RISK-BASED PRICING OF FINANCIAL PRODUCTS

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DECLARATION

I, Awelani Lynn Mukatuni, declare that the research work reported in this paper is my own except were indicated and acknowledged. The research is submitted in partial fulfilment of Master of Management in Finance and Investment at the University of the Witwatersrand, Johannesburg.

Signature of candidate: _____ Date: 07/30/2021

ABSTRACT

This is an analytical research that aims to contribute to the discussions around risk-based pricing of financial products. It aims at contributing a better understanding of the risk-based pricing model, its pros and cons, and areas of improvement in the consumer credit environment. The study uses real-life data and the risk-based pricing model to analyse suitable credit prices that would allow more people to afford taking up credit. The study uses the relationship between price sensitivity and the offered interest rate to support offered credit prices. The study also aims to analyse the national credit act regulations on the maximum interest rate that an institution can offer.

The study includes sample calculations that were drawn from Standard and Captec banks under the assumption that the two banks are using the risk-based pricing model. The results revealed that the model allows for more borrowers to have access to credit by allowing lenders to charge a high interest rate to high-risk borrowers. The model rewards low risk borrowers and compensates lenders for extending credit to high-risk borrowers. An analysis of the National Credit Act (NCA) revealed that it allows for banks and borrowers to maximise profit and marginalise a great number of borrowers at the same time. Due to its simplicity, the NCA becomes a good model to use as a basis for offering interest rates for high-risk borrowers, thus increasing the number of borrower classes.

Keywords and phrases: Financial product, Risk-Based Pricing, Financial risks, Credit, Credit price, Interest rate, Price sensitivity, and Credit scoring.

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1 INTRODUCTION

The financial system is essential for a growing economy and financial institutions such as banks are at the centre of such activities. Banks make money by borrowing low and lending higher (buying and selling of financial products) amongst other services. Lending is usually the largest asset and the main source of revenue, and it is exposed to credit risk (Chun and Lejeune, 2016). Pricing of services provided, especially credit needs to be optimal for banks to make a profit.

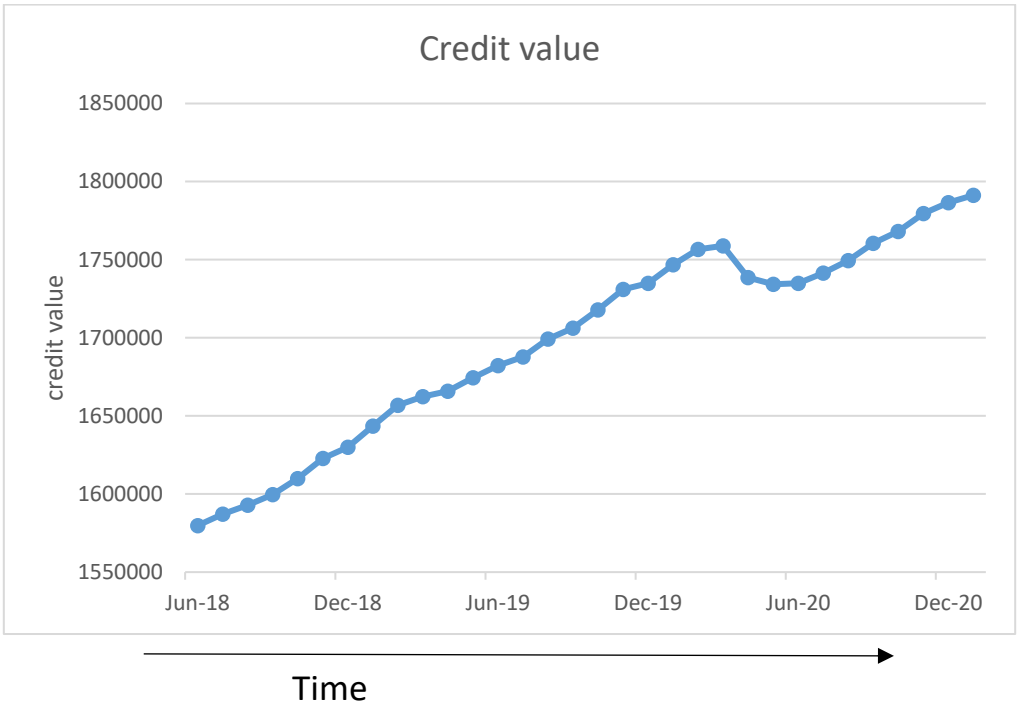
Financial products drive the financial ecosystem, and consumer credit forms a major part of that financial system. Financial products are services offered by financial institutions. Banks make money by selling these financial products, mostly lending, and borrowing (consumer credit). They collect money from savers and transfer it to borrowers. The money is collected by issuing liabilities to the money-saving public and loaned out against liabilities issued by borrowers (Luis, 2019).

Pricing of consumer credit was considered straightforward for some time (Phillips, 2013); however, the 2007-2008 financial crisis showed that mispricing and misallocation of consumer credit can have severe consequences for the entire financial system (Phillips, 2013).

Consumer credit is one of the products at the centre of financial system; it can determine a bank's profitability. For banks to achieve their profit targets and tap into new customer classes, credit pricing is crucial. Credit comes at a cost to the lender and is associated with risk; banks and other lenders usually evaluate the consumer's credit risk by considering factors such as their income bands and loan repayment history. Some lenders make use of higher-priced loans to compensate for not doing credit risk evaluation (Getter, 2018).

One of the immediate risks faced by banks is credit write-offs which exposes the bank to other risks. The banking report (SARB, 2019), states that the South African banking sector had a significant loss due to credit write-off. Banks wrote off a combined value of R 161.12 billion in advanced loans leading to April 2019.This represented a 22% increase from the previous year (SARB, 2019). Consider the graph below;

Figure 1: Household credit value increase from 2018 to 2020 (South African Reserve Bank).



Though the South African Reserve bank has reported an increase in the credit write-off, the credit value graph in figure 1 above shows an increase in the credit take-up. The continuous increase in household credit, the state of the South African economy, and evidence from the banking report are alarming. The alarming rates are an indication that credit must be priced correctly not only to allow more people to have access to credit but balancing their ability to pay back the loans.

Credit is one of the methods with which wealth is created. The exclusion of certain groups of people from accessing credit is, therefore, a hinderance to wealth creation (Staten, 2014). Financial inclusion is one of the highly debated topics and it is said that it could bring about economic growth. Financial inclusion does not only involve getting a bank account but also extends to having access to credit (Sonja, 2012). In the process of financial inclusions, banks must ensure that there is no reckless landing taking place to avoid financial crises such as the 2008/2009.

Since the 2008 financial crisis, credit pricing has become a topic of interest (Phillips, 2013). Adding to tropical issues about credit pricing is the aftermath of the 2009-2010 Nigerian banking crisis, of which concerns about financial stability began to surge in Sub-Saharan Africa (Brei et al, 2018). Credit risk assessment amongst other risks that are faced by the banking

institutions and pricing of credit is of paramount importance in ensuring financial stability of the financial ecosystem (Brei et al, 2018).

Most financial service institutions have not kept up to date with the current complex pricing models (Terblanche and De la Rey, 2014). Thus, amongst pricing models, lenders have begun to adopt pricing optimisation approaches that consider customer price sensitivity (Terblanche and De la Rey, 2014). The response of customers in taking up loans is of importance in estimating optimal loan prices.

Well priced credit can aid in the increase in financial assets as a percentage of GDP and increasing the number of participants in the financial system (Babu, 2018). One of the methods used for pricing credit is the risk-based pricing model which is said to be among the popular and adequate methods (Phillips, 2013). Risk-based pricing assesses risk and uses the assessment as a basis of interest offered. Lenders use the method to offer different interest rates and loan terms to different consumers based on their credit risk profile (Kagan, 2020). Risk-based pricing looks at factors such as consumer's credit score, credit history, employment status, and income (Kagan, 2020).

Different lenders use different approaches to assess risk. A customer who is deemed risky by one bank may not necessarily be risky to the other (Philips, 2013). This differential treatment of risk and the evaluation thereof is one of the reasons why customers may be charged different rates for the same loan by a different lender (Philips, 2013). Most lenders look at credit risk of which it has been shown that other risks such as liquidity should be considered when pricing financial products as they have a significant impact on the profitability of the banks (Wu, 2019). Improved operational and risk management practice might contribute to higher potential economic growth (Brei et al, 2018).

The paper aims to investigate risk-based pricing of financial products, by investigating the impact of the model on consumer credit. In addition to that, the study will also focus on the impact of risk-based pricing models on credit availability, cost, and price sensitivity using an analytical method and model analysis. Finally, the research will analyse the maximum interest rate as set by the National Credit Act of 2005, the impact it has on the credit price as it relates to the rates obtained from the calculations done using the proposed model.

1.1 Problem statement

In light to this background, the research will attempt to add to the discussions on credit pricing, through understanding its impact on availability, analyse and comment on some of the individual components of the risk-based pricing model. The impact of risk-based pricing on price sensitivity, availability, and cost will also be discussed in line with the model described by Phillips (2013) and price sensitivity models described by Terblanche and De la Rey (2014) as benchmarks to comment on price sensitivity by the customers.

Consumer credit is one of the products that are at the centre of the financial system. It is used to determine a bank's profitability and wealth creation. For banks to achieve their profit targets and tap into new customer classes, credit pricing is crucial. Limitation of wealth creation due to the loan write-off has been growing at a faster rate than issuing of new gross loans since April 2019 (SARB, 2019). Understanding the impact of risk-based pricing on the availability of credit could go a long way in assisting in financial inclusion in South Africa.

The increase in loan write-offs hinders economic growth and is an indication that most South African consumers are struggling with loan repayments and optimal pricing of loans must be studied and implemented (SARB, 2019). Therefore, studying credit risk and pricing of credit is of importance to aid banks' profitability, and allow for economic growth by introducing new classes of borrowers.

1.2 Purpose of the study

The purpose of this study is to analyse the impact of the risk-based pricing model on financial products in commercial banks. It also stands to investigate any discrepancies on pricing models and what it means for the consumers' ability to purchase credit. The study also seeks to analyse the components of the risk-based pricing model. If the risk-based pricing model is analysed and is proved that it offers reasonable credit prices, it could be utilised to introduce new classes of borrowers. Due to the simplicity of the model, it could be an asset in growing the South African economy.

