Banking Cost Efficiency, Banking Sector Development and Economic Growth of SADC Countries

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DECLARATION

I, Zvikomborero Nyamazunzu, hereby declare that this thesis is my own original work, and that it has not been submitted, and will not be presented at any other university for a similar or any other degree award. I also declare that I am fully aware of the North-West University's (NWU's) policy on plagiarism and research ethics and I have taken every precaution to comply with the regulations. I have obtained an ethical clearance from the NWU's Research Ethics Committee and my ethics number is: **NWU-00547-16-S9 - Z Nyamazunzu.**

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CERTIFICATE OF ACCEPTANCE FOR EXAMINATION

This thesis titled "**BANKING COST EFFICIENCY, BANKING SECTOR DEVELOPMENT AND ECONOMIC GROWTH OF SADC COUNTRIES**" submitted by **Zvikomborero Nyamazunzu**, student number **27086119,** of the Department of Economics in the Faculty of Economic and Management Sciences, is hereby recommended for acceptance for examination.

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ABSTRACT

This study explores the relationships among banking cost efficiency, banking sector development and economic growth in the Southern African Development Community (SADC) region. The study sought to provide answers to four sequentially structured questions: At what levels of cost efficiency do SADC banks combine their input factors – labour, capital, deposits, borrowings and other funding – to produce loans, interest and non-interest income? How have these cost efficiencies varied over the years, particularly during the pre-global financial crisis era and in the post-crisis period? In what direction, magnitude and significance do cost efficiency levels in the region change as a consequence of internal innovations, differences in the depth of banking sector development, macroeconomic environment, and quality of institutions? What is the nature of the relationship between banking cost efficiency, banking sector development indicators and economic growth? To shed light on these questions, an unbalanced panel of 12 SADC countries` banking data for the period 2005 - '15 for 63 sampled banks, totalling 693 observations was examined. The starting point was to employ the revised DEA procedure to compute the cost efficiency measures and further explore the variations in cost efficiency behaviour between time periods, using the Wilcoxon signed ranks test. The study provides evidence that banking cost efficiency is 77% in the region, with Namibia the most efficient banking sector and Mauritius the least efficient. Wider variability in efficiency performance is particularly observed in Angola, Botswana, Madagascar, Mauritius, Mozambique, South Africa and Zambia, highlighting greater scope for improvement in these countries. Bank managers, bank supervisors and policy-makers in the SADC region are implored to emulate and learn best practices from Namibia. In addition, the evidence shows that pre-crisis efficiency measures were significantly lower than those of the post-crisis period by 7.6%, implying that banking in the region has become increasingly efficient over time. Further examination of cost efficiency to understand their environmental factors using the censored Tobit regression reveals that bank cost efficiency is significantly and positively influenced by increased intermediation efficiency, high profitability, foreign ownership, and a stable macroeconomic environment of high growth, while negative influencers include low liquidity risk, poor asset quality or high credit risk, and increased systemic risk. The study also revealed that banking efficiency in the region is positively and significantly affected by political instability. Besides their statistical insignificance, large banks and highly diversified banks are found to be relatively more cost-efficient. Moreover, the results showed that high capital regulation in the banking industry inhibits cost efficiency; however its effect turned out to be statistically insignificant. Furthermore, the study reveals a positive and significant link between banking cost efficiency, banking inclusion and real economic growth in the region, while financial deepening exerts a negative effect. So we submit that economic growth in the SADC region is inextricably intertwined with the efficiency with which banks operate and the nature of banking and financial development in the economy.

Keywords: banking efficiency, banking sector development, cost efficiency, data envelopment analysis (DEA), economic growth, SADC.

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ABSA	Amalgamated Banks of South Africa
ADF	augmented Dickey Fuller
ADF-PP	augmented Dickey-Fuller–Phillips-Perron
AE	allocative efficiency
BCC	Banker, Charnes and Cooper
BER	Bureau for Economic Research
CBZ	Commercial Bank of Zimbabwe
CCR	Charnes, Cooper and Rhodes
CD	cross-sectional dependence
CE	cost efficiency
CEMAC	Central African Economic and Monetary Community
CPI	consumer price index
CRS	constant returns to scale
CU	credit unions
DEA	data envelopment analysis
DEAP	data envelopment analysis programme
DFA	distribution free approach
DMUs	decision-making units
DOLS	dynamic ordinary least squares
DPIN	decomposing productivity index numbers
DRC	Democratic Republic of Congo
DW	Durbin-Watson
ECM	error component model
EE	economic efficiency
EU	European Union
FBC	First Bank Corporation
FDH	free disposal hull
FEM	fixed effects model
FICA	Financial Intelligence Centre Act
FMB	First Merchant Bank
FNB	First National Bank
G20	Group of Twenty

GDP	gross domestic product
GDPP	gross domestic product *per capita*
GFC	global financial crisis
GMM	generalised method of moments
HHI	Herfindahl-Hirschman index
IMF	International Monetary Fund
ICICI	Industrial Credit and Investment Corporation of India
IFS	international financial statistics
IPS	Im, Pesaran & Shin
KLSE	Kuala Lumpur Stock Exchange
LLC	Levin Lin and Chu
LP	linear programming
LSDV	least squares dummy variable
MCB	Mauritius Commercial Bank
MSB	Malawi Savings Bank
MENA	Middle East and North Africa
MLE	maximum likelihood estimation
NBM	National Bank of Malawi
NMBZ	National Merchant Bank of Zimbabwe
NPLs	non-performing loans
OBS	off-shore balance sheet
OIBM	Opportunity International Bank of Malawi
OLS	ordinary least squares
OTE	output technical efficiency
PBBANK	Public Bank Berhad
PE	profit efficiency
POLS	pooled ordinary least squares
REM	random effects model
RHBCAP	RHB Capital Berhad
RISDP	Regional Indicative Strategic Development Plan
ROA	return on assets
ROAA	return on average assets
ROE	return on average equity
SADC	Southern African Development Community

SAP	structural adjustment policies
SBI	State Bank International
SBM	State Bank of Mauritius
SCOB	state owned commercial banks
SEDA	Small Enterprise Development Agency
SFA	stochastic frontier approach
SME	small and medium-sized enterprises
SMMEs	small, medium and micro-sized enterprises
SSA	sub-Saharan Africa/African
TE	technical efficiency
TFA	thick frontier approach
US	United States
VRS	variable returns to scale
WB	World Bank

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

The efficiency with which the banking sector or generally the financial sector operates in an economy is a critical factor in the development process of a country, region, continent or, indeed, the entire globe. Leaving the banking sector unmonitored may present dire consequences for the global economy. The 2007-'08 US sub-prime financial crisis that started with a single country demonstrated the magnitude of the catastrophe that could befall not only the host country but the entire globe. Mercan *et al* (2003) argue that the frangibility and delicateness of banking institutions and the fact that they are regarded as "institutions of confidence", affects not only banks but the whole economy. Kablan (2011) states that in sub-Saharan Africa, banks are the most fundamental financial intermediaries. So, if the banking sector, which assumes such a critical role in the financial system, is inefficient in its fundamental operations, that country's developmental aspirations will not be realised. Maredza and Ikhide (2013a) state that the growth of a country is strongly dependent on the soundness of the banking system. Efficient and well-managed banking sectors contribute towards growth through their role of efficient resource allocation and risk diversification. I also hypothesise that a bank`s cost of intermediation has a significant influence on economic growth via its impact on banking inclusion at both household and firm levels.

One fundamental aspect of the banking landscape that has drawn growing interest in recent years is banking efficiency. There are four main types of efficiencies that commonly dominate the literature on banking performance: technical efficiency, allocative efficiency, cost efficiency, and profit efficiency. A bank is considered technically efficient if it produces a given set of outputs (such as customer loans, interest revenue, non-interest revenue) using the fewest possible input resources (such as labour, deposits, capital, and operating costs). In contrast, allocative efficiency measures the degree to which a firm's resources are directed towards activities with the highest societal value (Ncube, 2009). Conditional on the objective at hand, a researcher can decide to explore efficiency from the profit or cost viewpoint. Profit efficiency measures the extent to which a firm generates the maximum attainable profit given prices of its inputs and outputs. So if the profits of a given bank are less compared with those of the best-practice bank under comparable conditions, that bank is deemed profit-inefficient. Cost efficiency on the other hand assesses the degree to which a bank's

actual costs are close to the best-practice bank's cost under similar conditions. An inefficient bank produces at costs higher than the cost of the best-practice bank. This concept of cost efficiency constitutes the main focus of this study.

At both the micro and the macro level, the need to ensure high banking efficiency within a country is important for several reasons. At the macro-level, banking institutions play an intermediary function by accepting deposits from the public and providing loans and other forms of credit to both the household and business sector. Cost inefficiency constrains access to cheaper and affordable finance, making worthwhile investment appear unprofitable, thus slowing economic growth. Hence, banking institutions act as critical channels of investment in their provision of credit and loans to businesses. Consequently, cost efficient banking institutions are expected to boost demand for both short- and long-term financial services like mortgages, business loans, car finance, insurance and overdraft facilities, stimulating consumption expenditure and, it is expected, economic growth. On the other hand, banks that are unproductive and inefficient come down to under-provision of such funds at the expense of key productive sectors. Greenberg and Simbanegavi (2009), state that the banking system also services the economy by being the primary conduit of monetary policy. Inefficiency on the part of financial institutions tends to diminish the effectiveness and success of monetary policy. At the household and firm level, banking inefficiency generally acts as a brake on efforts intended to expand banking and financial inclusion.

The SADC region was chosen for a variety of reasons. Firstly, banking in Southern Africa is the most advanced in Africa. In Southern African, Beck and Cull (2013) note that Mauritius and South Africa have well-developed banking systems. In particular, South Africa`s banking system is the largest and most advanced in the whole of Africa. In 2010, South Africa`s largest four banks represented 49% of the total assets held by Africa`s largest 100 banks at the time (KPMG, 2013). Hence the SADC region is dominant in African banking. It is envisaged that the key findings and policy recommendations from exploring the SADC region will contribute lessons for enhancing cost efficiency, foster banking sector development and thereby expanding growth in the rest of Africa and other developing economies. Secondly, bank account penetration or access to a bank account – regarded as a doorway to a host of other financial products – is highest in Southern Africa compared with any other region of Africa. In 2012, Demirgüç-Kunt and Klapper (2012), found the ratio of adults who had a bank account at a formal institution to be 51% in Southern Africa in comparison with

Central, North, Western and East Africa which had 11%, 20%, 23% and 28% respectively. It is for this reason that I also hypothesise that bank cost efficiency has a potential to increase growth via its impact on banking inclusion through expanded access to the unbanked and underbanked.

1.2 STATEMENT OF THE PROBLEM

Poor economic growth performance, not only in Africa but the world over, has been a huge challenge, particularly in the aftermath of the 2007-'08 global financial crisis. The World Bank (2018) reported the growth rate for the sub-Saharan African (SSA) region as being 1.3% in 2016 and 2.4% in 2017, with an estimated rise in growth to 3.2% in 2018 and to 3.5% in 2019. Although there is a slight improvement, growth in the region remains weak as it falls short of the regional target of 7% (African Economic Outlook, 2018, p9). According to World Bank (2018), the region is also still experiencing negative *per capita* income growth, weak investment, and a decline in productivity growth. In recent times, this problem of low growth has been exacerbated by oil and commodity price fallout, which has severely affected oil exporting countries in particular.

