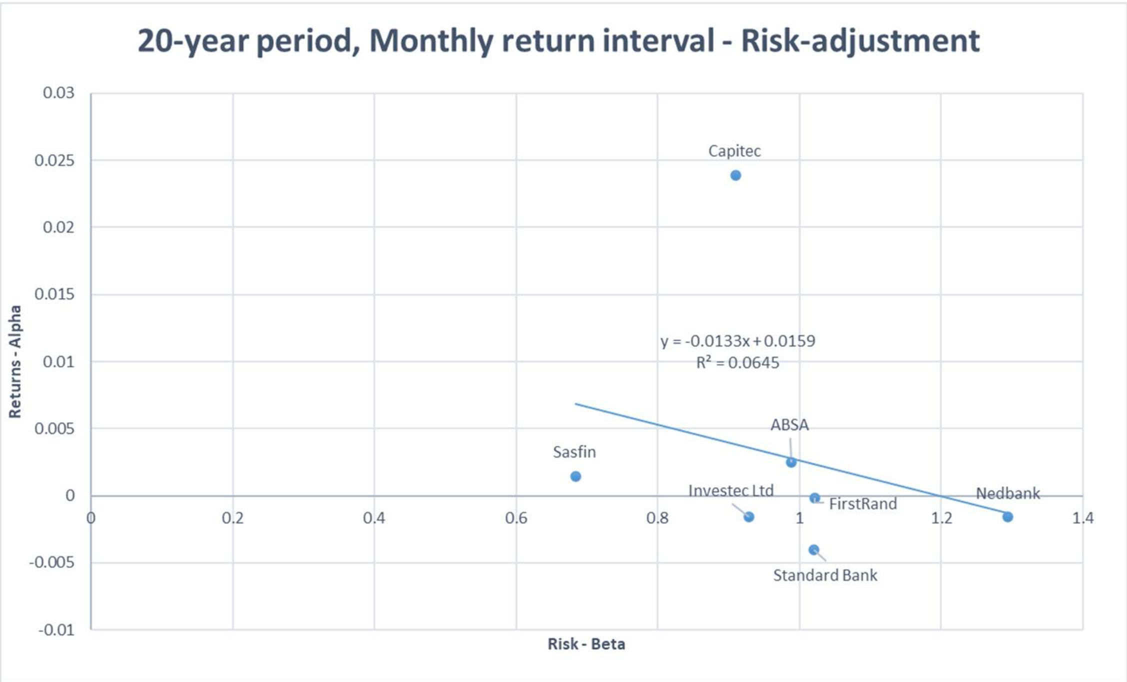
20-year monthly return interval

Weightings

Individual shares

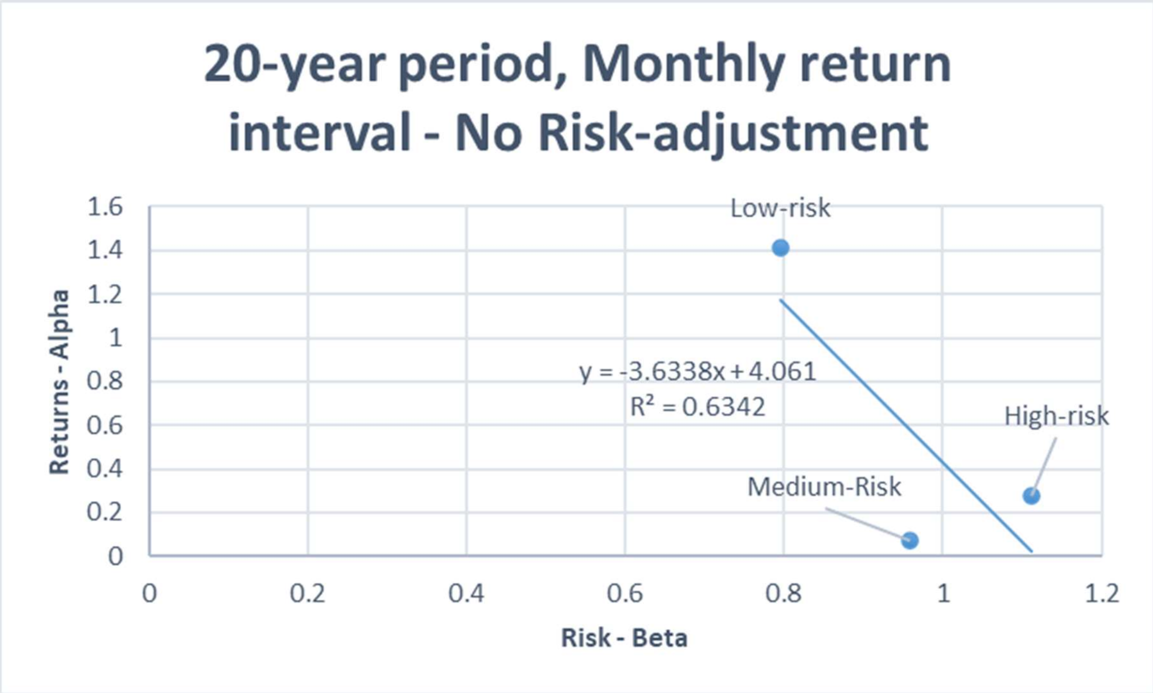
<u>Individual shares: Raw returns</u>

<u>Individual shares: Risk-adjusted returns</u>

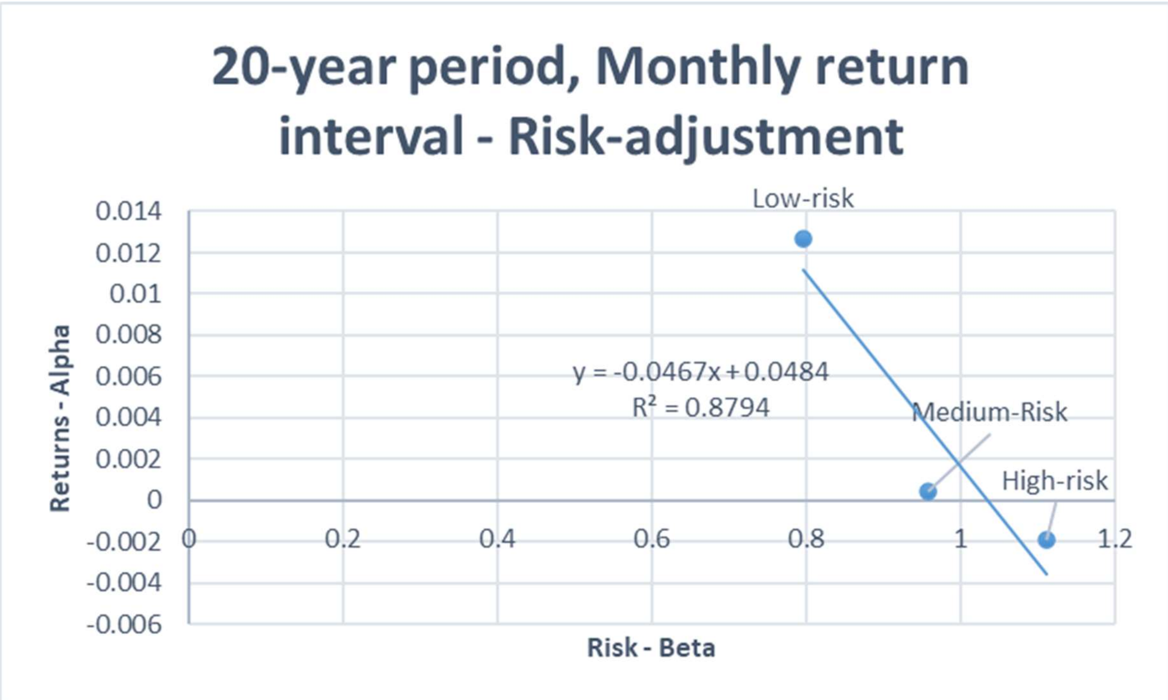


Equally weighted

Equally weighted: Raw returns



Equally weighted: Risk-adjusted returns