1.3 Objectives

- To investigate the impact of risk-based pricing on cost and availability of credit for each bank.
- To analyse and comment on the components of the risk-based pricing model.
- To analyse the maximum interest rate set by the National Credit Act.

1.4 Significance of the study

Risk-based pricing is a simple loan pricing model that lenders use to price credit according to the borrower's risk profile (Staff and Khartit, 2020). If a borrower is risky, risk-based pricing causes that borrower to pay more (generally in the form of a higher interest rate). A study on risk-based pricing is important to find reasonable credit prices to allow people to be able to take up loans.

Reasonable credit prices could assist in the limitation of credit write-offs and be essential to tap into groups that are currently 'unbanked', many individuals, small, micro, and medium enterprises (SMMEs) in sub-Saharan Africa (Brei et al, 2018). With the recent pandemic and current state of the South African economy, negatively impacting the unemployment rate, a growing economy is essential for the country.

One way of growing the economy is access to the disadvantaged groups. These groups tend to face difficulty and get charged higher prices when applying for credit. Improving the understanding of risk-based pricing might provide insight to policymakers and regulators. To make regulations that not only protect the customers but also leave room for financial inclusion and economic growth. Most of the limitations are due to the regulations set in the National Credit Regulation of 2007 that has been adopted by the financial institutions.

This research aims to contribute to the discussions on the pricing of financial products such as consumer credit by ways of risk-based pricing model analysis, NCA analysis, and make recommendations. Recommendations will be based on the obtained model calculations and model analysis. The information from this research can be used by the financial institutions and policymakers to help them in their profitability and decision-making process.

1.5 Methodology

To achieve the research purpose and objectives, this thesis examined the available research on risk-based pricing methods. The model used for the empirical calculations is an expanded version of the one proposed by Philip (2013). The research looked at the components of the model and make calculations of expected rates based on the model. Understanding the individual components of the model; areas for improvement have been identified. The research also analysed the NCA's credit regulations set on the maximum allowable interest charged by an institution.

The research was done on both unsecured and secured loans offered by two different banks using real-life data obtained from banks' balance sheets, income statements as well as Equity RT platform for each specific bank. The data from the bank financial results is information specified in the equation, such as bank deposits, revenue, and liabilities. The results were then compared to the current maximum allowable interest rates by the National Credit Act, to substantiate comments and recommendations.

1.6 Outline of study

This paper is structured in the following way:

- Chapter 1 is the Introduction to the topic, purpose, and outline of the study
- Chapter 2 is a detailed literature review and overview of the topic.
- Chapter 3 looked at the pricing literature rate of the pricing methods advantages and disadvantages.
- Chapter 4 covered the review of the price sensitivity research and how it relates to credit pricing.
- Chapter 5 looked at the empirical results, credit prices to be charged to potential customers, results, and discussions and comments on the maximum allowable interest rate charged as per the Credit Act.
- Chapter 6 gave the conclusions and recommendations based on results and research.

1.7 Ethical considerations.

The research was conducted ethically; the data used for this research was available to the public on publicised financial year-end results for each of the companies involved in the research. Additional information was obtained from the EquityRT data platform. All the work in the research is the hard work of the research except stated otherwise and referenced. As obligated, I followed all the ethical rules in researching as deemed by the University.

2 LITERATURE REVIEW

2.0 Introduction

Financial products are services provided to individuals, businesses, and other organizations such as government institutions by financial institutions. These services are offered by financial institutions such as banks and insurance companies and are usually in the form of contractual agreements (open risk manual, Unknown). Financial products can be classified as financial investments, borrowing of money, and or savings. The offering of financial products poses risk to the financial institutions and according to Luis (2019) a great number of players are a bit ignorant in understanding these underlying risks. Thus, players engage into buying these based on feelings and or emotions (Basu and Dulleck, 2020).

Financial institutions generate profits from selling these financial products, especially consumer credit. They collect money from deposits and transfer it to borrowers, "The money is collected by issuing liabilities to the money-saving public and loaned out against liabilities issued by borrowers" (Luis, 2019) at a cost (i.e., credit price). Borrowed products are services such as credit cards, personal loans, home loans, and bonds.

The selling of financial products exposes banks to several underlying risks that are as a result of dealing in financial products. When banks and other financial institutions are overexposed to risk, it can lead to crisis such as the 2008/2009 financial crisis (Grant and Graham, 2012). The consumer credit market has some risk associated with it, and Phillips (2013) suggests that the mispricing and misallocating of consumer credit can be risky at a global scale as evidenced in the 2008/2009 financial crisis.

Banks and other financial institutions that offer financial services are exposed to certain financial risks and the identification and understanding of such risks help banks and other financial institutions to efficiently and correctly price their financial products (Saunders and Cornett 2011 as cited in Thoka, 2015). The major risks faced by banks include credit, operational, market, and liquidity risk (CFI, 2015-2021). The underlying risks have an impact on the pricing of financial products amongst other factors (Ma et al, 2020).

2.1 Consumer credit

Consumer credit is credit extended to individuals to buy goods or services without upfront payment and then pay at a later stage (Getter, 2018). The consumer credit market consists of several products that are priced differently, such as mortgages, credit cards, car loans, personal loans, and student loans (Getter, 2018).

Table 1: Major consumer credit and their consumer book values (%) (Businesstech, 2020).

Types of loan	Total number of accounts	Consumer book (calculated)
Personal bank loan	5.1 mil	12.53 %
Home loan	1.9 mil	4.67 %
Credit card	7.0 mil	17.2 %
Vehicle loan	2.5 mil	6.14 %
Non-bank personal loan	7.0 mil	17.2 %
Retail loans	17.2 mil	42.62 %

Table 1 above highlights the percentage allocation for the major consumer products offered by the different South African financial institutions. Credit cards and non-bank personal loans have the second highest percentage. According to Businesstech (2020), credit cards offer a good source of liquidity to consumers who are short of money, hence this could have led to the reason why it ranked second highest. Non-bank personal loans are concentrated by high-risk borrowers (Businesstech, 2020) who usually suffer rejection when they apply for credit at financial institutions; as a result, this also led to it being categorised second highest.

There are two types of credit, first one is revolving credit, wherein a person is approved for a specific amount of credit and can use it whenever he or she needs it, such as a credit card (Gravier, 2020). The second one is instalment credit; the person pays a fixed amount for a specified number of payments until the loan is paid off (Gravier, 2020).

After the 2008/2009 financial crisis and the Nigerian banking crisis of 2009/2010, the concerns about financial stability have increased due to the lack of economic growth, and as a result, assessing risk is a crucial part of credit pricing (Blei et. Al, 2018). Credit is crucial for wealth creation and economic growth (RBC, 2018), and only a small group of people in South Africa has access to such type of credit. The limited access to credit is attributed to the lack of financial inclusion, limitations of the National Credit Act, and other regulations.

Credit approval and pricing is one of the important processes that lenders such as banks must undertake since it is one of the sources of income. The credit approval and pricing process rely upon assessing risk accurately and making a sound decision based on that analysis. A balance

between risk level and meeting customers' needs is fundamental to maximise revenue and maintain good relationships with the customers (Chun and Lejeune, 2016).

The use of consumer credit comes at a cost to the consumer, regardless of whether it is an instalment or revolving credit type. In either case, the cost of credit is paid in the form of interest, that is on remaining balances as well as penalties on failure by clients to meet their payments on time (Gravier, 2020). The interest paid on credit can also be called the price of credit which differs depending on the loan characteristics. Loans are classified as either secured or unsecured depending on their characteristics.

2.2 Secured loan

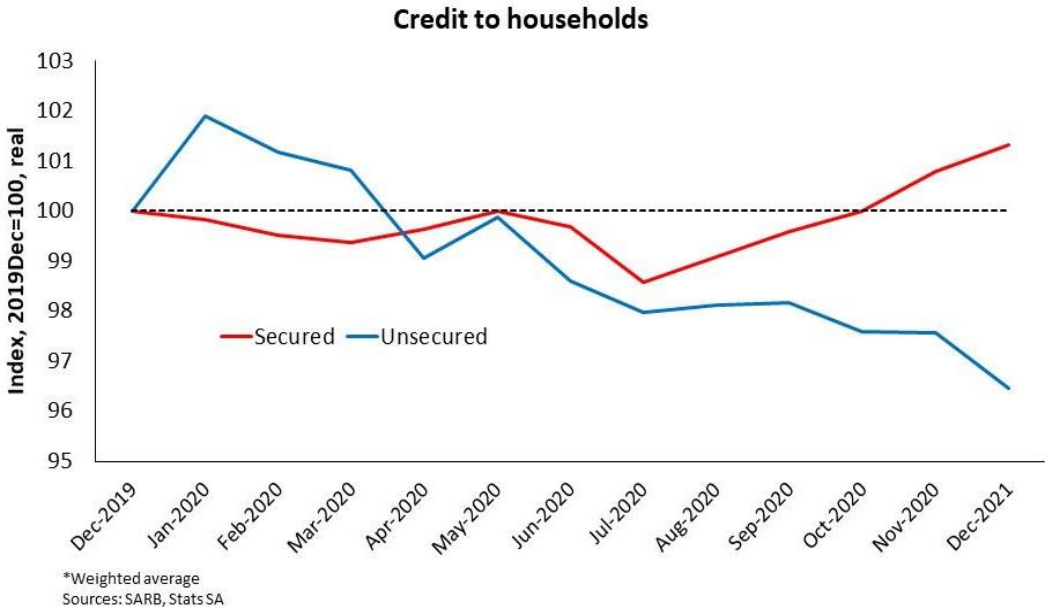
This is a loan that requires the borrower to present an asset such as a house, as collateral security, or assurance to paying back the loan. This makes secured loans less risky and safer for the lender and less expensive for the borrower (Oldmutual, 2017). Secured loans lower the risk associated with this financial product, hence allowing for lower interest rates to be quoted. In addition, secured loans are more accessible, and allows for refinance of assets.