The World Bank study "Making Finance Work for Africa" (2006, p3) suggested two approaches:

> "*Economic growth is the surest way to a substantial and sustained reduction in poverty in Africa; policy for long-term growth requires focusing on the larger and more formal parts of the financial system . . . but while even growth-enhancing policies are beginning to have their effect, improving the access of low-income households and micro-entrepreneurs to financial services should become an additional central focus of financial sector policy*."

In a study of 10 middle income countries, Chen (2009) showed that on average banks have the potential to save 20% to 30% of their total costs if they operate efficiently. Through efficiency, improvement additional resources are made available without actually looking for additional resources. If resources are being wasted, an improvement in efficient use is equivalent to additional resources. The World Bank study (2006) noted that high monthly service fees and high minimum bank balances preclude a large number of African people from having access to formal financial services. Deloitte (2004) notes that banking fees in SADC, particularly in South Africa, were the world's highest, accounting for 2% of an av-

erage individual`s gross income. We expect that the benefit of a decrease in a bank`s operational cost will be passed on to consumers, both retail and corporate. We expect that such cost benefits would then result in increased economic growth via consumption expenditure, investment and interest rate channels. Ikhide (2008) states that narrow interest spreads (increased intermediation efficiency) stimulate increased demand for investment loans. In the past decade, most governments have encouraged entrepreneurship via the promotion of small, medium and micro-sized enterprises (SMMEs) as a stimulant to attaining high growth. According to a study conducted by Bureau for Economic Research (BER, 2016) commissioned by the Small Enterprise Development Agency (Seda), such small businesses are significant drivers of economic growth, innovation, and job creation. I hypothesise that an efficient and well developed banking institution hold great potential in supporting such businesses and the general public via their efficient resource allocation and risk diversification.

Chen (2009) states among other reasons that the depth of financial development and macroeconomic stability have an important role in affecting bank efficiency levels. Africa is generally plagued by a number of developmental issues affecting its banking and financial sectors. These include the need to address Africa`s challenges with domestic solutions – improving financial inclusion for low-income and poor households and micro entrepreneurs. One study by the World Bank (2006) identified high transaction costs and information asymmetry as being among the key challenges related to banking exclusion in Africa. It was noted that scarcity of information and its poor quality concerning the risks of individuals are a huge barrier to evaluating creditworthiness. A study by Demirguc-Kunt and Klapper (2012) showed that relaxing or reducing requirements for documentation had the potential to improve the proportion of the adult population with a bank account by 23 percentage points in sub-Saharan Africa. Their study therefore recommends the relaxation of documentation requirements as one solution to improve access. These and other related developmental issues in banking are explored comprehensively in this present study.

1.3 OBJECTIVES OF THE STUDY

The overarching objective of this study is to provide an exposition of banking sector development issues in the SADC region and to determine the level and drivers of banking cost efficiency in the region and to investigate their effect on economic growth in the SADC countries. The specific objectives of this study are to:

- determine cost efficiency measures of banking institutions in the SADC region using the deterministic DEA technique.
- examine whether there has been any significant changes in the cost efficiency of the SADC banks between the pre-global financial crisis period and the post-crisis period.
- analyse the fundamental environmental factors (bank-specific, macroeconomic and institutional variables) driving cost efficiency in the SADC region.
- establish the nature of the relationship between banking cost efficiency, other banking sector development indicators and economic growth in the SADC region.

1.4 HYPOTHESIS OF THE STUDY

These null hypotheses are investigated in this study:

- Bank cost efficiency for the SADC region did not improve significantly during the period of study.
- There was no significant change between pre-crisis and post-crisis bank cost efficiency.
- Bank-specific, banking sector, macroeconomic and institutional variables have no significant effect on efficiency.
- Banking cost efficiency and other banking sector development indicators are not preconditions for economic growth in SADC.

1.5 CONTRIBUTION OF THE STUDY

The contribution of this study is fourfold. Firstly, studies on bank efficiency and banking sector development are relatively limited in Africa. Most such studies have concentrated on advanced economies, in particular the US and Europe. Kiyota (2011) cites a lack of quality data, small numbers of banking institutions and the low level of financial development among other reasons why bank efficiency studies are few in Africa. This particular study contributes to the literature by exploring developmental and institutional factors in the banking sector, like financial inclusion, volume of credit to the private sector, good governance and political stability. To our knowledge, this study is the first of its nature to complement

previous African banking studies by focusing only on the SADC region using recent data from Bankscope, spanning the period 2005-'15.

Secondly, this present study is different in that while it attempts to generate cost efficiency indices empirically and to determine their effect on economic growth, it exploits the seven-year period of "excessive regulation" to evaluate the behaviour of cost efficiency in sampled African banking institutions. The post-crisis period was characterised by high regulation in a bid to prevent the crisis effects from spiralling out of control. So one expects an average increase in post-crisis cost inefficiency or costs of intermediation for banks, due to the implementation of Basel capital regulations, domestic regulation and the supervision policies of central banks.

The third important contribution of this study is implanted in the contemporaneity of the research questions to be addressed. An unstudied but vital issue is whether banking efficiency makes a significant contribution to economic growth in the SADC. It would be worthwhile to compute the "efficiency elasticity of growth" for the SADC so as to define "best practice" countries for others to emulate for improvement.

The last distinctive contribution in this study is entrenched in the multifaceted methodological approach to be adopted. Traditionally efficiency has been measured using cost-to-income ratios. However, while ratios have the obvious merit of being relatively simple and straightforward, Ncube (2009) argues that they do not give sufficient insight into actual efficiency. So there is a need to use more robust techniques which have been proved to be superior to ratio analysis. The revised DEA technique will be applied in the first stage to generate cost efficiency indices.

1.6 ORGANISATION OF THE STUDY

This study is organised into eight chapters: Chapter 1 is an introduction. Chapter 2 is an overview of SADC banking sector developments and macroeconomic environment. Chapter 3 provides a comprehensive theoretical framework to the conceptualisation of efficiency and an empirical literature review related to bank efficiency, financial sector development and economic growth. Chapter 4 describes the data, discussion of the first stage's non-parametric approach and the second stage's panel data estimation techniques. Chapter 5 presents and analyses the CE levels from the DEA. The Wilcoxon signed rank test results will also be

presented and discussed in the same chapter. In Chapter 6, the efficiency measures obtained from the first stage are then used as regressors in the second stage analysis using the dynamic panel censored Tobit estimations. The results are presented and discussed in the same chapter. In Chapter 7, the results of running the efficiency-growth nexus using panel data models will be reported, interpreted and discussed. The key findings, policy recommendations and suggestions for further research are summarised in Chapter 8.

CHAPTER TWO

OVERVIEW OF SADC BANKING SECTOR DEVELOPMENTS

2.1 INTRODUCTION

This chapter focuses on providing an overview of the banking sectors among SADC countries as well as the corresponding economic performance of each country. The trends in economic growth are commented in line with the trends in banking sector performance, notably, the deepening of the financial system and its efficiency. The chapter is broadly divided into: regulatory frameworks among SADC countries; banking sector developments; macroeconomic performance; and a chapter summary.

2.2 BANKING SECTOR DEVELOPMENTS

Banking sectors around the world are known to be innovative, always transforming; very fragile, susceptible and a breeding ground of many crises; complicated in terms of business models – how to raise profits without neglecting or harming any part of the population (Keiding, 2016). Access to finance *per se* has been recognised more as a "public good", with governments calling for more financial inclusion as a vehicle to the economic emancipation of the poor and marginalised.

Key developments within the sector include changes in and the adoption of regulations, competition, and efficiency. The following sub-sections focus on each of the selected key indicators and compare them across the selected panel of SADC countries.

2.2.1 Regulation

Given the developments mentioned above, banks have been observed to be becoming increasingly opaque as vertical and horizontal integrations come into effect (Mishi, 2016; Keiding, 2016). Further, there is need to remain relevant and provide clients with a kind of "one-stop shop", for diversification, and a heightened need for regulatory framework adjustments. Unfortunately, the revisions in regulations are lagged, as changes are only effected in response to catastrophic events – which in some instances never recur – not because they have been prevented by new regulations, but because the virtuous transformation cycle has moved.

Nyantakyi and Sy (2015) observe that, since the early 1980s, many African countries have implemented financial sector reforms, including SADC countries. The authors further observe that the reforms were part of the proposed structural adjustment policies (SAP) of the Bretton Woods institutions (the IMF and the World Bank) that entailed restructuring and privatising state-owned banks. It is however noted that the reform policies also included ancillary policies loosening entry and exit controls, overhauling of supervisory and regulatory frameworks in the banking sector (Nyantakyi & Sy, 2015). Allowing free entry into the banking sector, giving autonomy to commercial banks, and permitting private ownership of banks were among the reforms implemented among Africa economies (Odhiambo, 2011),

With the desire to be connected to the global banking system, many countries have adopted international regulatory standards and within the banking sector, the Basel regulatory recommendations take centre stage. The Basel Accords are a set of recommendations with regard to capital adequacy, supervisory and market discipline (BCBS, 2012). International convergence of bank capital regulation started with the 1988 Basel Accord on capital standards (Basel I). There have been two further Basel Accords (Basel I ran from 1988 to 2006; Basel II 2006-'12 and the current Basel III 2013 to the present). Basel II, introduced on 1 January 2007, aimed at considering banks' own assessments of risk when setting capital requirements (the regulation had a more sensitive risk weighting). Basel II has been criticised for focusing strongly on micro-prudential regulation (financial solvency in individual institutions) and paying minimal attention to macro-prudential regulation regarding the financial system.

A criticism that became apparent with the advent of the 2007-'08 global financial crisis. The crisis highlighted the weakness of Basel II in the context of the fallacy of composition , it can happen that banks act in a manner that individually should keep them safe, but collectively makes the system vulnerable and unstable. This led to Basel III, which maintained the same pillars as in II but laid more emphasis on disclosure to allow market and depositor disciplining of banks (Nyantakyi & Sy, 2015; Mishi, 2015). The implementation period for Basel III was 2012-'17 (BCBS, 2012). The differences across the accords reflecting the adjustments over the years are summarised in Table 2.1.

TABLE 2.1. SUMMARY OF BASEL ACCORDS

	Basel I	Basel II	Basel III
Pillar 1	minimum capital and liquidity requirements (at 8%)	minimum capital and liquidity requirements	minimum capital and liquidity requirements
Pillar 2	-	risk management and supervision	risk management and supervision
Pillar 3	-	market discipline	market discipline
Adjustments	-	Additional two pillars	Adjustments in the amounts of capital (increase the total capital ratio) from 8% to 10.5% by 2019, to increase the Tier 1 capital ratio (Core Tier 1 ratio from 4.5% to 6% by 2019), and information to be disclosed.