Market capitalization

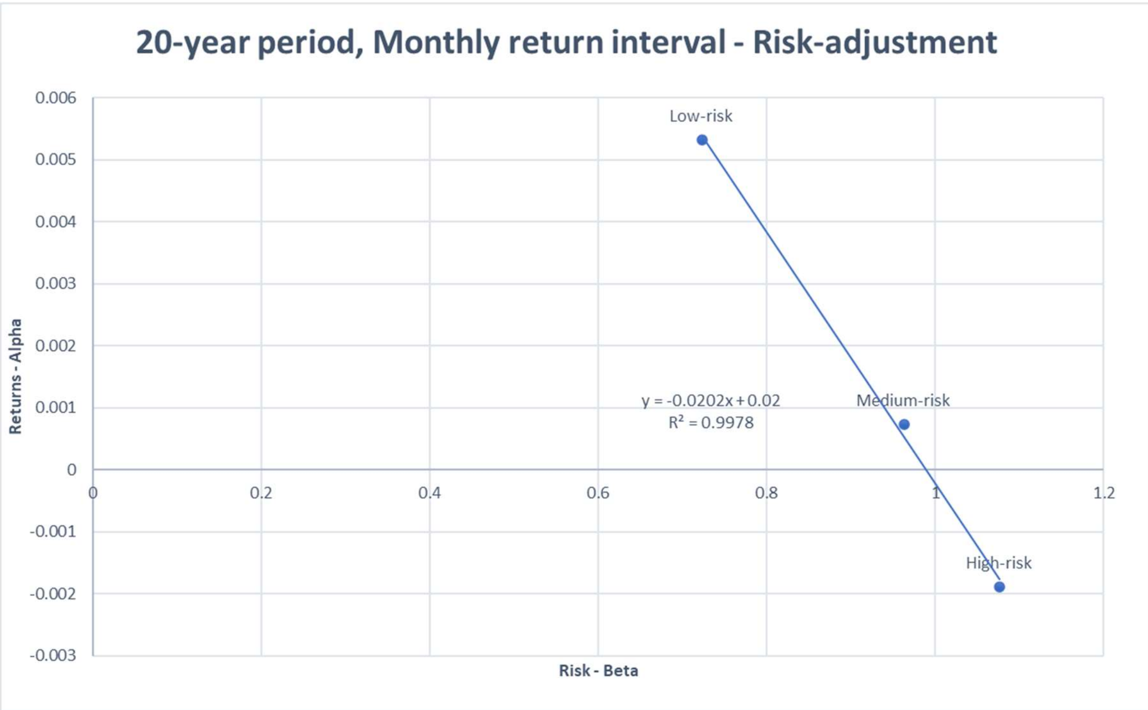
Market capitalization: Raw returns

Market capitalization: Risk-adjusted returns

Price-to-book ratios

Price-to-book: Raw returns

Price-to-book: Risk-adjusted returns

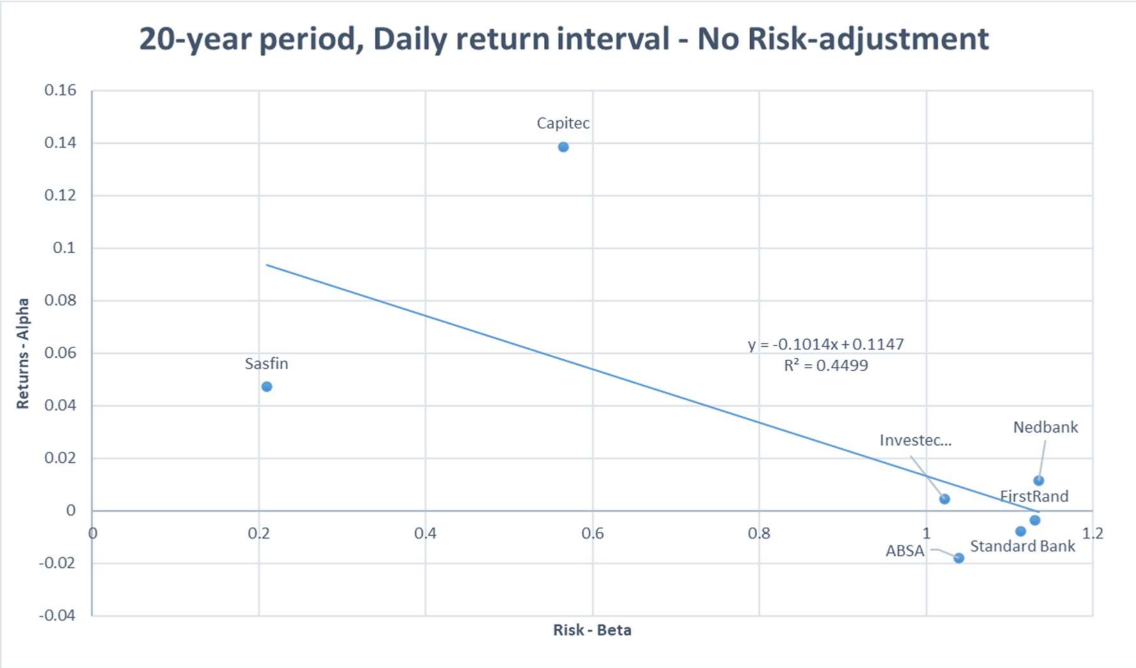


20-year daily return interval

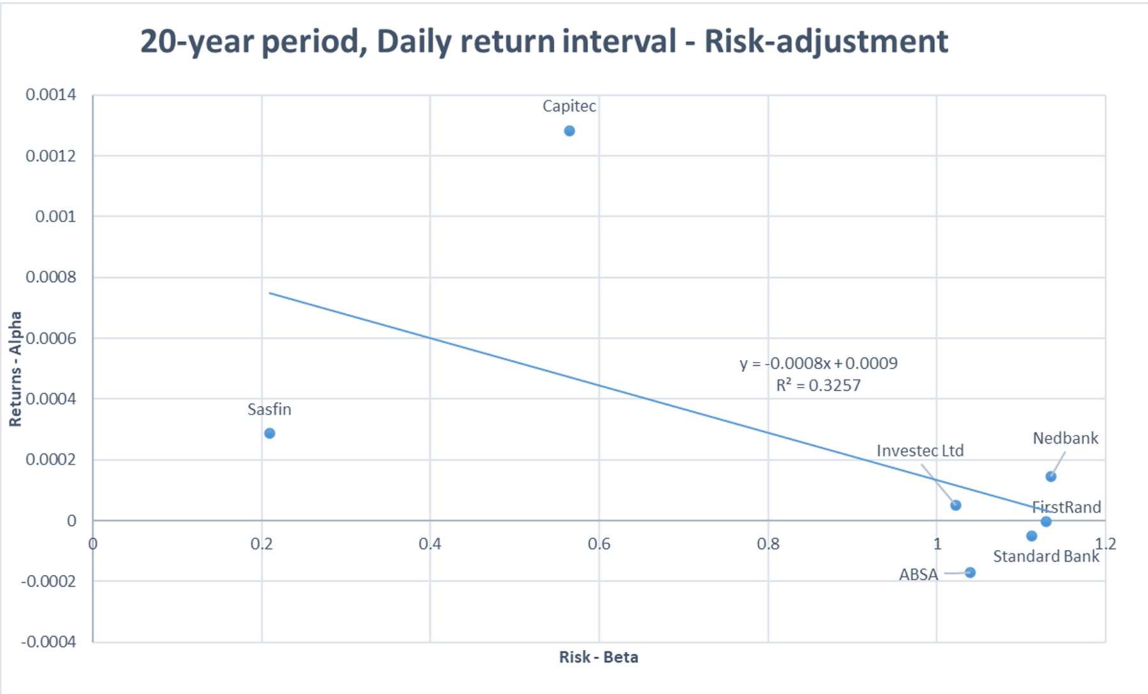
Weightings