However, the grey side of this type of loan is that borrowers are at risk of losing their assets in the event of a default (Oldmutual, 2017). In today's unstable economy, the rate of defaulting on payment is high, hence leaving borrower's assets venerable. Adding on the list of disadvantages is that secured loans typically have extended repayment periods, which translate to more incurred interest.

2.3 Unsecured loan

An unsecured loan refers to a loan that does not have any asset tied to it as a security. A loan that does not have security means that the lender takes on higher risks when giving out the loan. These loans tend to be highly priced, thus compensating the lender for the high-risk they are taking (Oldmutual, 2017), hence unsecured loans have the potential of yielding more profit if paid on time. They are expensive to the borrower since they are not taken for large loans, but they are good for emergencies and buying of small assets. However unsecured loans have strict requirements and normally correlate with the borrower's earnings (Oldmutual, 2017). The figure below shows the performance of the two types of loans from December 2019 to December 2021.

Figure 2: Loan trends in South Africa.



These two types of loans took a shift recently as evident in figure 2 (South African Reserve Bank, 2021). Before March 2020 unsecured loans were dominating the market in South Africa but after March 2020 this started to change. There has been an increase in the number of secured loans and a decrease in the number of unsecured loans.

Though the two loans do have financial risks, secured loans are less risky compared to unsecured loans. In these challenging economic times, the figure above indicates that secured loans are thriving because they are less risky, and lenders are taking precautions and are targeting lower-risk borrowers (Transunion, 2020).

2.4 Financial risk

Financial risk is defined as any fluctuation in the cash flows, financial results, and the company's value due to the influence of different kinds of factors, mainly market factors such as interest rates, exchange rates, commodity, and stock prices. In line to the above contributions financial risk maybe responsible for any changes in the financial condition of the company (Błach, 2010).

Financial risk has the potential of creating global financial crisis. To prevent such crisis regulations are put in place and as a result, institutions must realise that simple risk measuring rules are no longer sufficient (Phillips, 2013). Financial institutions and banks are very vulnerable to credit risk, liquidity risk, and insolvency risk (Błach, 2010).

2.5 Credit risk

Credit risk is defined as the loss associated with default, which is when a borrower fails to meet the obligations of the terms of the contract which causes the lender to suffer losses. These "obligations arise from lending activities, trade and investment activities, payment, and settlement of securities trading on its own and foreign account". Though credit risk is categorised by many scholars as default risk, “banks and other financial institutions also include the risk of delayed payments in this category” (CFI, 2015-2021). The defaults are mainly attributed to the insolvency of the borrower.

Credit risks play a crucial role to banks’ profitability. Thus, a small change in credit risk has a visible impact on the banks’ profitability (CFI, 2015-2021). Therefore, banks must put in place several measures to mitigate such risks. Measures such as setting aside funds per the Basel III accord may help to mitigate such risks (Juneja, 2021). The funds are set aside in a provision account as soon as a loan is made. Banks combine provision accounts and structured finance as a mitigation measure. Structured financing is used for more complex financial needs (Chen, 2020).

Defaulted loans continue to be an inherent trait of selling financial products such as consumer credit, and thus studying the pricing of such products is of importance (Juneja, 2021). The failure by financial institutions and banks to efficiently and accurately price financial products and services and the continuance of borrowers to default, eventually leads to the collapse of that bank's financial ecosystem.

2.6 Operational risk

Operational risk is defined as the loss associated with banks’ system failure, people, or processes that may cause errors, interruptions, or other damages. Issues such as fraud (e.g fishing) and wrong account accidental deposits are evident in operational risks. Operational risk tends to be very high for operations such as sales and trading (CIF, 2015-2021).

Digital fraud such as the breach of a bank's cybersecurity leads to a loss of funds whereas leaking of information damages the bank’s reputation and its profits. A negative impact on the bank's reputation therefore leads to many customers walking out from using specific banks (CIF, 2015-2021).

2.7 Market risk

This is the risk that is mostly associated with a bank's activities in the capital markets. Due to the unpredictability of equity markets, commodity prices, interest rates, and credit spread, this makes banks that have highly invested in the capital markets highly exposed (CIF, 2015-2021). Market risk has also been termed as systematic risk, which is the type of risk that individuals and or financial institutions may not be able to diversify even though it can be hedged. Major sources of market risk are recessions, political turmoil, changes in interest rates, natural disasters, and terrorist attacks. This type of risk has the potential of influencing the entire financial system at the same time hence its characteristic of systematic.

Banks tend to invest in various businesses which exposes them to this kind of risk (CIF, 2015-2021). Changes in the market leads to a direct change in the value of the company and the value of the investments. These changes are caused by the shift in the supply and demand of financial products which are mostly hard to predict (CIF, 2015-2021). Examples of systematic risk include interest rate risk which covers the volatility that usually accompany interest rate fluctuations due to fundamental factors that include central bank announcements in the monetary policy, equity risk which covers the changing prices of stock investments. Commodity risk which includes changing prices of commodities such as crude oil and corn and lastly currency or exchange rate risk which comprises of change in the price of South African rand against another currency.

2.8 Liquidity risk

Liquidity risk refers to the bank's inability to meet its short-term financial obligations. This risk threatens the bank's financial position or existence, thus financial institutions try to manage it through effective asset-liability management (Hronec, 2021). Managing this type of risk helps banks avoid a bank run. A bank run can occur several times throughout a bank's banking history.

Before the 2008/2009 financial crisis, financial institutions did not regard liquidity and balance sheet management as important (Juneja, 2021). But during the crisis, many institutions had issues maintaining their liquidity, this then led to the central bank having to come and rescue some of the banks by injecting funds to keep the economy from collapsing completely (Juneja, 2021).

Liquidity risk occurs because banks use deposits to fund their loans. The banks only hold back a percentage of the deposits received as reserves; the rest are used for loans. The banks become exposed to the risk if all the depositors were to withdraw all their money at once. They might not have the provision for such a situation. Morden banks tend to use the central bank as a backing call-in case a situation like this was to occur (Juneja, 2021).

Liquidity risk in asset pricing is of economic importance because liquidity risk arises from consumption and solvency constraints. When the economy performs poorly, market liquidity dries up, people who buy financial products may be forced to liquidate (cash out) their investment for consumption. A forced cash out can result in significant losses, as banks may have to cash out at low prices, especially during the liquidity crisis (Ma et al., 2020). Players in the financial system engage into this because, cashing out investment might be a way for people who have solvency constraints to meet their obligations such as loan payments (Ma et al., 2020).

Once liquidity risk passes a specific threshold, "it does not follow a mean-reversion pattern; instead, it feeds on itself, gathers momentum and causes more severe market declines than those that would occur under normal conditions" (Brunnermeier and Pedersen, 2009 as cited in Wu, 2019). Surpassing the threshold makes it difficult to control liquidity crisis and eventually the financial system will collapse.

Awareness is one positive step that arose from the crisis. It made institutions to be aware and better manage liquidity and their balance sheet (Juneja, 2021). The financial crisis exposed the consequences of inadequate asset-liability management. The inadequacy then led to systemic risk, which is a risk that goes beyond an individual organisation but reaches other organisations in all the different industries, affecting the entire global financial ecosystem (Juneja, 2021).

2.8.1 Liquidity risk management

Liquidity risk management and ALM entails the processes and strategies a bank uses to manage risk (Hronec, 2021). Maintaining the balance sheet earns a desired to net interest margin, without exposing the bank to unwarranted risks from the interest rate volatility (Hronec, 2021).

Maintaining the balance sheet entails planning and structuring the balance sheet with an optimal mix of assets and liabilities. This then optimises the risk-return profile of the bank from that point going forward (Hronec, 2021). Assessing the ability to meet cash flow and collateral needs without having a negative impact on day-to-day operations or its overall financial position (Hronec, 2021) results in the bank having to efficiently managed liquidity risk. The

risk is mitigated by developing strategies and taking appropriate actions designed to ensure that necessary funds and collateral are available when the need arises (Hronec, 2021).

There are regulatory bodies such as the Basel Accord, that are put in place, to prevent another financial crisis in the future. As a result, banks need to play their part in managing their liquidity risk both for the good of the firm and the economy. Pricing of financial products is another way of managing liquidity risk of which most pricing models do not include other forms of risk in their models (Ma et al., 2020).

2.9 Regulations

Regulations are put in place to protect financial institutions together with the borrowers. These regulations also help protect the global economy, promote transparency from the financial institutions and to limit or prevent financial crisis from reoccurring (Teall, 2018). These regulations are constantly being modified to keep up with the financial times.

Different lenders use different approaches to evaluate risk and price credit with the guidance of regulations. In this regard, this can lead to differences as to why customers may be charged different rates for the same loan by different banks/lenders (Philips, 2013).

2.9.1 Credit market regulations (National Credit Act)

Financial institutions are not allowed to just charge and give out loans recklessly, they are guided by the regulations set in the National Credit Act (NCA). The National Credit Act of 2005 is there to promote a "fair and non-discriminatory marketplace for access to consumer credit and for that purpose to provide for the general regulation of consumer credit and improved standards of consumer information" (NCA, 2005).

It aims to monitor and regulate the South African credit market hence all credit providers are to abide by it (Arunkumar and Kotreshwar, 2016). To ensures that borrowers are not charged beyond the maximum interest rate specified by the act, the act requires for all credit providers to register, except for incident credit providers, credit providers with less than 100 agreements, and providers with a total outstanding book of credit less or equal to R500 000 (Deloitte, 2013).

The act requires that the interest rate offered by the credit provider should be calculated on the day that the agreement is reached to ensure compliance (Deloitte, 2013) and should remain unchanged for the duration of the loan term. All the consumer credit products must be priced and monitored within the regulations of the national credit act of 2005. The maximum interest

rates set by the Credit Act are linked to the South African repo rate using the equations described below (NCR, 2005).