There is a keen interest in implementing the Basel Accords by the Group of 20 (G20) economies,[1] however in Africa, only South Africa is a member. In essence the G20 is an international setting that brings together the world's leading industrialised and emerging economies, with the group accounting for 85% of the world's GDP and two-thirds of its population. Most economic policies and practices around the globe are driven by this group and it has been influential even in non-member economies.

It is important to note, however, that in Africa, only two countries (which also happen to be SADC members – Mauritius and South Africa), had implemented all the requirements of Basel II by 2015 (Sunday Standard[2], 2015). The rest of the countries were still under the guidance of Basel I and were only working on plans to implement Basel II (Nyantakyi & Sy 2015). The relevance of the accords to African countries has been questioned, more so in the face of the paradox of significant improvement in banking stability among African economies, despite their lagging behind in respect of Basel Accords implementation. Intuitively one can argue that rules and requirements proposed under the Basel Accords are less applicable in Africa. South Africa is the only member of the SADC that is part of the G20 and a

[1] The members of the G20 are: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, the Republic of Korea (South Korea), Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States and the European Union.
[2] http://www.sundaystandard.info/does-bob-need-implement-basel-ii

signatory to the Basel Accords. It is important to note that the South African financial system is one of the best in the world and is highly regulated. It has been rated "compliant" with regard to implementation of the Basel Accords (IMF, 2015).

2.2.2 Financial depth

Financial deepening refers to an increase in provision of financial services, with a wide range of services targeted to all levels of society, and it is of interest to economic development experts. According to Nyantakyi and Sy (2015), financial deepening, the process by which agents are able to use financial markets for savings and investment decisions, has been found to be linked strongly to economic growth. The linkage is argued to be through enhancing the access of firms and businesses to long-term investments.

Financial deepening emanates from financial institutions and financial markets. The literature has provided four main indicators for financial deepening in financial institutions, namely (as a percentage of GDP): private sector credit, pension fund assets, mutual fund assets and insurance premiums (life and non-life). On the other hand, deepening in financial markets is proxied by number of indicators. The indicators include stock market capitalisation to GDP and stocks traded to GDP. The other indicators are (as a percentage of GDP): international government debt securities; total debt securities of non-financial corporations and total debt securities of financial corporations (Nyantakyi & Sy, 2015).

There are various indicators used to gauge financial deepening. These include domestic credit to the private sector as a percentage of GDP. This indicator, the most popular one in the literature, captures claims on the private sector by deposit-taking financial institutions relative to economic activity. As a result, the measure indicates the role played by financial intermediaries in channelling savings to private sector investors. Higher value, more depth, implies the provision of productivity-enhancing financial services and is good for the economy (King & Levine, 1993). Table 2.2 below summarises the financial deepening component indicators.

TABLE 2.2: FINANCIAL DEEPENING COMPONENT INDICATORS

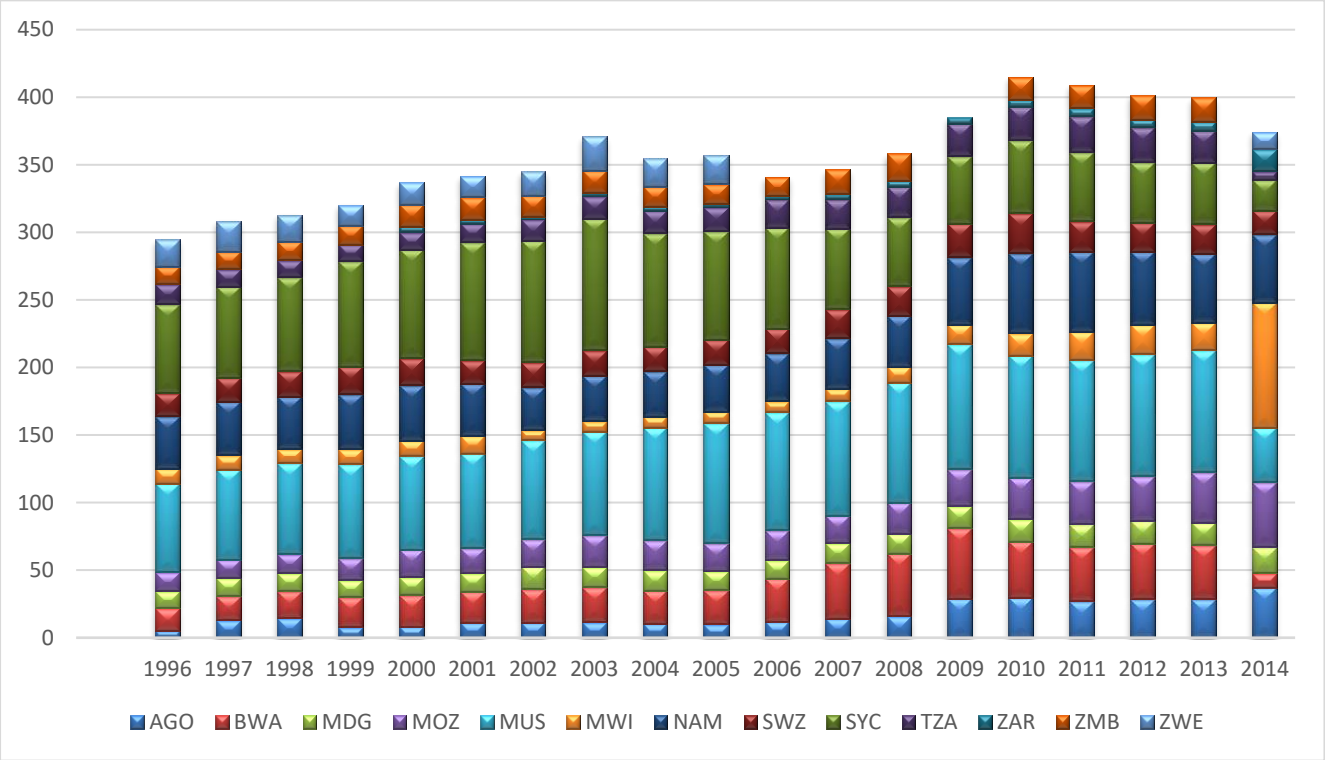
Financial Institutions	Financial Markets
1. Private-sector credit (% of GDP) 2. Pension fund assets (% of GDP) 3. Mutual fund assets (% of GDP) 4. Insurance premiums, life and non-life (% of GDP)	1. Stock market capitalisation to GDP 2. Stocks traded to GDP 3. International debt securities government (% of GDP) 4. Total debt securities of nonfinancial corporations (% of GDP)

The focus of this study is on the banking sector, so it focuses particularly on the financial deepening of financial institutions. It is also important to note that over and above the listed proxies, the literature suggests others. For example, Mosley (1999), measured financial depth using bank deposits and M2 as a percentage of GDP, finding that the two indicators have varying degrees of response to financial sector reforms.

The review of the trends in financial deepening starts with deposits to GDP indicator. Figure 2.1 presents financial deepening measured by deposits as a percentage of GDP. Historically, taking a look since the 1980s, financial depth in Angola, Mozambique, Swaziland and Tanzania witnessed steady increase in financial deepening, as measured by deposits to GDP ratio, until 2013. Madagascar, Botswana, Seychelles and Zimbabwe experienced fluctuations in the deepening measure over the study period. On the contrary, Malawi had one of the shallowest financial systems, which started deepening slowly in about 2008, and became the deepest system as proxied by deposits to assets by 2014.

Generally, countries have been deepening and rebounding to shallow levels. For example, Tanzania suffered a sharp contraction of financial depth in the second half of the 1980s before recovering almost half of the fall in the mid-1990s. One country that has a notable stable trend across the study period is Namibia, which did not witness much fluctuation. There are various factors that could explain the trends. However it has been observed in the case of Zambia, for example, that efforts to curtail the deterioration of financial deepening through reforms can fail. It is important to note that in the region, financial deepening has been fluctuating with a robust increase between 1996 and 2003 and a subsequent decline until 2007. Financial dependence started increasing again up to a peak in 2010.

FIGURE 2.1: TRENDS IN FINANCIAL DEEPENING- DEPOSITS AS A PERCENTAGE OF GDP



Source: Global Financial Development Data (GFDD), World Bank (2017)

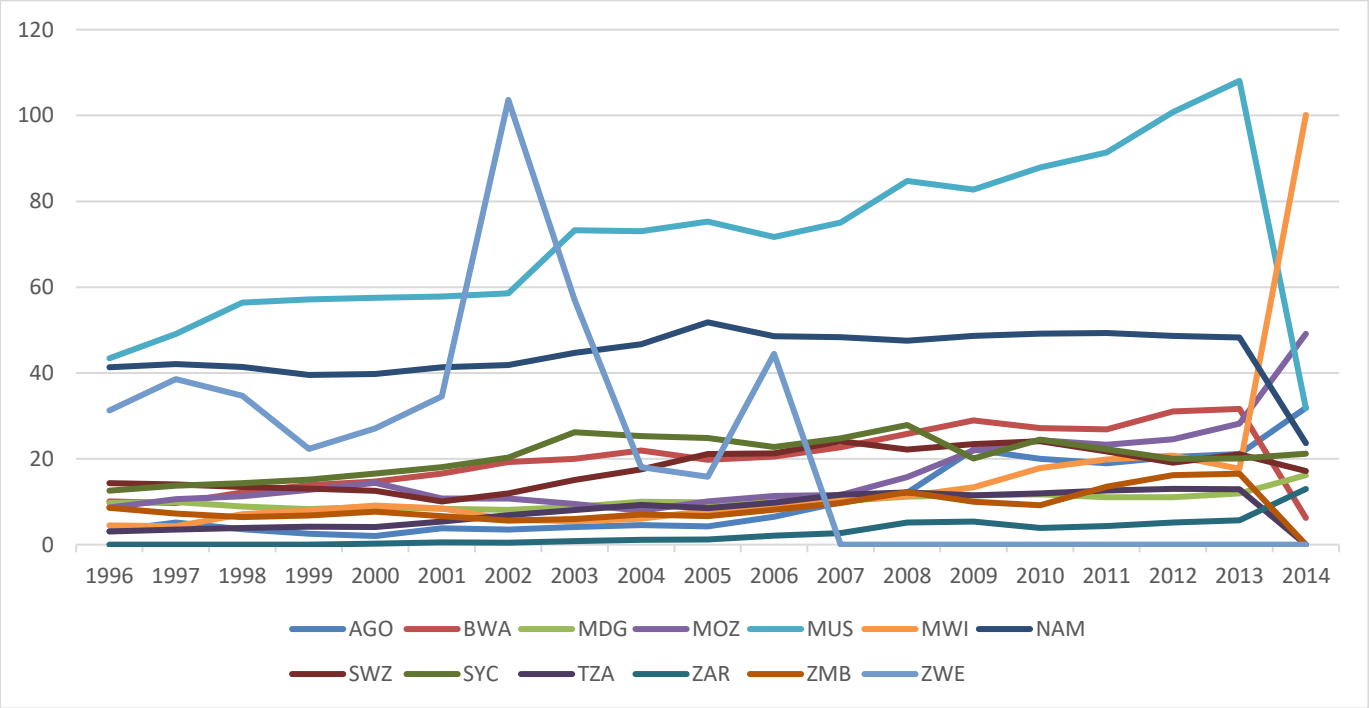
Another proxy reviewed is domestic credit to private sector as a percentage of GDP. Figure 2.2 displays the trend over time, comparing the selected countries. Based on this proxy for financial deepening, Mauritius is on top, however with a sharp slump in 2014. Looking at the graph, from 1996 to 2013, Mauritius had the deepest financial sector, being overtaken by Zimbabwe in 2001-'03, and recently, in 2013, by Malawi. It can also be observed that Namibia has been consistently No 2 in terms of financial deepening over this period. On the other hand, other countries had relatively low and similar levels of deepening. The trend in domestic credit to the private sector as a percentage of GDP is similar to that observed with deposits to GDP in Figure 2.1 above, especially with regard to Malawi, Mauritius and the region at aggregate level. Different measures of financial deepening are used for robustness checks, and indeed, they confirm one another.