Individual shares

Individual shares: Raw returns

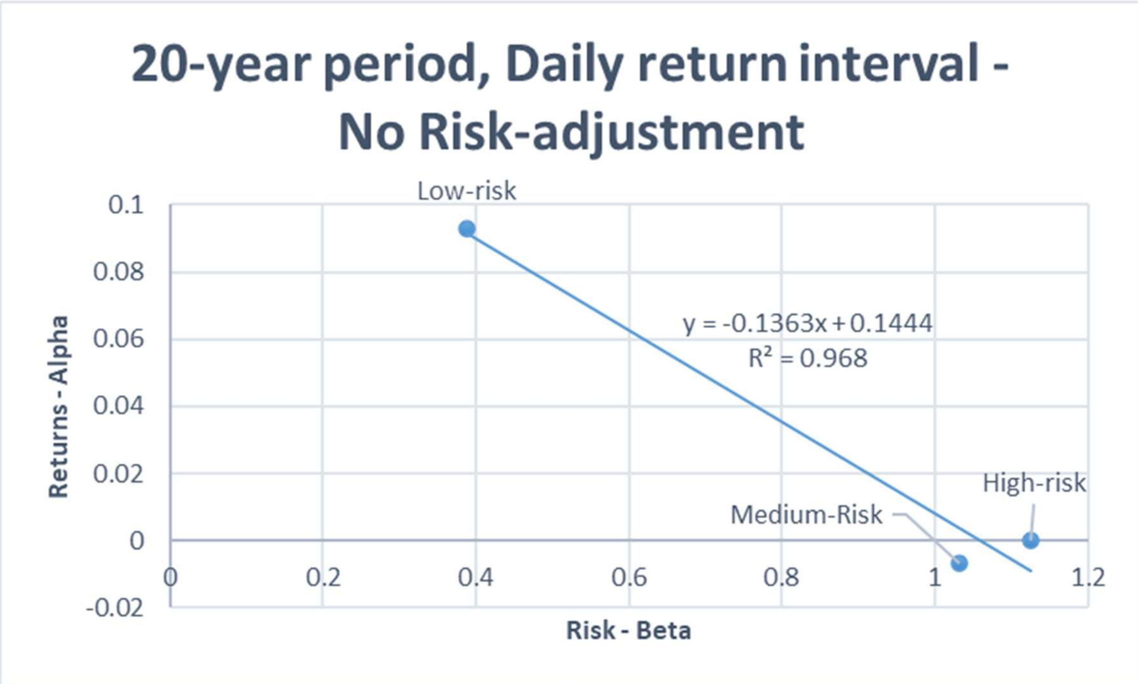


Individual shares: Risk-adjusted returns

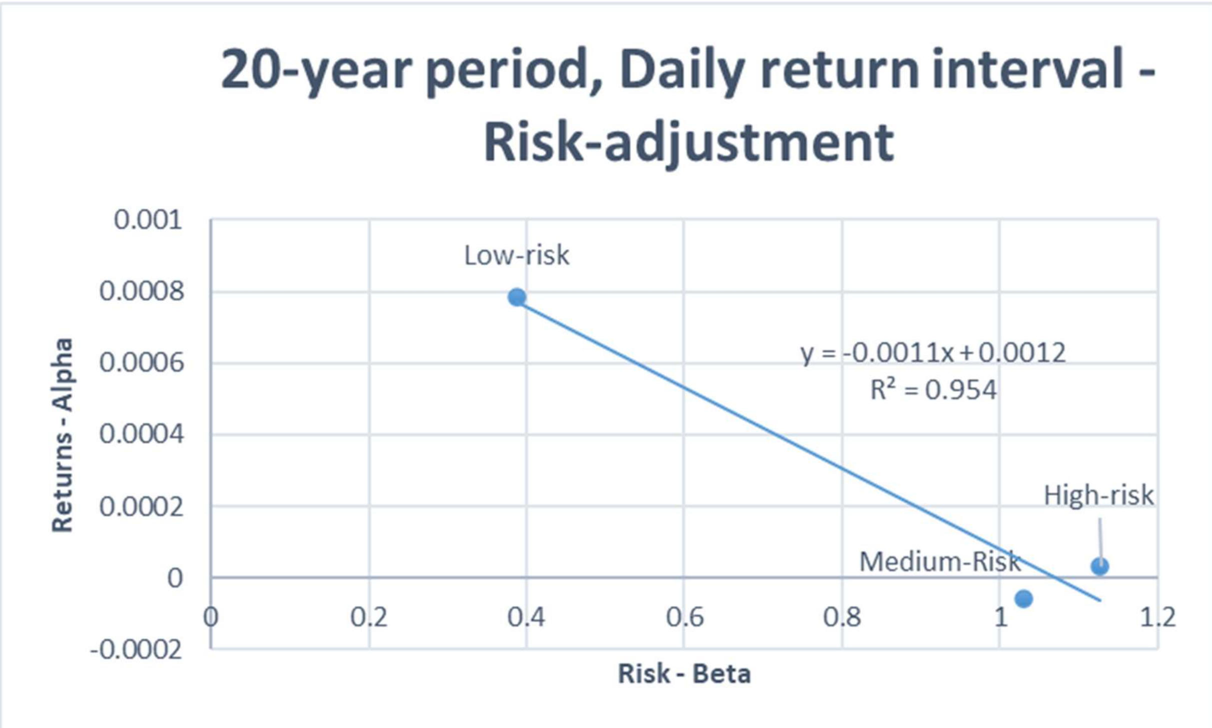


Equally weighted

Equally weighted: Raw returns

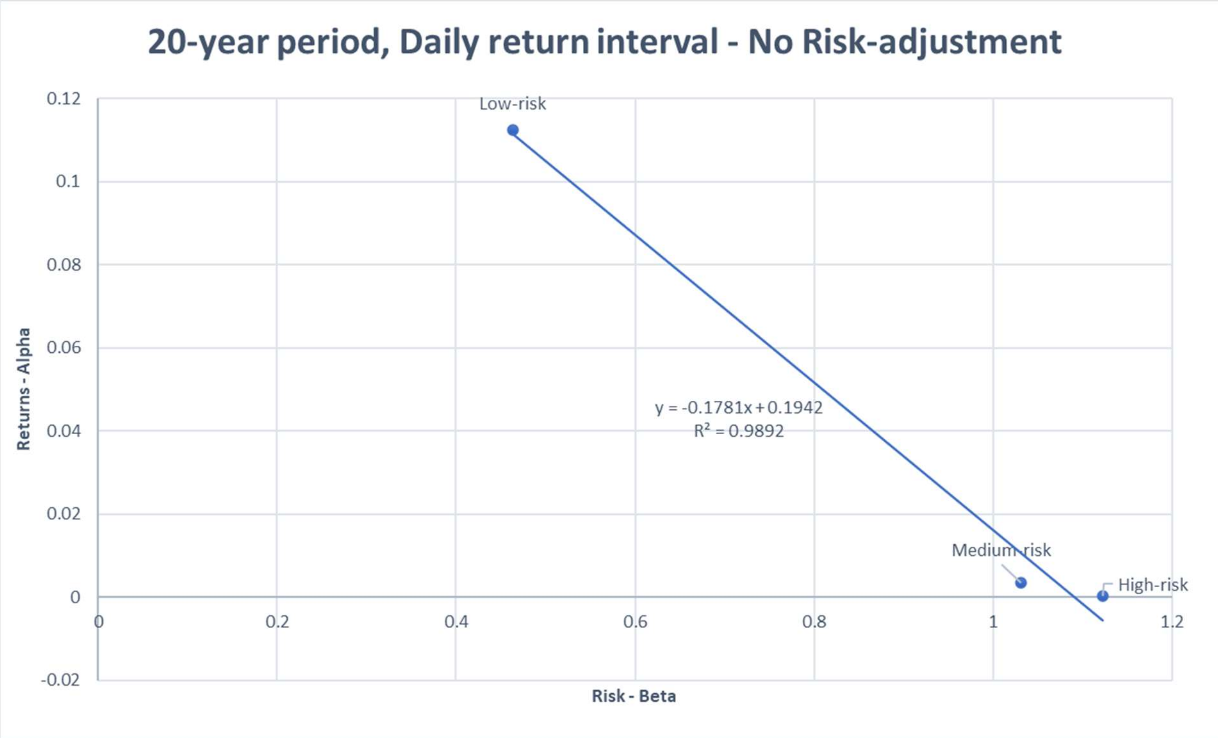


Equally weighted: Risk-adjusted returns

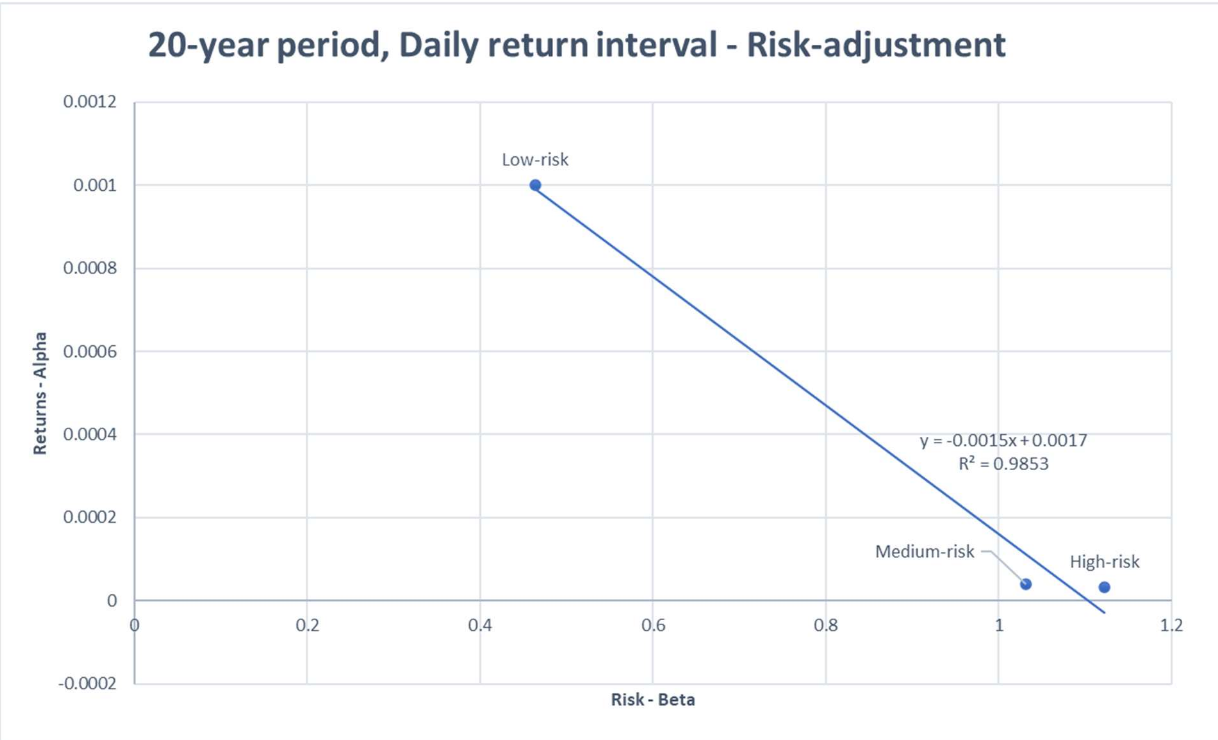


Market capitalization