Equation1 $$Home\ loans\ = (Repo\ rate\ x\ 2.2\ +\ 5\%)\ per\ year$$

Equation 2 $$Credit\ facilities\ = (Repo\ rate\ x\ 2.2\ +\ 10\%)\ per\ year$$

Equation 3 $$Unsecured\ Credit\ = (Repo\ rate\ x\ 2.2)\ +\ 20\%\ per\ year$$

Credit facilities facilities such as credit cards, store cards, overdrafts, and vehicle loans are priced higher than home loans, whereas home loans are priced slightly lower than credit facilities. Unsecured credit is priced higher than both credit facilities and home loans (mortgages) because their increased risk.

$$Home\ Loans\ =\ R1000\ +\ 10\%$$

$$Unsecured\ credit\ =\ R\ 150\ +\ 10\%\ of$$

$$Incidental\ credit\ =\ 2\%\ per\ month$$

(NCA, 2005)

The National Credit Act has set a maximum initial fee to be charged to borrowers if the lender requires an upfront initial fee. For home loans, the fee is set for an amount excess of R10 000 with an overall maximum of R5000 (NCA,2005). With unsecured credit, it is set for any amounts greater than R1000 with a Maximum of 1 million. Incidental credit is the interest that is charged due to failure to pay for the goods and services after a given period of time (Deloitte, 2013).

2.9.2 Capital regulation (The Basel Accord)

The Basel Accords are bank capital regulations that were introduced by the Bank for International Settlements (BIS) in 2001. The Basel capital accord is used on a consolidated basis to internationally active banks to address the risk management practices for active financial institutions in the international arena. The accord can and is reviewed frequently to address issues that develop in the financial world (Martens, Baesens, Gestel and Vanthienen, 2017).

The accord exists to improve the banking "sector's ability to absorb shocks that arise from financial and economic stress through regulating the banks' capital requirements. It was also put in place to regulate risk management strategies and the banks' governance to prevent the build-up of systemic risk and enforce transparency and full disclosure (Olokoyo, 2011).

The Basel Accords has three series of banking regulations set by the Basel Committee on Banking Supervision (BCBS), which are Basel I, Basel II, and Basel III. The three Accords formulate part of the financial institution regulatory system. They ensure that banks have sufficient capital to meet their obligations, withstand shocks and mitigate unexpected losses (Olokoyo, 2011).

Basel III is the latest accord and was introduced as a response to the financial crisis. It came to addresses several regulatory issues that emanated before the crisis. Banks are required to keep a minimum amount of capital and liquidity ratios. Basel III requires that banks maintain more capital of higher quality to cover unexpected losses. The Accord also requires banks to keep a minimum of 6% of Tier 1 capital, an increase from the previous 4%. It goes further to require that the capital is of the highest quality e.g., "common shares and retained earnings" which is an additional requirement to Global systemically important banks (Martens, Baesens, Gestel and Vanthienen, 2017).

The liquidity ratio requires that banks hold sufficient liquid assets to get them through 30 days in case of difficult times. These ratios promote a better balance between assets and liabilities. The ratio aims to regulate credit risk, market risk, Credit Valuation Adjustment, and operational risk calculations by using standardised approaches to promote greater risk sensitivity and comparability (Martens *et all*, 2017). When banks offer and price credit, they are required to keep the Basel accords in mind and meet the minimum capital regulations if that loan is offered at specific prices (Malhorta and Malhorta, 2013).

2.10 Credit scoring

Credit scoring is a tool used to set appropriate default premium when determining the interest rate to charge a potential borrower (Diette, 2000). Its produced credit scores can be a number between 300 and 850 that is then used to outline a borrower's creditworthiness. The credit scoring tool was developed approximately 50 years ago and has been used by lenders to evaluate the probability of the borrower to repay loans on time, therefore, identifying risky borrowers (Arunkumar and Kotreshwar, 2016).

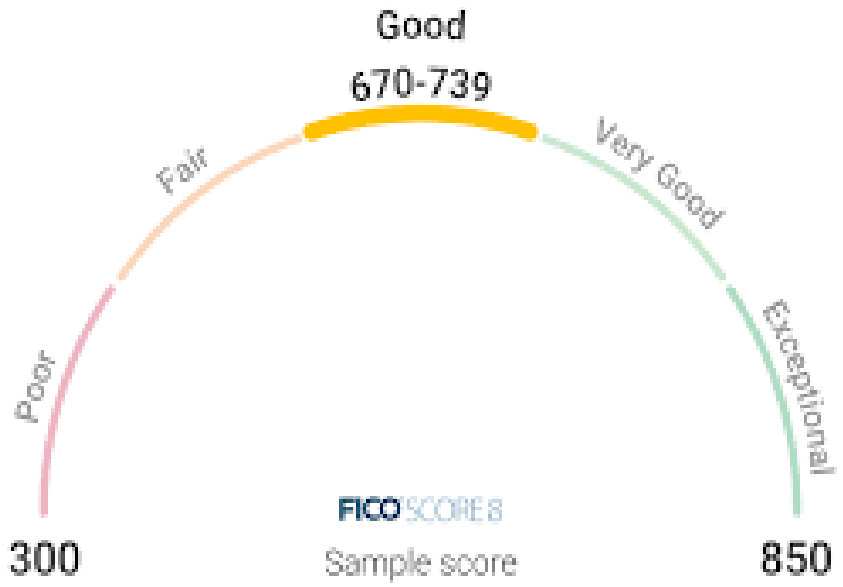
The higher the score, the lower the risk of the potential borrower, which makes the borrower look good to lenders (Kagan, 2021). Credit scores play a major role in the lender's decision-making process of credit offering. One of the biggest scoring systems used is the FICO scoring system, figure 3 below shows how the risk is categorised in relation to the credit score.

2.10.1 How does credit scoring work

The credit scoring tool uses advanced computer software to evaluate the creditworthiness of potential borrowers (Deitte, 2000). The tool analyses data from many borrowers, it looks at the borrower's credit history that is; the repayment history, total amount of debt, age of the account, and other factors (Central Bank of Jordan, 2018).

The tool does several calculations by analysing the history and then compare it to other borrower's history. The data is then used to produce a credit score to assign each customer which is usually between 300 and 800 (Central Bank of Jordan, 2018). This software can either be developed by the bank or the bank can choose to purchase it.

Figure 3: FICO credit scoring meter (credit scoring)



When a borrower's details are entered into credit-scoring software, complete credit history is then retrieved from the credit reporting agencies. The scores are categorised from very poor to exceptional credit risk as demonstrated in figure 3 above. A score above 700 is normally considered a good credit risk and a score under 670 is considered to be high-risk (Kagan, 2020).

Borrowers in the high-risk category either have gaps or negative information in their credit report or are referred to as "subprime" borrowers. Categorising the borrows with credit scores benefits the lenders, by allowing them to estimate the default rate because a borrower with a score of 710 has an estimated default rate of 1 in 21, while a borrower with a score of 680 has an estimated default rate of 1 in 11 (Lahsana, Ainon and Wah, 2010).

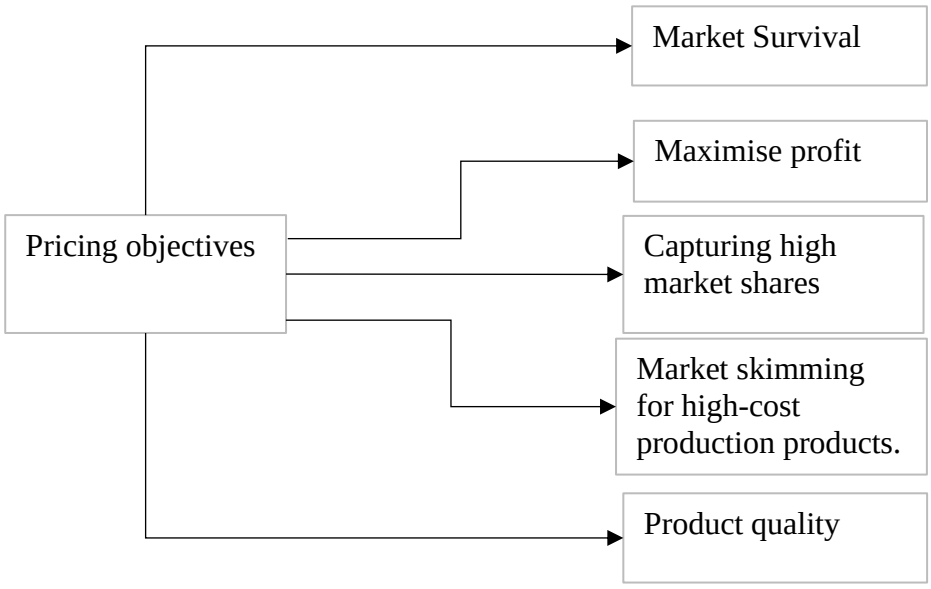
Borrowers can obtain their credit scores regardless of the complexity of the calculations that are used to determine the credit scores (Deitte, 2000). Though lenders are not obligated to share the borrower's credit score with the potential borrower, the borrower can request it from any of the three major credit reporting agencies or ask for it (Arunkumar and Kotreshwar, 2016). Different countries use different credit scores

3 PRICING LITERATURE

3.0 Pricing overview

Pricing is a process of determining the value of a product that will yield a return desired by the lender or service provider (Faith and Edwin, 2014). The lender or service provider stands to make a profit from the interest they charge borrowers. Pricing factors include manufacturing cost, market location, competition, market condition, and the quality of the product. Pricing is one of the primary components of product marketing and has a significant and direct impact on product sales and revenue (Faith and Edwin, 2014).

Figure 4: Summary of pricing objectives diagram (Faith and Edwin, 2014).



Every organisation primary objective is to earn profit and, therefore, the price must be set with the cost of production together with the benefits the customers stand to gain in mind (Business Jargon, 2021). To achieve the pricing objectives listed in figure 4 above, credit pricing should be independent of competitor's rates but should rely on research.

To ensure survival in this highly competitive industry, setting the credit prices according to what other banks in your area charge will not guarantee a competitive advantage (Smith and Howard, 2018). Competitiveness is not the only important factor to look at when determining loan prices. Other factors such as desired return, cost and risk, and credit profile are important to look at. A better way to set loan prices is to conduct a thorough, objective analysis using a loan-pricing model (Smith and Howard, 2018).

Institutions use numerical loan-pricing models. Financial institutions formulate and optimise loan pricing in a way that they ensure compensation for the risk they are taking (Biery, 2016). For a bank to make a profit, their loan profiles need to make a suitable return; thus they use pricing models. One of the most important components that impact a loan portfolio is the interest rate, which is referred to as the price of a loan (Chun and Lejeune, 2016).