Overall, the region experienced ups and downs. There was a steady rise from 1996 to 2003, followed by a slowdown between 2004 and '06, a rise again from 2007 to '10, and then followed by a persistent downward trend until 2014. In summary, the SADC region's financial system has been becoming shallower every year over the past five years. High levels of

unemployment, exacerbated by the global financial crisis (2007-'10) and persistently high financial exclusion may be the drivers for the shallow financial system.

In comparing different sub-regions in Africa, Nyantakyi and Sy (2015) observe that West and East Africa record the lowest ratios of 20% and 21% respectively, while Southern Africa has a relatively high ratio of 43%. The high ratios in Southern Africa are arguably driven mainly by the high financial system deepening of Mauritius, Madagascar, Namibia and Botswana as top performers, based on deposits to GDP.

FIGURE 2.2: DOMESTIC CREDIT TO PRIVATE SECTOR AS A PERCENTAGE OF GDP



Source: Global Financial Development Data (GFDD), World Bank (2017)

On the other hand, domestic credit to private sector as a percentage of GDP reflects the financing opportunity available to the private sector to grow and contribute to the overall performance of the economy. The higher this measure is, the better the economy. The better the private sector gets and the bigger role it has in the national economy, as more financial resources are available to the private sector. Arguably this is also better for the health and development of that country's economy. Mauritius and Namibia have performed relatively better than other SADC countries over the period and the expectation is that their economies would be performing well too (we will turn to economic performance later in the chapter).

To put this ratio into perspective, in 2013 China had a ratio of domestic credit to private sector/GDP of 133.7% and has succeeded in high economic growth. In the same year, the respective ratios for Australia, the US and the UK were 122.4%, 183.6% and 176.8%. These are well-developed and advanced economies because private companies have great financing. In the SADC overall, only Mauritius has shown a persistent upward trend over the study period, going beyond 100% in 2013, while Zimbabwe reached the 100% mark only in 2002. Namibia is also remarkable with a steady ratio above 40% over the study period. Most of the countries fall below 30% of domestic credit to private sector as a percentage of GDP, which explains the poor economic growth trajectories of most economies in the region.

Mauritius is reported to have been achieving high values in terms of financial deepening due to increasing financial inclusion over the years. Financial inclusion has been increasing with regard to access and a wide variety of services or products. As of 2014, the country was ranked 26th worldwide, based on financial sector depth measured by domestic credit to private sector as a percentage to GDP (Nyantakyi & Sy, 2015). Financial deepening in Mauritius has been driven from the financial institutions side, a sector which is dominated by commercial banks with assets amounting to MuR 1 125 billion or 278% of GDP. The financial markets component is, however, noted to be on an increasing trend, and this will result in deeper financial development (PWC, 2016).

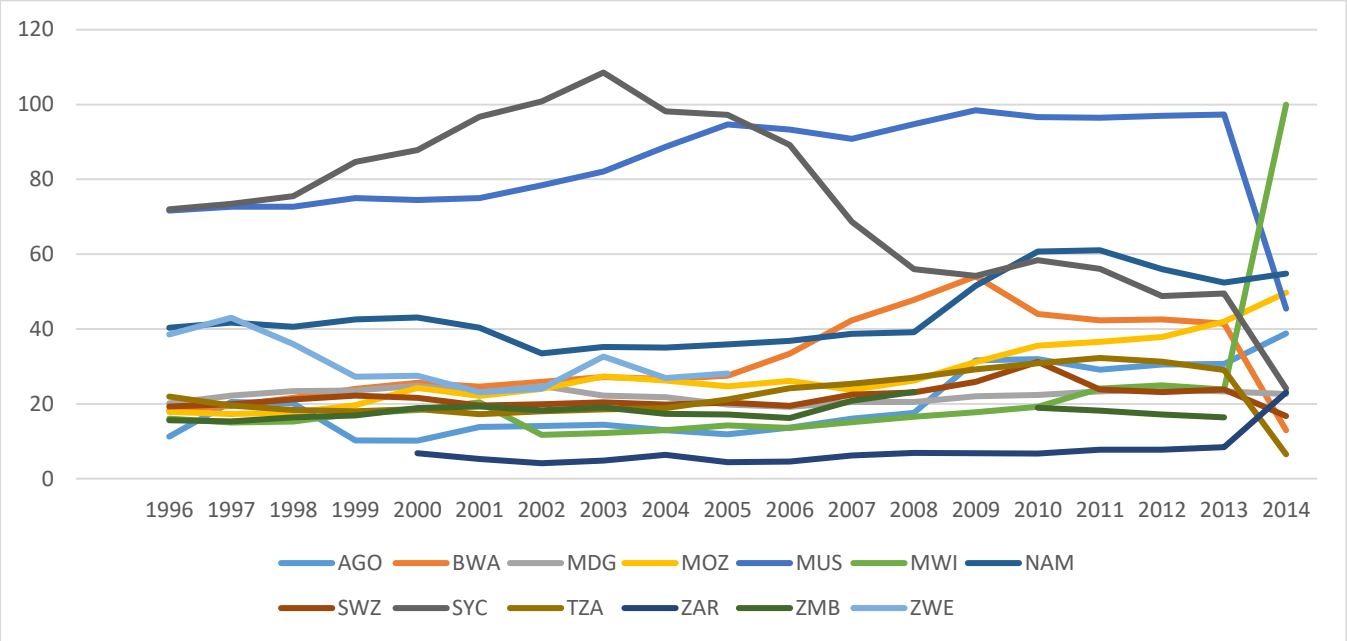
The story of Mauritius should give hope to its SADC counterparts, as it stands out as one economy that has overcome many obstacles and improved significantly. The economy was in the past heavily reliant on sugar farming, but has diversified since independence, venturing into tourism, textiles, ICT and financial services. As a result of its improved economic performance, the country has managed to widen its social welfare net, with the result that only 1% of the population is considered poor. As indicated earlier, from the banking sector perspective, Mauritius is one of two countries in Africa that are well ahead in terms of implementing Basel III recommendations. Its banks are observed as having 17% of Regulatory Tier I capital to risk-weighted assets, well above the proposed Basel III requirements. The sector has been improving from the regulatory perspective, as well as in the provision of services (IMF, 2008; Nyantakyi & Sy 2015). Unfortunately, the same cannot be said for South Africa, despite its similar standing in the implementation of regulations and its being more advanced in financial sophistication.

Other indicators of interest that relate to financial deepening are the ratio of liquid liabilities to GDP and central bank assets to GDP (Levine, 1997). These are presented in Figures 2.3 and 2.4 respectively.

Mauritius stands out again with its ratio of liquid liabilities to GDP, which is computed as broad money (M3) to the size of the economy (GDP). Seychelles used to be the top SADC country with regard to this measure, but was overtaken by Mauritius in 2005. In addition, as Malawi had shown a sharp rise in financial deepening in 2014, based on deposits to GDP as well as domestic private credit as a percentage of GDP, the same trend is observed here. South Africa has recorded the lowest financial depth with regard to all measures even though its financial system ranks impressively high globally. This raises serious questions regarding the trade-off between financial and regulatory sophistication and financial system participation by the majority of the population. This paradox may explain the country's high inequality and poor economic performance despite impressive financial sector "development"

Overall, with regard to financial deepening in general, there are various reasons that can be put forward in relation to varying trends among the SADC economies. Financial deepening has been argued to be dependent on the ability of financial institutions to track repayment history; this requires credit registry and information sharing among financial intermediaries. South Africa, for example, has a robust credit bureau system that allows all financial intermediaries, including retail credit providers, to access information of all potential clients. Without a credit registry it will be difficult to determine any borrower's ability and willingness to repay, and when combined with the lack of legal support for creditor rights, bank lending schemes are restrained. This will result in shallow financial development. There is a strong link between financial deepening and legislative environment, as the literature asserts that in weak legal and institutional environments, financial institutions run the risk of lending to agents with little or no desire to repay.

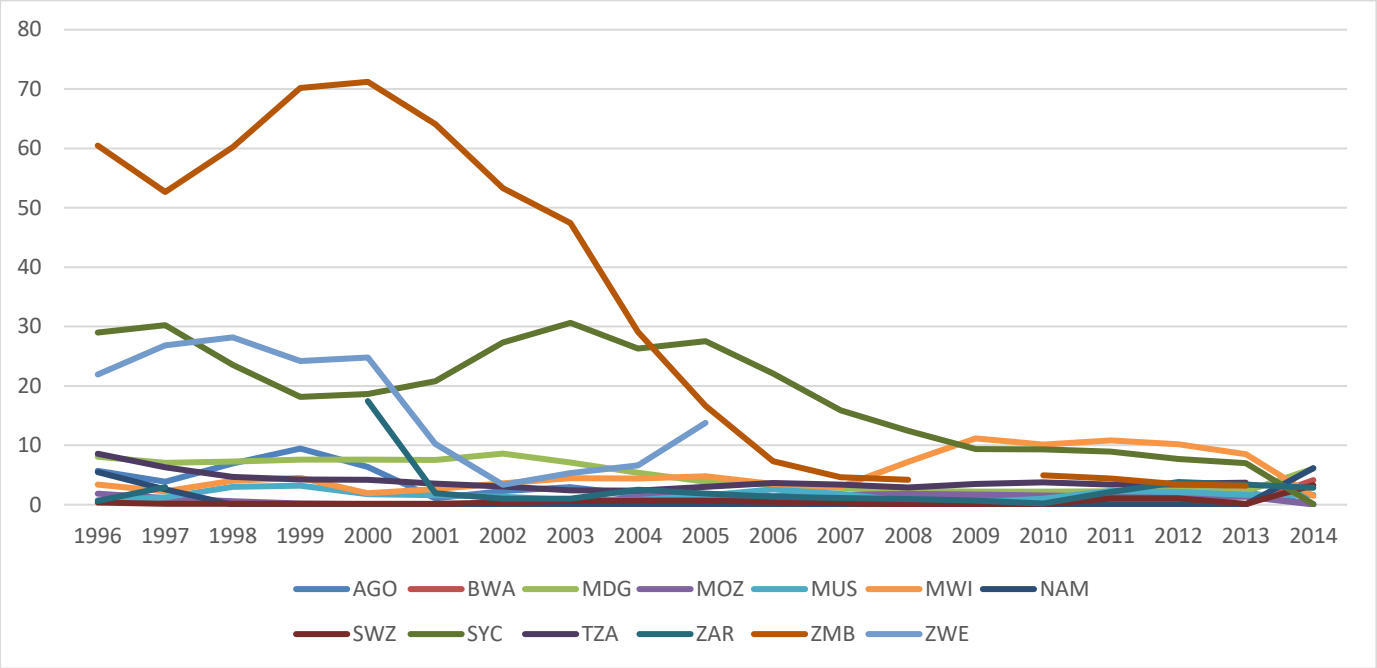
FIGURE 2.3: THE RATIO OF LIQUID LIABILITIES TO GDP



Source: Global Financial Development Data (GFDD), World Bank (2017)

In addition, the size of the central bank is one other financial sector indicator of interest. Figure 2.4 presents the trends in the variable. Central bank assets are claims on the domestic real non-financial sector by the reserve bank. The indicator reflects financial system structure (higher values mean the economy is bank-based) and political independence of the central bank (high values, low political independence). As a result, lower ratios implying deeper financial systems that are independent from politics and are more balanced between bank and capital financing. Zambia was scoring high on this indicator until 2004, when a sharp decline was recorded, resulting in the trend cutting down below Seychelles. Zambia's central bank has been under heavy political control, but began gaining independence from about 2004. An independent bank has the ability to respond to market forces, ensuring clarity of policy stance and credibility, which both promote participation in the financial system and thus promote financial deepening.