Market capitalization: Raw returns



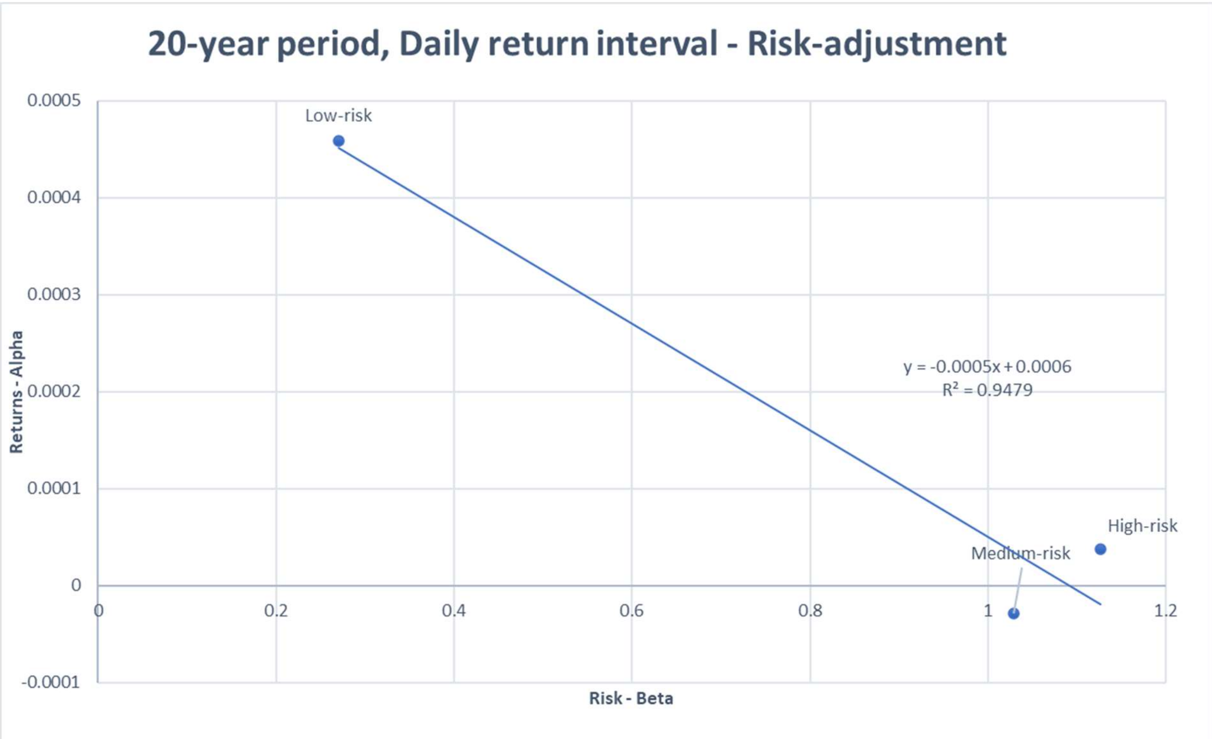
Market capitalization: Risk-adjusted returns



Price-to-book ratios

<u>Price-to-book: Raw returns</u>

<u>Price-to-book: Risk-adjusted returns</u>



Appendix three: Robustness tests

Table 1: Low-risk anomalies annualized

Risk-based Portfolios	Betas	Magnitude	Return intervals/ year	Annualized Magnitude (Bps)	Low-risk/High-risk