The interest rates affect both the performance and risk of the loan profile and many financial institutions have recognised the importance, risk, and challenges of loan pricing (Chun and Lejeune,2016). A study on credit pricing is of importance, and there are methods put in place for pricing loans and other financial products.

3.1 Importance of loan pricing

Loan pricing models can allow financial institutions to set prices that align with their profit goals. Loan pricing also allows for capital optimisation, which gives the institution more financial flexibility for the development of new products. It also allows for better justification of price changes and avoid prosecutions by regulatory bodies (Biery, 2016). They also assist with the identification of the imbalances in the market's supply and demand (Biery, 2016). It helps borrowers and lenders to make informed decisions before buying risky products (Biery, 2016). A good pricing model can limit questionable practices such as a lender who does not include the cost of risk associated with lending in their prices (Hannagan, 2005). Loan pricing can be used to encourage cross-selling to more customers (Hannagan, 2005).

3.2 Types of pricing strategies

There are several pricing strategies in the industry used by businesses. Numerical methods help ensure efficient loan that are in line with each specific borrower to ensure a sale occurs (Biery, 2016). Each strategy has its benefits and companies choose a strategy that will best help them reach their company goals.

Cost-Based Pricing

Cost-based pricing is one of the simplest and cheaper pricing methods because it requires very little market research (less information), and it does not consider consumers' perspectives and what the competition is doing (Campbell, 2020). This approach relies on random costs and mark-ups it aims to set prices that will cover the cost of production and set a profit margin that ensures that the institution earns its target profit (Lumen, unknown). Though it is not ideal for most companies, companies that use it intend maximise their profits.

Competition-Based Pricing

Competition-based pricing or strategic pricing is a process of setting price points strategically to take advantage of a product or service based on the market relative to competition (Khartit, 2020). With competition pricing, a firm will base what they charge on what other firms are charging. This means that marketers will set prices depending on the results from their research (Lumen, unknown).

Demand-based pricing

Demand-based pricing uses consumer demand to set the price of products. Demand-based pricing considers what is happening in the market, the fluctuations in product demand and adjusts prices to cater to those changes (Fuchs, 2020). Demand-based pricing has several methods which include price skimming, value-based pricing, penetration pricing, and premium pricing (Fuchs, 2020).

Flat rate pricing

Flat rate pricing is a model that offers users a single price per month or year for all features and all levels of access (Campbell, 2020). It is a cheaper method that enables the creation of scalable pricing structures, and is rarely used in modern software technologies. This model is primarily used by businesses that sell physical products and subscriptions (Campbell, 2020).

Risk-based pricing

The risk-based pricing model is a strategy that uses a borrower's credit risk to help determine the interest rate to charge (cost of credit). Philips (2013) says it is a simple and more adequate model which has become a popular pricing method in the industry.

3.3 Risk-Based Pricing Literature

One of the most important elements that impact the performance and risk of a loan is the interest rate, which is also known as the price of the loan (cost of credit) (Chun and Lejeune, 2016). Most people in the industry have picked up several challenges of structured loan pricing. Some pricing models exclude the cost of risk associated with lending as part of their pricing process (Hannagan, 2005). The exclusion of risk in the pricing model promotes reckless lending, allowing borrowers who have a bad credit history to borrow at the same rate as those with good credit profiles (Hannagan, 2005).

Until the early 1990s, banks were simply using one price for each loan type and rejecting the borrowers with the most risk (Chun and Lejeune, 2016). Through the years since the introduction of the credit scoring method, lenders have been working and improving the underwriting models (Edelberg, 2003). The improvements resulted in a decrease in data storage costs and a reduction in costs of risk-based pricing (Edelberg, 2003).

Banks had started to manage their risks more effectively by taking on the risk-based pricing model which estimated the risk specific to each borrower and offered borrower the interest rates related to their risk (Chun and Lejeune, 2016). The key element to such a pricing strategy is identifying the risks that are being priced (Chun and Lejeune, 2016), and the extent of potential loss arising from counterparty exposure due to lack of risk assessment is great (Ghosh, 2012).

The rationale behind risk-based pricing is direct in the sense that; risk-based pricing estimates the specific risk for each customer/borrower and offers different interest rates and other loan terms to customers based on the likely hood of the customer to default their loans (Staten, 2014). The model uses credit scores to set default premiums (risk premium) to find optimal rates and loan cut-off points for each risk category (Diette, 2000). Risk-based pricing is one of the simple methods that are available in the industry that takes risk into account.

Risk-based pricing allows for very high-risk borrowers to be charged high-interest rates rather than be ruled out (Edelberg, 2003). This broadens the range of customers for lenders who dealt mainly with low-risk borrowers. Through large amount of data being processing and the improvement in credit scoring tools, risk-based pricing can expand credit access (Hackbarth, 2014).

A lender charges higher prices for borrowers with higher default risk and larger potential losses because it cost the lender more to finance that borrower (Hackbarth, 2014). For the same loan, lenders will offer a lower interest rate if they view the borrower as a low-risk borrower, due to a good credit score (Staten, 2014). The borrower's high risk can be attributed to the potential borrower declaring bankruptcy, loss of job and is several payments behind current loans.

This method gives lenders the ability to tailor prices and extend credit to more borrowers rather than reject applicants who posed default risk, creditors could accept them and charge an appropriately higher price for the loan to cover the extra risk (Hackbarth, 2014). A 2007 Federal Reserve report found that risk-based pricing expands access to credit for previously credit-constrained populations, as creditors are better able to evaluate credit risk, and by pricing it

appropriately, offer credit to higher-risk individuals. This has extended consumer credit to millions of Americans across the economic spectrum (Hackbarth, 2014) and it could do the same for South Africans and other African countries.

The Risk-based pricing model can be used to price various services, such as business loans, credit cards, trade credit, and equipment leasing. This model has been adopted by banks to manage the risk associated with lending more effectively (Chun and Lejeune, 2016). Banks that use risk-based pricing can offer competitive prices, reject, or price high-risk loans at a premium (Diette, 2000).

When a bank uses risk-based pricing the borrower may get a notice if they have less favourable terms compared to other borrowers based on any part of the credit report when an interest rate is quoted by the bank (FTC, 2016). The notice includes the customer's annual credit report, credit score, the score range, and the negative factors affecting the score (FTC, 2016). Transparency is not the only benefit that comes out when risk-based pricing is done the right way, it may bring forth other financial benefits to the business.

The increase of high-risk borrowers in the credit environment due to this model works only if the offered interest rates are not above the potential borrower's reservation interest rate (Edelberg, 2003). Though risk-based pricing has some positives, it also comes with some challenges. One of the challenges is that the difference in the loan characteristics and borrower profiles, the assignment of risk or risk premium problematic in loan pricing (Unknown, 2004).

Issues with the risk-based pricing model

Though Phillips (2013), describes risk-based pricing as one of the more adequate models and has become a popular pricing method it has some issues attributed to it. One of the issues is whether the risk-based loan prices should be strictly followed for all kinds of loans and advances. The model does not take loan maturity into account. Calibration of the risk-based loan rate to match up with the risk rating scale is also an issue (Ghosh, 2012). Another issue is that wealthy, stable borrowers usually get more offers at a low cost, while the borrowers who considered to be riskier are unable to keep up with the costs. This eventually affect the supply of credit to all customers (Wolff, 2020).

Advantages of risk-based pricing.

The risk-based pricing model promotes fairness since it does not look at the social status of the borrower (Hackbarth, 2014). It can also help improve the lender's profitability, by charging high prices for loans with a higher potential of default and price accordingly when the cost of capital rises. Risk-based pricing also creates a fairer marketplace (CCMC, 2021). It helps improve customer loyalty by rewarding borrowers with low credit risk with better pricing terms (CCMC, 2019). It is also said to be a good model for financial inclusion through tailoring pricing of the loans, thus, lenders can extend credit to more consumers (Hackbarth, 2014). Financial inclusion can help with economic growth and banks' profits.

Lenders used to either charge low-risk and high-risk borrowers the same price and/or reject very high-risk households before the introduction of the risk-based pricing (Edelberg, 2003). The risk-based pricing model gives the high-risk borrowers a chance to be assessed rather than being rejected upfront (Edelberg, 2003). Without the risk-based pricing, very high-risk borrowers will continue to be left out of the market, rather than be charged high premiums (Edelberg, 2003).

3.4 Risk-based pricing model

Consumer credit is sold through a customised pricing process in which the lender obtains information about a customer and the desired loan, before quoting a price (Phillips, 2013). The lender uses the information he has about the customers, those who have accepted the loan offer as well as those who have rejected it. The most common approach to pricing consumer credit is risk-based pricing (Phillips, 2013). The equation below is an extended model (Ghosh, 2012).

This paper follows Ghosh's (2012) risk-based pricing model which is like that of Phillip's (2013) short version. The model is simple and covers the important factors required when pricing a loan or credit. Following Ghosh's model, the risk-based pricing function is expressed in the following form:

Equation 4 $$\boldsymbol{r_i = r_c + m + l_i + r_s + r_f}$$

We are going to discuss equation 1 below where, r_i is the rate offered in a specific risk band, r_c is the cost of capital (opportunity cost), m is the profit margin, l_i is the risk premium, r_s is the cost of service and r_f is the cost of funds.

Cost of funds

The cost of funds refers to the interest rate that financial institutes pay on the funds that they have borrowed for them to conduct their business i.e., lending (Kagan, 2020). The lower the cost of funds the higher the profit of return. When the funds are used for loans to borrowers; that is, the bank or financial institution gets to see high profits. The bank's risk profile does play a role in the cost of funds, causing this value to differ from one organisation to another (Thoka, 2015). The cost of funds is different from the interest rate charged because banks get their extra funds mainly from the reserve bank (Kagan, 2020). The cost of funds is calculated using the following expression (Ghosh, 2012);

$$cost\ of\ funds = ((\text{Interest paid on deposit} + \text{interest paid on Borrowings} + \text{interest paid on bond and Debenture} + \text{accrued interest})/(Interest\ bearing\ liabilities))x100 \quad \text{Equation 5}$$

The components of the cost of funds equations are components of the balance sheet, the values reflect the personal banking details and not the corporate banking amounts.