FIGURE 2.4: CENTRAL BANK ASSETS TO GDP



Source: Global Financial Development Data (GFDD), World Bank (2017)

2.2.3 Financial Inclusion[3]

Many governments around the world have committed to improving financial inclusion, with the understanding that financial access will open doors for economic development (Nene, 2015). This view of finance preceding growth is held by many (Adusei, 2013a; 2013b; Zang & Kim, 2007). Conceptualising financial inclusion has been a topical issue given recent developments in the financial sector necessitated by the adoption of technology. Measuring financial inclusion needs to go beyond just access, as it needs to ensure affordability and availability.

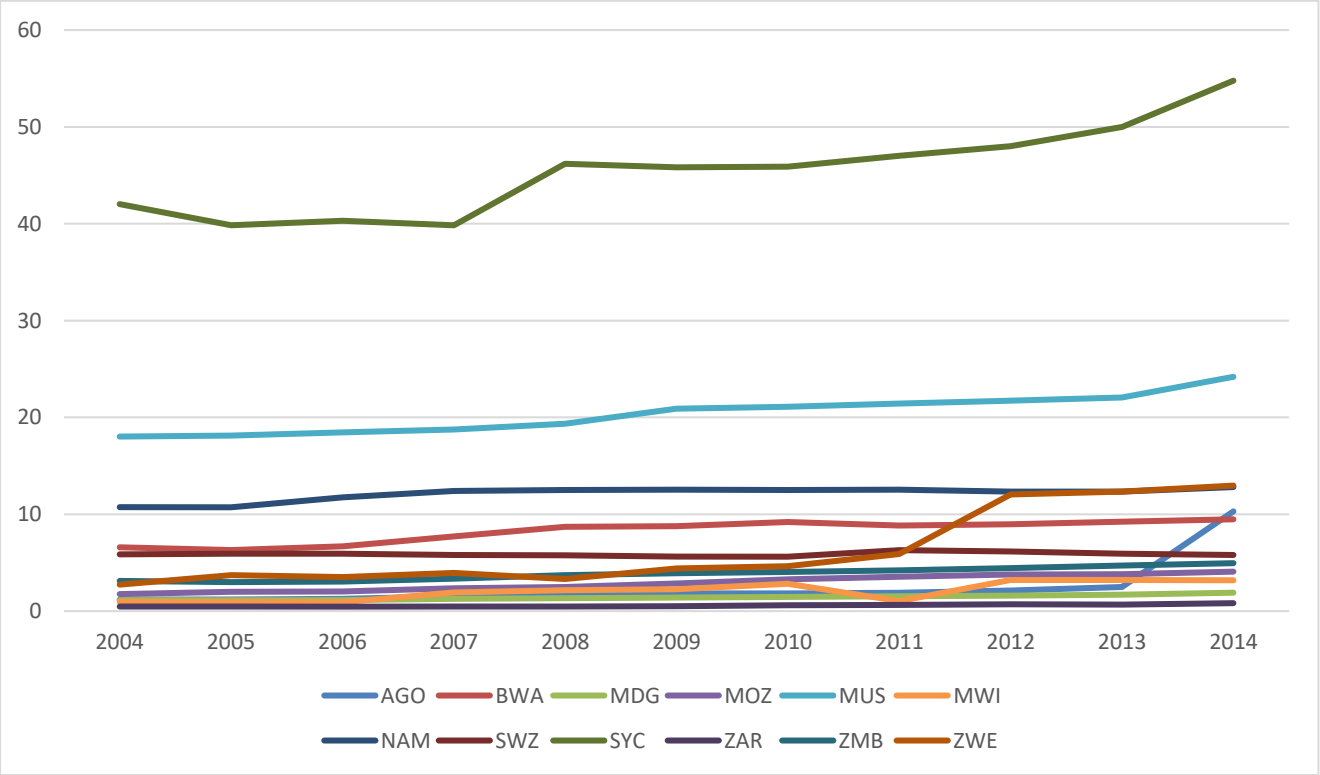
The efforts towards financial inclusion can be looked at from the demand side (for example, number of bank accounts per 1 000 people) or the supply side (for example number of branches or ATMs per 1 000 people). However, the actual use of bank accounts or ATMs/ branches needs to be taken into account. Unfortunately usage data is not readily available. This points to the argument that financial inclusion is more than mere access – it is all about the delivery of financial services and products that are available, accessible and affordable to all segments of the population. This translates into three dimensions of financial inclusion: access, use and quality. In a nutshell, access implies the availability and appropriateness of

[3] http://www.gov.za/speeches/minister-nhlanhla-nene-sadc-financial-inclusion-indaba-23-jul-2015-0000

financial products and services, while use relates to the frequency of uptake or utilisation of financial products and services. On the other hand, product fit, addition to value, convenience and the avoidance of risk, make up the quality dimension.

Figure 2.5 shows the trend in bank branches per 100 000 adults. Seychelles is way above the other countries in all the years surveyed (1996-2014), followed by Mauritius. These two countries are among the smaller countries in terms of population and surface area, as indicated in the introduction. The geographical area and population do play a significant role. For example South African is geographically dispersed and the population (among SADC countries) is high (over 52 million) – as a result such economies record low values.

FIGURE 2.5: BANK BRANCHES PER 1 000 ADULTS



Source: Global Financial Development Data (GFDD), World Bank (2017)

Another measure for financial inclusion, now for the demand side, is bank accounts per 1 000 adults. Seychelles indicated that some individuals have had more than one account since 2012, as the number of accounts per 1 000 adults was more than 1 000. Other countries, like Namibia, Botswana and Angola, are moving towards the point where every adult has a bank account, while South Africa, Madagascar and Zimbabwe are among the lowest as of

2014. Ironically, Madagascar is one of the economies with deep financial systems measured in terms of deposits as a percentage of GDP (Figure 2.1); South Africa has a highly sophisticated and top-ranked financial system in terms of regulation, and is also a recognised financial powerhouse in the region under study. The trend raises questions concerning the developmental objective or implications of regulations and deepening on the financial sector on one hand, and on the other hand the appropriateness of fit of having a bank account as an indicator for financial inclusion.

Financial inclusion can be proxied by bank accounts per 1 000 adults, which is also a demand-side indicator. Table 2.3. presents the statistics of 10 countries where data was available.

TABLE 2.3: BANK ACCOUNTS PER 1 000 ADULTS

	AGO	BWA	MDG	MWI	NAM	SWZ	SYC	ZAR	ZMB	ZWE
2004	0.4[4]	340.4	18.6	-	98.5	343.3	275.0	0.5	13.1	492.1
2005	16.4	341.4	20.1	-	95.8	358.1	492.7	0.8	16.9	493.6
2006	25.3	338.1	21.9	-	140.2	368.7	517.6	1.6	22.6	493.6
2007	33.0	382.4	26.5	124.0	151.0	366.3	564.4	3.0	25.3	194.2
2008	49.8	433.0	36.9		153.1	426.2	590.1	5.0	28.0	212.3
2009	76.8	504.5	39.7	158.7	166.3	457.0	666.0	12.2	27.5	91.5
2010	71.9	509.3	106.5	182.2	165.8	448.5	697.7	12.3	-	161.5
2011	92.2	479.2	52.3	184.0	441.8	452.5	731.0	16.4	-	79.6
2012	458.7	592.3	53.9	203.7	645.3	488.3	1019.2	27.4	-	83.7
2013	548.0	645.3	59.4	237.2	713.4	430.0	1688.3[5]	35.0	-	80.2
2014	608.7	670.8	60.2	-	834.3	464.5	1654.7	46.0	-	88.0

Source: Global Financial Development Data (GFDD), World Bank (2017)

Table 2.3 shows that most of the countries have been becoming more financially inclusive, apart from Zimbabwe, which has shown more and more evidence of financial exclusion since 2007. Such a decline in financial inclusion, as measured by the number of bank accounts per 1 000 adults, is a result of the hyperinflation recorded in the country, reaching climax levels in 2007-'08 before the official adoption of the US dollar (dollarisation) in 2009. Prior to official dollarisation, the population had lost confidence in the domestic currency and were holding foreign currencies which could not be deposited into the financial system as it was still illegal to be in possession of foreign currency. As people lost trust in

[4] 0.4 accounts per 1000 people may be interpreted as 1 account per 2500 people.
[5] 1688 accounts per 1000 people simply implies that some individuals hold more than 1 bank account.

the currency, the banking system was shunned, leaving many bank accounts lying idle and or being closed, except for those few that were "burning"[6] money. In comparison, bank branches remained largely the same, as it is not easy to adjust due to their fixed nature. Besides, from the supply side, banks would be expecting more business in the future when the economic turmoil subsides, so they do not make quick decisions to close a branch.

Many African economies comprise informal sectors that do not meet the minimum requirements for opening a bank account, so many communities remain excluded financially. The process of acquiring a bank account has also been regarded as cumbersome, with some countries and even some top banks requiring having access to a formal address, an identification card, proof of formal employment and a constant stream of income with a minimum required deposit (PWC, 2016). This is beyond reach of many and as a result, they remain financially excluded and marginalised. Regulatory developments like South Africa's Financial Intelligence Centre Act (Fica), with subsequent amendments, which safeguards international relevance and recognition, have added a huge burden to the requirements for opening and maintaining a bank account – which many can unfortunately not afford.

This discussion has focused on the performance of the sector as a whole, but it is also important to shed some light on how individual entities within the sector are structured. Aspects relating to bank ownership and competition among banks are addressed in the next section.