Equally weighted	5-year monthly return raw	-0.1183	12	-142.06	LR
Equally weighted	5-year monthly return risk-adjusted	0.0064	12	7.63	HR
Market Cap	5-year daily return raw	-1.9549	12	-2345.97	LR
Market Cap	5-year daily return risk-adjusted	-0.0078	12	-9.46	LR
Price-to-book	5-year daily return raw	-1.0140	12	-1216.82	LR
Price-to-book	5-year daily return risk-adjusted	-0.0026	12	-3.13	LR
Equally weighted	5-year daily return raw	-0.0702	365	-2562.62	LR
Equally weighted	5-year daily return risk-adjusted	-0.0004	365	-16.68	LR
Market Cap	5-year daily return raw	-0.5381	365	-19642.08	LR
Market Cap	5-year daily return risk-adjusted	-0.0051	365	-186.26	LR
Price-to-book	5-year daily return raw	-0.2331	365	-8508.76	LR
Price-to-book	5-year daily return risk-adjusted	-0.0020	365	-76.04	LR
Equally weighted	20-year monthly return raw	-3.5894	12	-4307.35	LR
Equally weighted	20-year monthly return risk-adjusted	-0.0464	12	-55.74	LR
Market Cap	20-year monthly return raw	-11.2826	12	-13539.19	LR
Market Cap	20-year monthly return risk-adjusted	-0.1079	12	-129.53	LR