Cost of capital

Cost of capital refers to the required return an organisation needs to start a project that requires capital. It measures the risk worthiness of a project. The cost of capital is a representation of the market's required rate of return on capital invested in that organisation (The strategic CFO, 2020). The cost of capital is calculated using the following expansion (Ghosh, 2012).

The opportunity cost of regulatory capital with capital-to-risk weighted assets ratio (CRAR) target at 10% is calculated by doing a series of calculations to get the individual components listed below:

- Tier I capital (%)
- Tier II capital (subordinated debt instruments) (%)
- Cost of Tier II capital at annual coupon rate (repo rate) and Tax rate

$$The\ post\ tax\ cost\ of\ Tier\ II\ capital = (Cost\ of\ Tier\ II\ capital \times (1 - tax\ rate))$$

- Risk-free return (yield on 5 years sovereign security)
- Cost of Tier I capital based on the expected return on allocated capital invested in a selected band of equities in the capital market, rated bonds, mutual funds, etc.

$$The\ weighted\ average\ cost\ of\ regulatory\ capital\ =$$
$$(70\%\ of\ cost\ of\ Tier\ I\ capital\ +\ 30\%\ of\ the\ post\ tax\ cost\ of\ Tier\ II\ capital)$$

$$The\ opportunity\ cost\ of\ regulatory\ capital\ = (cost\ of\ regulatory\ capital\ -\ yield\ on\ 5\ years\ sovereign\ security)$$

Cost of service

Cost of service reflects the total amount that must be collected in rates for the business to recover its costs and earn a reasonable return i.e., it is the cost of rendering service and can be calculated using the following expression (Ghosh, 2012);

$$cost\ of\ service = (total\ operating\ expense)/(Lendable\ resources\ as\ on\ account\ closing\ date) \quad \text{——————} \text{Equation 6}$$

Lendable resources as on account closing date refers to the deposits, bond proceeds, and borrowings.

Risk premium

The risk premium (l_i) is chosen to compensate for the expected loss rate associated with customers in that specific risk band. The risk premium is chosen with relation to the credit score categories. While in theory a lender could offer a different risk-based price to each customer due to operational and practical considerations, most lenders group customers into a relatively small number of bands (Phillip, 2013).

Profit margin/ income spread

The profit margin is the excess of selling price over costs that the lender hopes to make to remain profitable (Thoka, 2015). It indicates profit per rand sold and is expressed as a percentage. There are several types of profit margin to choose from and it plays a significant role in the pricing models.

4 PRICE SENSITIVITY REVIEW

4.0 Price sensitivity literature

Price sensitivity is defined as the extent to which demand will change with respect to the change in price of a product or service. It is commonly measured using the price elasticity of demand, which "states that some consumers would not pay more if a lower-priced option is available" (Kagan, 2020). The importance of price sensitivity it that it varies relative to other purchasing criteria, such as quality, that may rank higher than price, making consumers less susceptible to price sensitivity (Saeed, Shahid and Tirmizi, 2020).

In illustrating the effect of price sensitivity and the effect of adverse selection, Terblanche and De la Rey (2020) performed several tests using the formula below based on South African credit buying sensitivity. Price sensitivity is important when determining the price of credit because it gives the financial institutes an idea as to the right optimum price for credit and if the borrowers will be willing to take out loans at such prices.

The variables contained within the model are:

If a customer took up a loan then Y will be = 1, If a customer does not take up a loan then Y will be =0, r is the quoted interest rate, r_0 is the repurchase rate, a is the loan amount, n is the loan term, p is the probability of default, β_i is the regression coefficient.

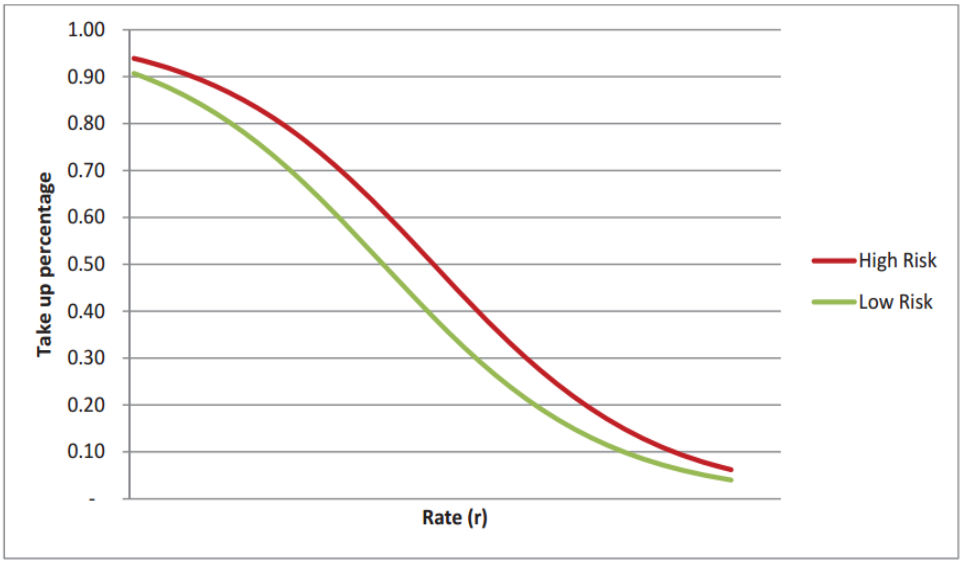
The probability of a customer taking up a loan is expressed by following the response function obtained from fitting a logistic regression model:

$$R(r, a, n, p) = 1/(1 + e^{(-(\beta_0+\beta_{1r}+\beta_{2a}+\beta_{3n}+\beta_{4p}+\beta_{5r0}))})$$

The model was used by Terblanche and De la Rey in their 2020 pricing sensitivity research paper, where R (r, a, n, p) were used to obtain a two-dimensional response function in terms of the variable r by using the variables given (a, n, and p) to the logistic regression model. The model indicates that there was an inverse relationship between the response function (R) and the variables entailed in the equation, thus when the response increases the other functions decrease. Such results from such an experiment would typically represent the expectations of many players in the financial services sector. The regression coefficient was estimated through the maximum likelihood method (Terblanche and De la Rey, 2020).

4.1 Price sensitivity comments

Figure 5: offered vs take-up, response research results obtained from Terblanche and De la Rey's research on the price sensitivity of borrowers.



Terblanche and De la Rey's found out that in credit retail industry, low-risk borrowers are more sensitive to an increase in prices compared to high-risk borrowers (Terblanche and De la Rey, 2020). Price sensitivity also varies from one person to another depending on the individual's situation (Kagan, 2020). The results can be attributed to the fact that majority of the high-risk borrowers were people with low income who might need credit to meet some of their obligations.

The other condition that might affect price sensitivity changes is the change in the repo rate as it affects the rate the banks will charge borrowers. Understanding price sensitivity allows the lender to maximise on profit and offer optimum prices to borrowers.

The graph in figure 5 above suggests an inversely promotional relationship between the quoted/offered interest rate and the take-up rate. An increase in the offer rate causes a decrease in the take-up rate, and if banks want to increase loan take-ups and increase their customer base, this relationship must be considered whenever the risk-based pricing model is used to determine the interest rate to be offered (Kagan, 2020). Research on price sensitivity can be essential to a lender using a risk-based pricing model because the research may be carried out based on the borrower's risk. Lenders will be able to have an estimate as to the borrower's likely hood of taking up the loan at the current offered interest rate.

5 EMPIRICAL RESULTS

To achieve the objectives of this research, the risk-based pricing model, National Credit Act comments together with the price sensitivity and offered interest rate relationship comments will be used. Using programming software and using real-life data from annual reports of each bank. The proposed year for the annual report is 2019 for Standard Bank and Capitec bank.

The data collected was from banking results from the two banks. The results obtained will then be compared to see the extent of discrepancy between the banks and check for the impact of risk-based pricing on the cost and availability. The price sensitivity comments will serve as a compensation for the lack of the customer response factor in the risk-based pricing model.

Table 2: The different Trans-union risk bands and their assumed risk premium.

Rating	Credit Score	Risk premium
Excellent	767 – 999	0.25 %
Good	681 – 766	1 %
Favourable	614 – 680	4 %
Average	583 – 613	6 %
Below average	527 – 582	9 %
Unfavourable	487 – 526	12 %
Poor	0 – 486	15 %

Ratings have relevant information; considering that they are related to a measure of risk exposure of high or low risk default probability, the exposure is related to the risk premium (Hilscher and Wilson, 2013). A person with a high credit score is low risk and thus the premium will then reflect the credit score and it will be low. On the other hand, a person with a very low credit score is considered to be high risk and thus the risk premium will be high. In this study, the risk premiums used are assumed to relate to the trans-union credit scores ratings, considering that the risk premium in table 2 above will apply to both banks. The following results were calculated using real-life data from the 2019 financial year-end balance sheet results and financial statement and Equity RT 2019 bank data which was public knowledge.

All the calculations below are theoretical, performed using real-life data with the assumption that both Standard Bank and Capitec bank are using the risk-based pricing model.

To calculate the hypothetical credit price, the risk-based pricing model (refer to equation 4) was used and the individual components of the model were calculated using a series of equations below.

The following are series of calculations for each bank:

Standard Bank Calculations – 2019 amounts are in Rand per million

Cost of funds (r_f)= (Interest paid on deposits + interest paid on Borrowings + interest paid on bonds and Debentures + accrued interest) ÷ Interest-bearing liabilities.

Table 3: Cost of funds data (standard bank 2019 yearend financial results).

Component	**Amount Rm**
Interest paid on deposits	65,927
Interest paid on Borrowings	1,270
Interest paid on bonds and Debentures	2,258
accrued interest	5, 494
Interest-bearing liabilities	1,419,286

Accrued interest in table 3 above is the difference between the carrying and notional value.

$$r_f = ((65{,}927 + 1{,}270 + 2{,}258 + 30{,}05\ )/1{,}419\ 286)\ x\ 100$$

$$= 5.28\ \%$$

Cost of service (r_s)= (Total operating expenses ÷ Lendable resources as on account closing date (deposits, bond proceeds, and borrowings)) × 100

Table 4: Cost of service data (standard bank 2019 yearend financial results).