2.2.4 Competition and Ownership

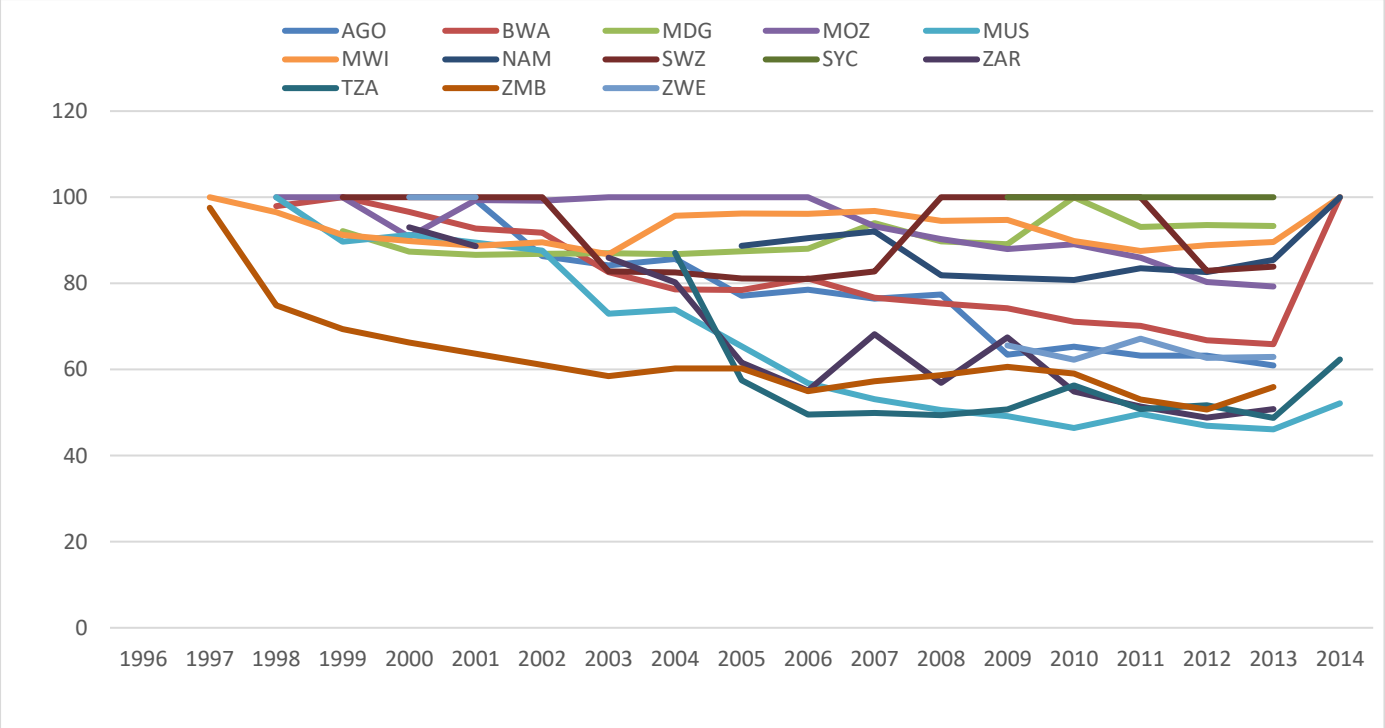
Globalisation and the ability to merge financial institutions have made it increasingly easy to access markets in the region and beyond. This was supported by the financial sector reforms implemented as mentioned in Section 2.1 above. The reforms included opening, entry and exit of domestic and international players.

It is argued that the global financial crisis aroused the interest of policymakers and academics in bank competition and the role of governments in competition policies. Determining how and to what extent banks can compete became of paramount importance. It is the belief of many that the intensification of competition and financial innovation in markets contributed to the financial turmoil.

[6] http://www.thezimbabwean.co/2008/11/demystifying-the-burning-process/

As much as competition is needed for the health of any sector, within the banking sector, there should also be a serious consideration of stability. The banking sector is very delicate, as it is susceptible to bank runs. In measuring competition, the authorities in most economies have resorted to the use of concentration indicators, where higher concentration means low competition. Figure 2.6 presents the trends in banking sector concentration of SADC countries using the concentration among the top five banks[7], (CR5), albeit limited by data availability.

FIGURE 2.6: BANK CONCENTRATION (%)



Source: Global Financial Development Data (GFDD), World Bank (2017)

Figure 2.6 shows that Mauritius, Tanzania, Zambia and South Africa are currently the countries with the lowest concentration ratios in the region, implying that they are the most competitive in the SADC. Other countries, like Mozambique, Swaziland and Zimbabwe, had recorded 100 for concentration, implying that the sectors were in the hands of only a few entities and so were least competitive. It is however important to understand that concentration measures are generally not good predictors of competition. There are various factors to be taken into account. Frequently the use of concertation indicators as a proxy for competition is refuted. A good example would be the consideration for entry and exit restrictions.

[7] The market share of 5 largest banks in the market in relation to the overall market size

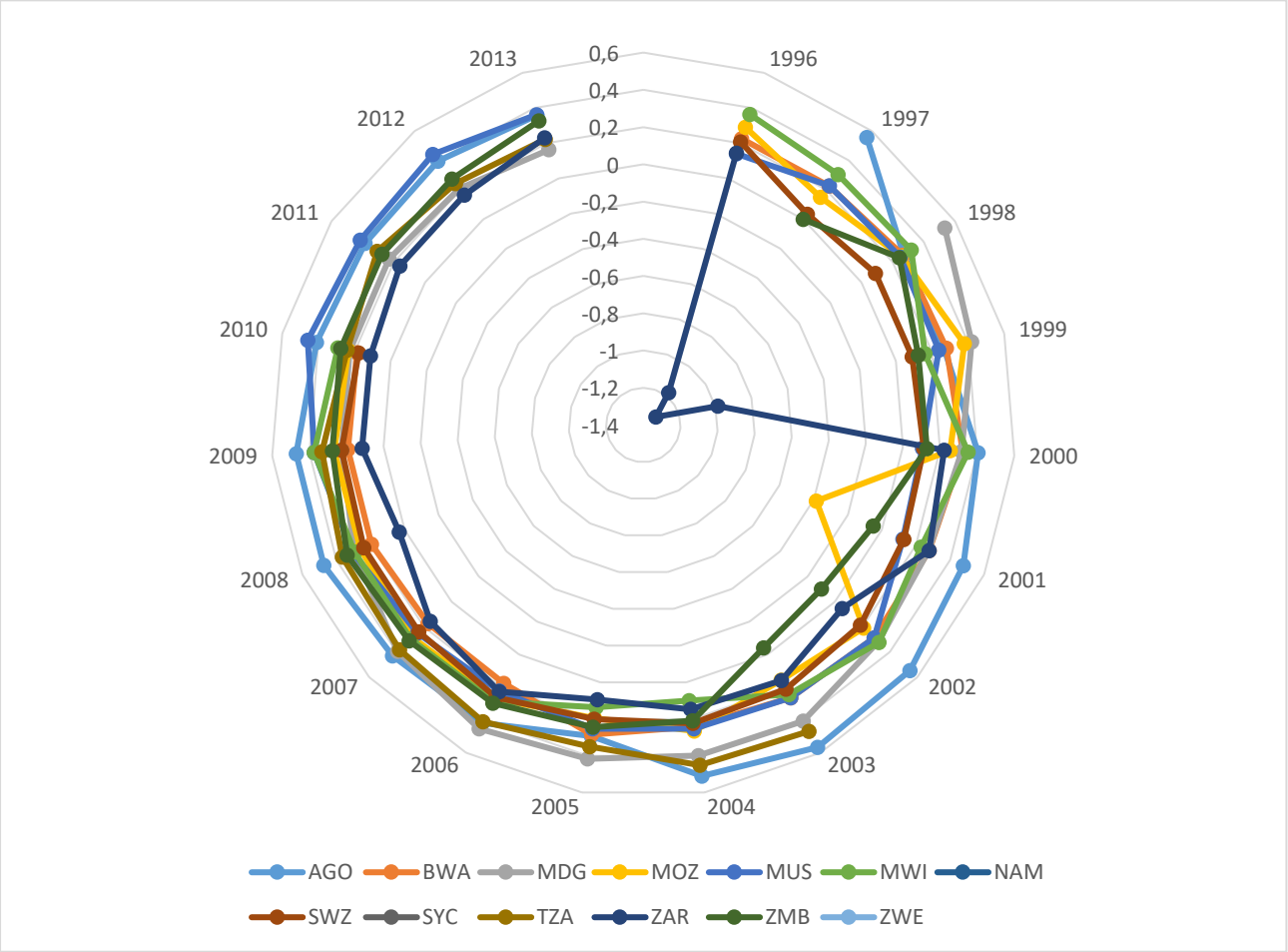
Most economies' banking sectors are liberalised by reforms, making entry and exit very easy. In that regard, banks are pressured to behave competitively in such reformed economies, despite the levels of concentration, as there is an impending threat of the entry of new players or the exit of underperforming ones.

As a result, direct measures of competition estimated from pricing behaviour or market power have been suggested and are becoming popular in the literature. Examples of such measures include the Panzar-Rosse H-statistic, the Lerner index, and the Boone indicator (see Beck, 2008; Boone, 2001; Panzar & Rosse, 1982; and Leon, 2014). This study has data for the last two measures only. They are presented in Figure 2.7 and Table 2.4 respectively.

The Lerner index, based on mark-ups in banking, is computed as output prices less marginal costs (relative to prices). The price values are obtained from total bank revenue over assets, while marginal costs are derived from an estimated translog cost function with respect to output. Higher values of the Lerner index signify less bank competition. In theory the Lerner index ranges between zero and one; however empirical works have shown that in reality the index can be below zero (it assumes negative values) (see the work of Pruteanu-Podpiera,. Weill & Schobert; 2007; and Spierdijk & Zaouras, 2017). The negative values imply lack of dominant market power by any entity, hence the sector is more competitive.

Even though South Africa is regarded as one of the most highly concentrated financial systems in the world by PWC (2016) and thus translates to low competition, its concentration is low relative to other SADC member countries (see Figure 2.6 above). On the other hand, in line with concentration as shown in Figure 2.6, South Africa is the most competitive system in the SADC, based on the Lerner index. South Africa was highly competitive in the early years observed (1997-'99) but weakened from 2000 onwards. This trend can be attributable to the lagged effects of the Asian financial crisis of 1997, as well as the South African banking crisis that matured in 2001-'02, which saw some banks closing and others being absorbed. This resulted in a smaller number of banks and the creation of a few large ones (Mishi, Sibanda & Tsegaye, 2016). However, there are not many differences among the SADC countries' banking sector systems, all reflecting a Lerner index score below 0.5 (averaging 0.33) over time. The statistics point to banking systems that are competitive, with the assumption that this will translate to better services, which could lead to greater financial deepening and financial inclusion.

FIGURE 2.7: THE LERNER INDICES



Source: Global Financial Development Data (GFDD), World Bank (2017)

On the other hand, the newly added Boone indicator measures the effect of efficiency on performance in terms of profits. By computation, it is the elasticity of profits to marginal costs, with elasticity calculated as the log of a measure of profits (for example, return on assets) regressed against a log measure of marginal costs. From the indicator perspective and by its conceptualisation, more-efficient banks achieve higher profits. By deduction, the more negative the Boone indicator is, the higher the level of competition in the market, because the effect of reallocation will be higher. Negative Boone value imply that profits should fall with a unit increase in marginal cost.