Price-to-book	20-year monthly return raw	-1.8441	12	-2212.94	LR
Price-to-book	20-year monthly return risk-adjusted	-0.0203	12	-24.45	LR
Equally weighted	20-year daily return raw	-0.1257	365	-4588.27	LR
Equally weighted	20-year daily return risk-adjusted	-0.0010	365	-37.31	LR
Market Cap	20-year daily return raw	-0.1703	365	-6216.96	LR
Market Cap	20-year daily return risk-adjusted	-0.0015	365	-53.59	LR
Price-to-book	20-year daily return raw	-0.0727	365	-2653.66	LR
Price-to-book	20-year daily return risk-adjusted	-0.0005	365	-17.96	LR

Table 2: Impact of IFRS 9 on the cost of capital of banks – Riskless debt

Test	Risk-based portfolios	Betas	Impact on cost of capital
1	Equally weighted	5-year monthly return raw	0.51%
2	Equally weighted	5-year monthly return risk-adjusted	-0.03%
3	Market Cap	5-year monthly return raw	8.37%
4	Market Cap	5-year monthly return risk-adjusted	0.03%
5	Price-to-book	5-year monthly return raw	4.34%
6	Price-to-book	5-year monthly return risk-adjusted	0.01%
7	Equally weighted	5-year daily return raw	9.14%
8	Equally weighted	5-year daily return risk-adjusted	0.06%
9	Market Cap	5-year daily return raw	70.07%
10	Market Cap	5-year daily return risk-adjusted	0.66%
11	Price-to-book	5-year daily return raw	30.35%
12	Price-to-book	5-year daily return risk-adjusted	0.27%
13	Equally weighted	20-year monthly return raw	15.36%
14	Equally weighted	20-year monthly return risk-adjusted	0.20%
15	Market Cap	20-year monthly return raw	48.30%
16	Market Cap	20-year monthly return risk-adjusted	0.46%

17	Price-to-book	20-year monthly return raw	7.89%
18	Price-to-book	20-year monthly return risk-adjusted	0.09%
19	Equally weighted	20-year daily return raw	16.37%
20	Equally weighted	20-year daily return risk-adjusted	0.13%
21	Market Cap	20-year daily return raw	22.18%
22	Market Cap	20-year daily return risk-adjusted	0.19%
23	Price-to-book	20-year daily return raw	9.47%
24	Price-to-book	20-year daily return risk-adjusted	0.06%

Table 3: Impact of IFRS 9 implementation on the cost of capital

Test	Risk-based portfolios	Betas	(1-Debt beta)	Impact of cost of capital including debt-risk
1	Equally-weighted	5-year monthly return raw	1.0746	0.54%
2	Equally-weighted	5-year monthly return risk-adjusted	1.0746	-0.03%
3	Market Cap	5-year monthly return raw	1.0746	8.99%
4	Market Cap	5-year monthly return risk-adjusted	1.0746	0.04%
5	Price-to-book	5-year monthly return raw	1.0746	4.66%
6	Price-to-book	5-year monthly return risk-adjusted	1.0746	0.01%
7	Equally-weighted	5-year daily return raw	1.0788	9.86%
8	Equally-weighted	5-year daily return risk-adjusted	1.0788	0.06%
9	Market Cap	5-year daily return raw	1.0788	75.59%
10	Market Cap	5-year daily return risk-adjusted	1.0788	0.72%
11	Price-to-book	5-year daily return raw	1.0788	32.74%
12	Price-to-book	5-year daily return risk-adjusted	1.0788	0.29%
13	Equally-weighted	20-year monthly return raw	1.1621	17.86%
14	Equally-weighted	20-year monthly return risk-adjusted	1.1621	0.23%
15	Market Cap	20-year monthly return raw	1.1621	56.13%

16	Market Cap	20-year monthly return risk-adjusted	1.1621	0.54%
17	Price-to-book	20-year monthly return raw	1.1621	9.17%
18	Price-to-book	20-year monthly return risk-adjusted	1.1621	0.10%
19	Equally-weighted	20-year daily return raw	1.1658	19.08%
20	Equally-weighted	20-year daily return risk-adjusted	1.1658	0.16%
21	Market Cap	20-year daily return raw	1.1658	25.86%
22	Market Cap	20-year daily return risk-adjusted	1.1658	0.22%
23	Price-to-book	20-year daily return raw	1.1658	11.04%
24	Price-to-book	20-year daily return risk-adjusted	1.1658	0.07%

Table 4: Average capital ratios for sample banks

Capital Ratio	**Average (1999 - 2022) (percentage)**
Leverage ratio	11.7272
Tier 1 Capital Ratio	17.5507
Total Risk-Based Capital Ratio	21.1241