Component	**Amount Rand per million**
Total operating expenses	65, 335
Lendable resources as on account closing date	
Deposits	1,395,220
Bond proceeds	24,066
Borrowings	157,371

$$r_s = ((62{,}335\ )/((1{,}395{,}220 + 24{,}066 + 157{,}371)))\ x\ 100$$

$$= 3.95\%$$

The opportunity cost of regulatory capital with a CRAR target of 10% is calculated using a series of calculations and public data such as tax rate and balance sheet data. The amount was taken from the financial year-end results which are available to the public (standard bank 2019 yearend financial results).

$$Tier\ 1\ capital = (Tier\ 1\ capital)/(qualifying\ regulatory\ capital)$$

$$= 147{,}981/169{,}983$$

$$= 87\%$$

$$Tier\ 2\ capital = (Tier\ 2\ capital)/(qualifying\ regulatory\ capital)$$

$$= 22{,}002/169{,}983$$

$$= 13\%$$

$$Cost\ of\ Tier\ 2\ capital\ at\ annual\ coupon\ rate_{2019} = 9.38\ \%$$

$$tax\ rate_{2019} = 20.6\ \%$$ (Standard bank 2019 financial results)

The coupon rate and the tax rate are then used to calculate the post-tax cost of tier 2 capital using the equation below;

$$Post\ tax\ cost\ of\ Tier\ 2\ capital\ = (Cost\ of\ Tier\ II\ capital\ \times (1 - tax\ rate))$$

$$= \big(0.0983\ x\ (1 - 0.206)\big)x\ 100$$

$$= 7.81\ \%$$

Risk-free return (yield on 5 year sovereign security) at 9%

The cost of Tier 1 capital based on the expected return on allocated capital invested in a selected band of equities in the capital market, rated bonds, mutual funds, etc. = 15.81 % (ROE obtained from Equity RT

$$Weighted\ average\ cost = 0.7x\ cost\ of\ Tier\ 1\ capital + 0.3x\ post\ tax\ Tier\ 2capital$$

$$= 0.7x\ 15.81\% + 0.3\ x\ 7.81\%$$

$$= 13.41\ \%$$

Weighted average cost of regulatory capital (70% of cost of Tier I capital + 30% of the post-tax cost of Tier II capital)

The opportunity cost of regulatory capital = cost of regulatory capital minus yield on 5 year sovereign security)

$$13.41\% - 9\% = 4.41\ \%$$

$$\text{Opportunity cost at } 10\% \text{ CRAR} = 0.1\ x 4.141\% = 0.441\%$$

Capitec Bank Calculations – 2019 amounts are in Rand per million.

Table 5: Cost of funds calculation data (Capitec 2019 yearend financial results).

Component	Amount Rm
Interest paid on deposits	3,900
Interest paid on Borrowings	4,729
Interest paid on bonds and Debentures	533
accrued interest	46
Interest-bearing liabilities	78 752

$$cost\ of\ funds = ((3{,}900 + 4{,}729 + 533 + 45.8\ )/78{,}751.9) x\ 100$$

$$= 11.69\ \%$$

Table 6: Cost of service calculation data (Capitec 2019 yearend financial results).

Component	Amount Rand per million
Total operating expenses	7,494
Lendable resources as on account closing date	
Deposits	76,443
Bond proceeds	500
Borrowings	2.2

$$cost\ of\ service = ((7{,}493\ )/(76,443 + 500 + 2.2))\ x\ 100$$

$$= 1\ \%$$

The opportunity cost of regulatory capital with CRAR target at 10% (CRAR = capital to risk-weighted assets ratio) is calculated using a series of calculations and public data such as tax rate and balance sheet data.

$$\text{Tier 1 capital} = (Tier\ 1\ capital)/(Qualifying\ regulatory\ capital)$$

$$= (20{,}989/21{,}614)x100$$

$$= 97.1\%$$

$$Tier\ 2\ capital\ = \ (Tier\ 2\ capital)/(Qualifying\ regulatory\ capital)$$

$$= (625/21{,}614)x100$$

$$= 2.89\ \%$$

$$Cost\ of\ Tier\ 2\ capital\ at\ annual\ coupon\ rate\ _{2019} = (533/4{,}583)x100$$

$$= 11.63\ \%$$

Cost of tier 2 capital was not given, thus it was calculated from the interest paid on subordinated debt and the total subordinated debt amount from the 2019 financial results.

$$tax\ rate_{2019} = 25\ \%$$

$$Post\ tax\ cost\ of\ Tier\ 2\ capital\ = \ (Cost\ of\ Tier\ II\ capital\ \times\ (1 - tax\ rate))$$

$$= 0.1163\ x\ (1 - 0.25)$$

$$= \ 8.72\%$$

Risk-free return (yield on 5 year sovereign security) at 6.9 %

Cost of Tier I capital based on the expected return on allocated capital invested in a selected band of equities in the capital market, rated bonds, mutual funds, etc. =26.51 % (ROE obtained from Equity RT)

$$Weighted\ average\ cost = 0.7x\ Tier\ 1\ capital + 0.3\ x\ post\ tax\ Tier\ 2capital$$

$$= 0.7x\ 26.51\% + 0.3\ x\ 8.72\ \%$$

$$= 21.17\ \%$$

Weighted average cost of regulatory capital (70% of cost of Tier I capital + 30% of the post tax cost of Tier II capital).

The opportunity cost of regulatory capital = cost of regulatory capital minus yield on 5 year sovereign security).

$$21.17\% - 11.63\% = 9.543\ \%$$

Opportunity cost at 10% CRAR $r_c = 0.1\ x\ 9.543\% = 0.95\%$

Table 7: Calculated individual components of the risk-based pricing model.

	r_f	r_s	r_c	m
Standard bank	5,28 %	3,95 %	0,44 %	2,68 %
Capitec bank	11,69 %	0,98 %	0,95 %	7,45 %

Table 7 above, shows the calculated components of the risk-based pricing model for both Capitec Bank and Standard bank in percentage. The profit margin (m) used for the research is the net interest margin (NIM), NIM is a profit indicator and was therefore appropriate to use in this research. The net interest margin (NIM) was obtained from the Equity RT data platform.

5.1 Results and discussions

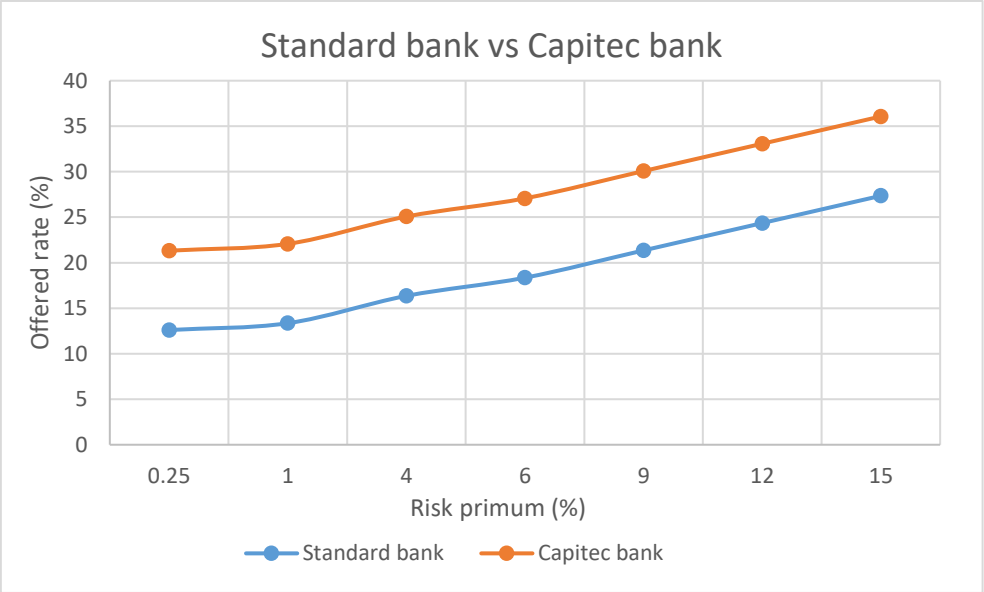
It is worth mentioning that the offered credit prices from each bank were calculated under the assumption that both Standard Bank and Capitec bank are using the risk-based pricing model. Results from table 7 were used as input to equation 1 to calculate the hypothetical offered credit prices as calculated results in table 8.

Table 8: Hypothetical offered credit prices (r_i).

Category	m	**Standard** (r_i)	**Capitec** (r_i)
Excellent	0,25 %	12,61 %	21,32 %
Good	1 %	13,36 %	22,07 %
Favourable	4 %	16,36 %	25,07 %
Average	6 %	18,36 %	27,07 %
Below average	9 %	21,36 %	30,07 %
Unfavourable	12 %	24,36 %	33,07 %
Poor	15 %	27,36 %	36,07 %

The offered credit interest rate in table 8 above shows a gradual increase in the offered rate from one category to another. Both banks show a constant increase of 3% from a “good” rate category to a Poor rate category.

Figure 6: Risk-based prices.