TABLE 2.4: BOONE INDICATORS

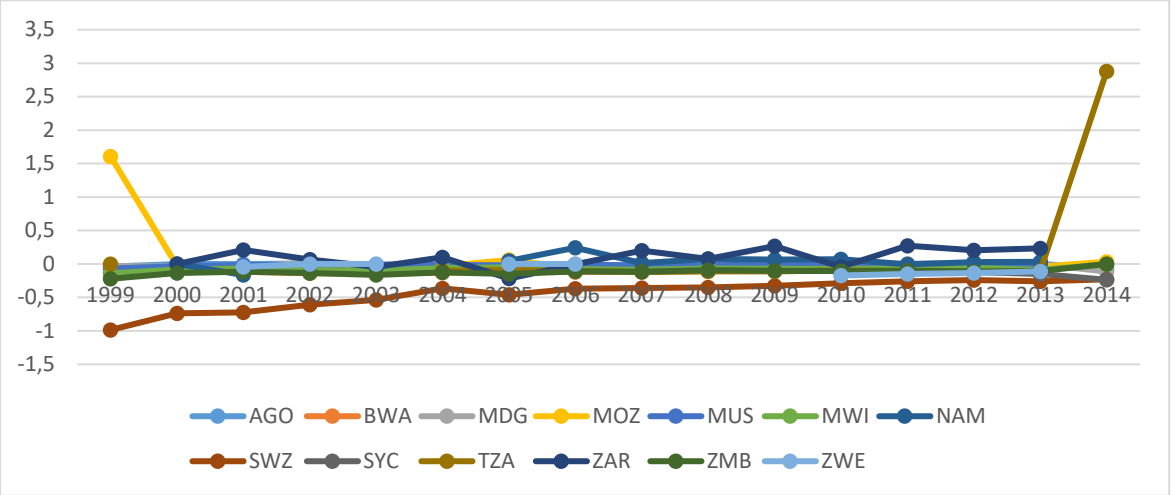
Year/Country	AGO	BWA	MDG	MOZ	MUS	MWI	NAM	SWZ	SYC	TZA	ZAR	ZMB	ZWE
1999	-0,03884	-0,13852	-0,02934	1,607414	-0,06823	-0,14181		-0,98632		0		-0,2216	
2000	0,000782	-0,12048	-0,04086	-0,02828	-0,03657	-0,08355	0	-0,73908			0	-0,13379	
2001	-0,00242	-0,11821	-0,04065	-0,06107	-0,01693	-0,06739	-0,16434	-0,72278			0,210786	-0,11416	-0,04497
2002	0,007415	-0,14066	0,020798	-0,10003	-0,01391	-0,09654		-0,60744			0,066314	-0,13465	0
2003	-0,01874	-0,14378	-0,01539	-0,06838	-0,00443	-0,09865		-0,53503			-0,04323	-0,16579	0
Average (1999-2003	**-0,01036**	**-0,13233**	**-0,02109**	**0,269931**	**-0,02802**	**-0,09759**	**-0,08217**	**-0,71813**		**0**	**0,058469**	**-0,154**	**-0,01499**
2004	-0,0084	-0,13144	-0,01858	-0,0325	-0,01421	-0,0644		-0,36273		-0,10012	0,098398	-0,12447	
2005	-0,05911	-0,12238	-0,03092	0,061479	-0,02142	-0,04655	0,045877	-0,45951		-0,09271	-0,21778	-0,15042	0
2006	-0,03231	-0,12103	-0,02286	-0,06284	-0,01044	-0,07939	0,242023	-0,37007		-0,10378	-0,0077	-0,10954	0
2007	-0,02432	-0,11381	-0,04102	-0,07818	-0,01972	-0,08748	0,014996	-0,35999		-0,11881	0,199303	-0,11555	
2008	-0,02666	-0,10724	-0,01154	-0,06808	-0,01999	-0,06783	0,075484	-0,34901		-0,11339	0,07722	-0,09265	
Average 2004-2008)	**-0,03016**	**-0,11918**	**-0,02498**	**-0,03602**	**-0,01715**	**-0,06913**	**0,094595**	**-0,38026**		**-0,10576**	**0,029888**	**-0,11853**	**0**
2009	-0,01971	-0,09436	-0,00058	-0,06148	-0,00371	-0,07331	0,067259	-0,32806		-0,11063	0,264517	-0,10157	
2010	-0,01852	-0,08928	0,00514	-0,10349	-0,01084	-0,0735	0,068934	-0,29016	-0,1184	-0,09801	-0,04378	-0,10393	-0,17216
2011	-0,01188	-0,08394	0,002453	-0,10379	-0,00862	-0,06886	-0,00438	-0,25888	-0,10963	-0,10571	0,2731	-0,10123	-0,14856
2012	-9,2E-05	-0,07572	0,014401	-0,07217	-0,00287	-0,06068	0,028116	-0,2379	-0,12158	-0,12408	0,203189	-0,11223	-0,13738
2013	0,003099	-0,07601	-0,00581	-0,03804	-0,00981	-0,08777	0,031007	-0,25892	-0,14811	-0,10191	0,235094	-0,10411	-0,10963
2014	-0,07545		-0,1129	0,032951		-0,00589		-0,2292	-0,23665	2,879169		0	
Average 2009-2014	**-0,02043**	**-0,08386**	**-0,01622**	**-0,05767**	**-0,00717**	**-0,06167**	**0,038186**	**-0,26719**	**-0,14687**	**0,389806**	**0,186423**	**-0,08718**	**-0,14193**

Source: Global Financial Development Data (GFDD), World Bank (2017)

Based on the Boone indicator trends presented in Table 2.4, as of 2014, competition is lowest in Tanzania, South Africa, Namibia and Mozambique as reflected in the last figure entries for each of these countries down the years. On the other hand, Swaziland, Seychelles and Madagascar have highly competitive sectors, given the more negative entries. It should be noted however that for most of the countries, in most instances (years), the figures are in the negative, implying that there is some degree of competition present. This indicates that no Southern African economy has a monopolised banking sector. However Namibia is an interesting case – on average competition is very low, given that the Boone indicator is positive down the years, apart from 2001 and 2011.

Figure 2.8 below shows the trend in the indicators, with Tanzania outstanding in the positive side surpassing the Mozambican value in 1999. On the other hand, Swaziland's indicator values have been more negative since 1999, with values coming closer to zero by 2008. All other countries have values trending between 0 and – 0,5.

FIGURE 2.8: TRENDS IN BOONE INDICATOR



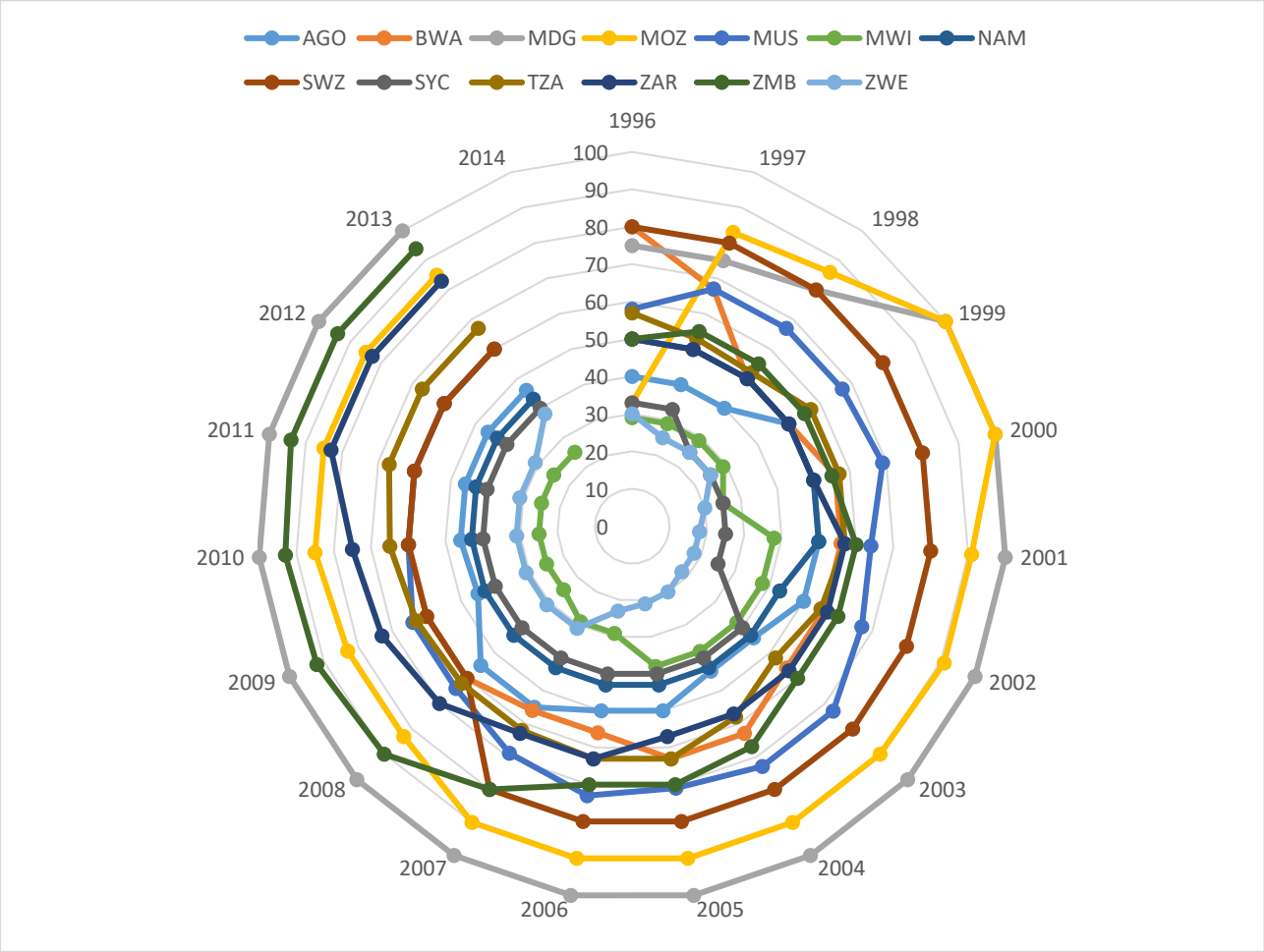
Source: Global Financial Development Data (GFDD), World Bank (2017)

Banking Sector Structure (Foreign Ownership)

Another indicator of interest that is closely related to competition is the size of foreign ownership in the banking sector. Empirical evidence points to the conclusion that the presence of larger foreign banks is generally linked to greater access to finance for small and medium-scale enterprises (Clarke *et al*., 2005). As a result of this evidence, more foreign-owned banks, preferably large ones, would be considered ideal for any sector that is pro-developmental, given the significant role that the SME sector can play in creating employment, reducing inequality and eradicating/ reducing poverty.