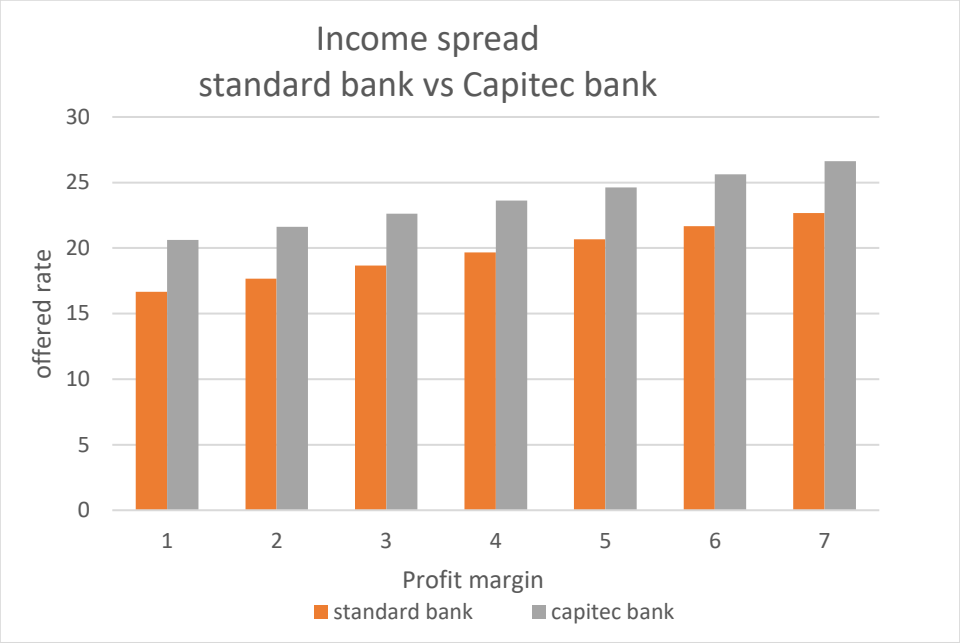
(Risk-based prices offered by standard bank vs prices offered by Capitec bank).

Figure 6 above is a graph comparing the calculated rates/credit prices offered by Standard Bank and Capitec Bank. The results indicate that the rate (credit prices) offered by Standard Bank are lower than as compared to those offered by Capitec bank. The difference may be attributed to the high NIM Capitec bank obtained in the year 2019 and the high cost of funds. In using the risk-based pricing model, Capitec seems to be more expensive than Standard bank.

The graph also shows that there is a direct relationship between the offered rate and risk premium, as the premium increase so does the rate offered, the pattern is observed for both banks. The risk-based pricing model offers a very high interest rate but allows for high-risk borrowers to get loans. The prices that are offered by both banks using the risk-based pricing model are more on the expensive side (Kroll, 2014) as far as for Capitec bank. The trend does agree with the risk-based pricing notion, that the riskier the borrower the more the borrower gets charged.

Profit margin impact

Figure 7: Standard bank vs Capitec bank income spread difference.

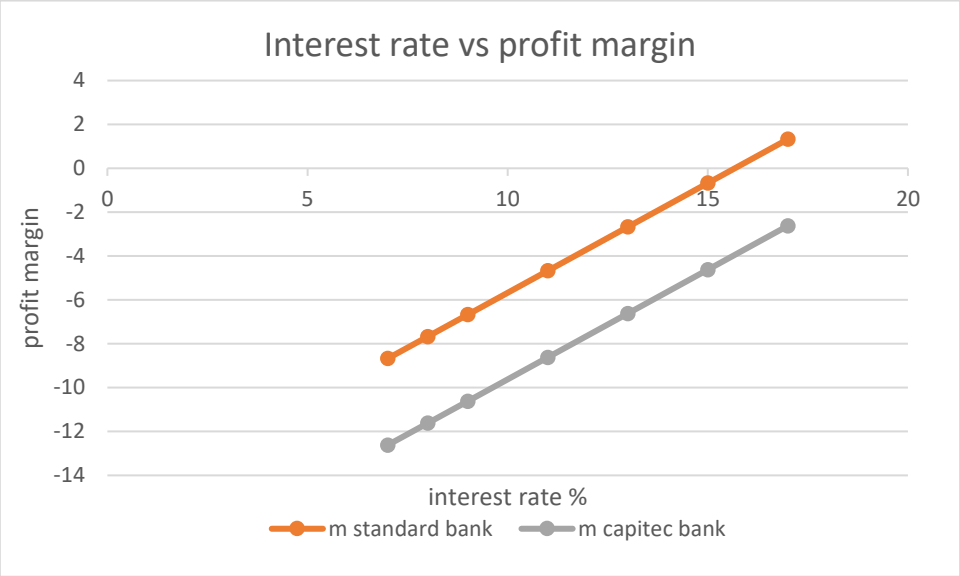


Keeping the values in table 7 the same and a constant risk premium of 6% and varying the profit margin, this will protrude the impact on the offered rate hence generate results in figure 7. The figure above shows a direct relationship between the offered rate and the profit margin, an increase in the profit margin causes an increase in the rate offered. Capitec bank offered higher interest rates compared to standard banks and this can be attributed to the high cost of funds since all the profit margins used were assumed to be the same for both banks.

Business-tech reported that Capitec bank has the least number of branches and employees, but it has the most customers to service. The high number of customers could be the reason for the high cost of service (Saeed, Shahid and Tirmizi, 2020). An increase in the operating expense causes an increase in the service cost, which can be attributed to the business making less profit than the other banks including Standard Bank, even though it has the most customers. Another factor could be that Capitec bank has been reported to have the highest “non-performing loans” compared to the total loans (Wasserman, 2020). Low profit can affect the bank’s profit margin and in return affect its offered interest rate.

Impact of the risk-based pricing model

Figure 8: Credit prices vs the calculated profit margin.



To analyse the impact of the model on the profit margin, all the calculations in table 7 were used and kept constant for each bank and a constant 6 % risk premium. Different credit prices were assumed, to calculate the required profit margin the bank would require if they offered the assumed credit price. Figure 8 above gave rise to a graph that shows the relationship between the offered rate and the profit margin. The graph reveals an increase in the offered credit prices interest rate increases the bank's profit margin indicating a direct relationship. If a bank is using the risk-based pricing model to set a necessary profit margin, the is need for the bank to thrive, offering a low interest rate to borrowers which then exposes the banks to running with a negative profit margin (PwC, 2015).

A low profit margin could mean that a company uses an ineffective cost structure and/or a weak pricing model (CFI, 2015-2021). A negative profit margin is an indication that the bank is not profitable (Murphy, 2019). If the two banks are to use the risk-based pricing model to calculate the relevant profit margin to compensate for the offered credit prices, they would have to offer interest rates above 17% (PwC, 2012). This then becomes expensive for borrowers, especially the high-risk borrowers.

National credit act (NCA) maximum interest rate

The NCA's model for the maximum interest rate that a lender can charge credit card borrowers and unsecured lending. The calculation respectively at a repo rate of 6.5% for the year 2019.

$$Credit\ facilities\ = (6.5\%\ x\ 2.2 +\ 10\%)\ per\ year$$

$$= 24.3\ \%$$

$$Unsecured\ Credit\ = (6.5\%\ x\ 2.2) + 20\%\ )\ per\ year$$

$$= 34.3\ \%$$

The NCA puts the maximum interest rate that can be charged to a borrower at 24.3 %, although this maximum interest rate is meant to protect borrowers from being charged excessive rates. This action excludes several borrowers, and on the other hand including borrowers who have fair credit scores at Standard bank and borrowers with good credit scores at Capitec bank. This analysis is based on the risk-based pricing model calculations. Based on those calculations the national NCA can cater for borrowers if borrowers are taking up unsecured loans (Cho and Lee, 2016).

According to the results obtained in the above calculations, and for the two banks to stay within the maximum set credit limit by the NCA Capitec bank needs to take borrowers with a risk premium of 1% for secured loans and offer credit to all risk categories except for the poor category to stay within the NCA limits. On the other hand, Standard Bank can have borrowers with a risk premium that is as high as 15% meaning Standard bank can be able to offer credit to borrowers across all risk categories for unsecured credit and up to 9% risk premium for secured credit to stay within the NCA limits.

6 CONCLUSIONS

The risk-based pricing model is a simple model that can be used by banks as a starting point for setting interest rates. From the results obtained, Capitec bank is slightly more expensive compared to Standard Bank. The results also suggest that for the two banks to stay within the maximum interest rate set by the NCA, Capitec bank needs to keep to a risk premium of 1% and Standard Bank can go up to a premium that is as high as 9% for secured loans. When they offer unsecured loans a premium of 12% for Capitec bank and 15% for Standard Bank would apply . These results indicate that the NCA regulations promote marginalisation of many borrowers if this model is being used.

The results also indicate that the higher the risk premium the higher the offered interest rate. A decrease in loan take up is observed if the price is high. Issues such as the model not considering the maturity of the loan and collateral could be the reason why the offered rates tend to be quite high. Collateral and maturity do have an impact on the borrower's risk. Adding collateral reduces the borrower's risk and gives the borrower favourable rates.

The FICO risk premiums are high and are directly related to the offered rate being high, maybe the credit scoring system is not the best, because people who do not have a credit history are automatically rated as high-risk. Lack of credit history has a negative impact on the people who are mostly in the rural areas and townships. Though the lack of credit history has a negative impact, risk-based pricing does have positives, the model allows for these high-risk borrowers who could otherwise be rejected to get the opportunity at getting a loan.

Changes in the risk premium and the profit margin have a significant impact on the offered interest rate. A bank requires a positive profit margin in order therefore the two components must be regulated to give borrowers fair prices.

The NCAs maximum interest rate gives banks and the borrower room to maximise profit but it marginalises a great number of borrowers in the process. The results support the risk-based pricing notion that it allows for a borrower that would normally be rejected by the banks can now be considered for loan approval. The risk-based pricing model includes high-risk borrowers by increasing the cost of credit, it rewards borrowers with low-risk and compensates lenders for lending to high-risk borrowers.

Essentially high-risk borrowers are afforded a chance of obtaining credit at very high prices and this might be off-putting. The higher the interest rate the fewer the people who are willing to take up the loans. The increase of high-risk borrowers in the credit environment due to this

model works only if the offered interest rates are not above the potential borrower's reservation interest rate. The right price on credit can affect profitability, availability and can influence borrowers to either take up the loans or not.

In conclusion, the research finding suggest that the current interest rate calculations are structured in a way that marginalises a great number of South Africa who do not have good credit scores due to lack of information that might assist in calculating their credit scores.

7 RECOMMENDATIONS

Due to the lack of the maturity factor in the model, it is recommended that maturity of the loan be included in the model. Incorporating the effects of adding collateral to the model could assist when pricing secured loans. It is also recommended that other forms of risk factors such as the liquidity risk that affect banks should be considered. Future research should also focus on finding a suitable model to calculate the risk premium for people with little to no credit record, like people in the rural and township areas. Future research could also look at how risk based pricing could affect the demand of loans in the market if it were be implemented. Because of its simplicity, it can be a good model to use as an interest rate offering starting point for very high-risk borrowers.

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