On the other hand, it is also argued that unfair competition can arise in cases where foreign banks dominate the banking industry disproportionally in terms of assets and branches. Even though foreign banks can bring in good support for SMEs, the proportion of foreign ownership is of paramount importance. Figure 2.9 presents the proportion of foreign ownership in the banking sectors of the SADC countries.

FIGURE 2.9: BANKING SECTOR STRUCTURE (FOREIGN OWNERSHIP)



Source: Global Financial Development Data (GFDD), World Bank (2017)

Figure 2.9 shows that foreign ownership has been highest in Madagascar since 2000, followed by Zambia (2008-'13), Mozambique (1999-2013), and South Africa since 2007. On the other hand, foreign ownership is lowest in Zimbabwe and Malawi. For Zambia the increase in foreign ownership was marked between 2004 and '08. Swaziland is the one country with notable significant reduction in foreign ownership, registered in 2008.

To conclude this sub-topic of competition and foreign ownership share, we arrive at the same conclusion as Claessens and Horen (2014) who noted that there should be some country-specific factors, like the general level of development and regulations, driving foreign ownership and the concentration of assets. Considering the trends depicted in Figure 2.9, countries like Zimbabwe and Malawi have had strict regulatory reservations towards foreign investors in the banking sector, while Zambia, Mozambique and Madagascar have been encouraging more of foreign ownership through their policies, arguing that it is a source of

strength.[8] Consequently the indictor reflects the policy stance of each economy towards foreign ownership, so clearly it is not an invisible hand phenomenon. This is after observing that generally there is relatively low competition in the banking sectors of the SADC countries (Lerner averaging 0.33 and the Boone indicator about 0), high asset concentration among the top five banks (averaging 90%) in the presence of a relatively large foreign bank asset ownership (average 66%). This makes it harder to conclude whether foreign presence increases or decreases competition in the continent's banking sector

2.2.5 Financial Stability and Efficiency

As no banking system in the SADC has been found to be devoid of competition – there is neither a monopoly nor monopolistic competition among them –it is prudent to observe that cost controls and effective use of resources are central to the success of financial intermediaries operating in a competitive environment. This study reviews efficiency levels and trends among the SADC countries' banking systems.

Before delving into efficiency, financial stability and its links with financial deepening is first reviewed briefly. Financial stability has been recognised as the absence of system-wide episodes in which the financial system fails to function (crises), implying that it is more about the resilience of financial systems to stress. Even though financial deepening has been argued to be good, as it is positively correlated to economic growth, it does however increase the risk of financial instability. This could be why many banking systems maintain stringent conditions for financial access, for example the opening of bank accounts, at the expense of financial deepening. The commonest measure of financial stability is the Z-score (Mishi and Khumalo, 2017), which measures the amount of buffers the banking system has to guard against shocks to earnings. A lower Z-score means a shorter distance to distress – that is, greater financial stability risks (Laeven & Levine, 2009); Čihák & Hesse, 2010).

Table 2.5 presents the Z-scores over time for each SADC country. The statistics show that the banking systems of Swaziland, Zambia and Zimbabwe have the shortest distance to distress, which implies that these three countries face high risk to their financial stability. Of late, Seychelles, Mauritius, Malawi and Madagascar have had the most stable financial systems (as of 2013-'14). It will be of interest to observe the macroeconomic performances of

[8] https://www.imf.org/external/pubs/ft/scr/2016/cr16377.pdf

these countries, as it is argued that a stable financial system is capable of "efficiently allocating resources, assessing and managing financial risks, maintaining employment levels close to the economy's natural rate, and eliminating relative price movements of real or financial assets that will affect monetary stability or employment levels" (Nyantakyi & Sy, 2015).

TABLE 2.5: SADC COUNTRIES' Z-SCORES

	AGO	BWA	MDG	MOZ	MUS	MWI	NAM	SWZ	SYC	TZA	ZAR	ZMB	ZWE
2005	11.11	8.51	4.08	2.15	19.63	8.20	11.44	17.42	6.52	7.87	4.27	2.33	2.40
2006	11.36	7.06	4.31	2.19	18.56	8.94	8.85	14.33	6.54	8.57	4.86	2.14	3.15
2007	11.40	5.96	3.95	2.71	12.18	9.72	10.12	15.30	7.19	9.99	4.56	2.17	
2008	10.58	6.38	3.53	2.52	16.19	10.17	9.26	19.34	13.54	9.09	4.63	2.12	
2009	12.21	7.28	3.09	2.42	13.64	10.48	8.59	17.10	11.41	9.15	4.33	2.07	3.09
2010	13.12	8.40	3.17	2.52	16.78	10.16	8.59	17.32	10.24	8.86	4.99	1.82	2.85
2011	13.16	9.36	3.44	2.90	16.95	9.70	9.10	18.75	10.23	8.22	5.63	2.17	2.97
2012	11.25	9.97	3.22	3.31	16.72	9.36	8.58	17.49	10.59	8.70	4.66	2.48	3.37
2013	11.80	10.77	3.73	3.09	16.45	10.25	7.34	15.28	8.81	10.02	4.67	2.98	3.29
2014	10.83		11.51	7.95		15.53		2.87	19.96			2.40	

Source: Global Financial Development Data (GFDD), World Bank (2017)

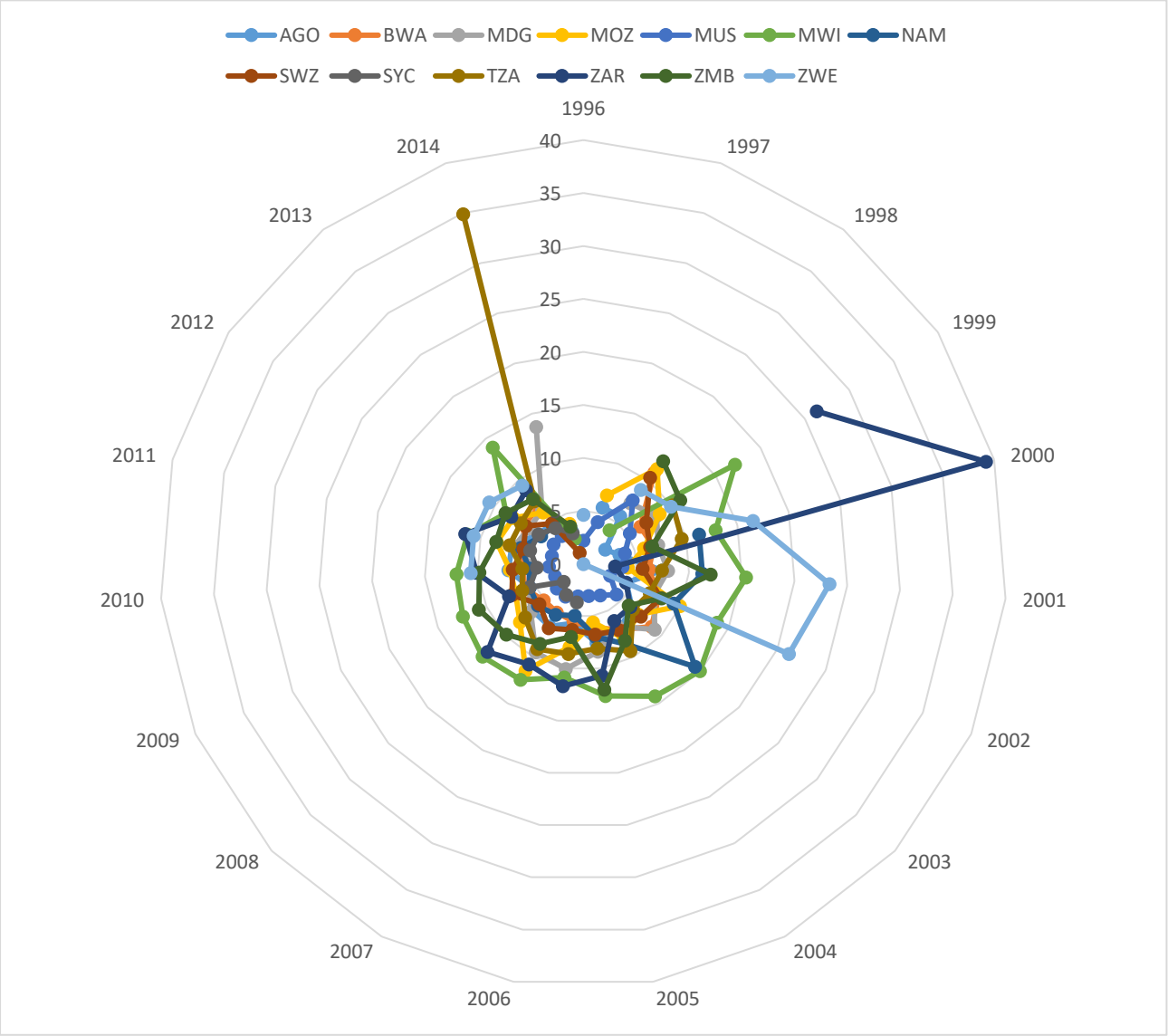
The Z-score measure of financial stability has become popular as it has a clear (negative) relationship to the probability of a financial institution's insolvency, that is, the probability that the value of its assets become lower than that of its debt (Beck, Demirgüç-Kunt, & Levine, 2007; Demirgüç-Kunt, Detragiache, & Tressel, 2008; Laeven & Levine 2009; Čihák & Hesse, 2010). It is important to note, however, that this measure is best at firm level, but not when aggregated. Aggregating and averaging or proportionally weighting the scores to obtain an industry-wide score has its own shortcomings, recognised in this study, *i e* the aggregated values do not take into account the interconnectedness of financial institutions (contagion effect).

On the other hand, efficiency is one of the variables of key interest when one reviews banking systems. The variable is of interest because in sectors where business regulations and procedures are inefficient, banks end up incurring substantial day-to-day operational expenses. There are various measures put forward in the literature, which include net interest margin, bank lending-deposit spread, non-interest income to total income, bank overhead costs to total assets (%), and return on assets and return on equity.

Net Interest Margin (NIM)

This indicator measures how successful the investment choices of banking systems are compared with the debt levels. Any negative value indicates that an optimal decision was not made, as interest expenses will be greater than any returns generated. NIM is an indirect measure of spread-efficiency and market power, with persistently high NIM indicating the possibility of higher spread (lending minus deposit rate) and hence banks are charging persistently high interest rates (higher bank costs) but offering lower rates on deposits. The description here align to market power in the hands of banks than customers, with customers being price takers, charged higher interest in the loan market and are given lower rate in the deposit market. The bargaining power of banks maybe high due to concentration levels as in such markets banks do not care much that customers will leave them given few alternatives (oligopolistic tendencies- insinuating ground for collusion).

FIGURE 2.10: NET INTEREST MARGIN



Source: Global Financial Development Data (GFDD), World Bank (2017)

Figure 2.10 shows a handful of spikes of high efficiency, mainly in South Africa (2000), Tanzania (2014) and Zimbabwe (2001, 2002). The rest of the countries have relatively stable net interest margins, Malawi's being the most stable and persistent at about 15% down the years.

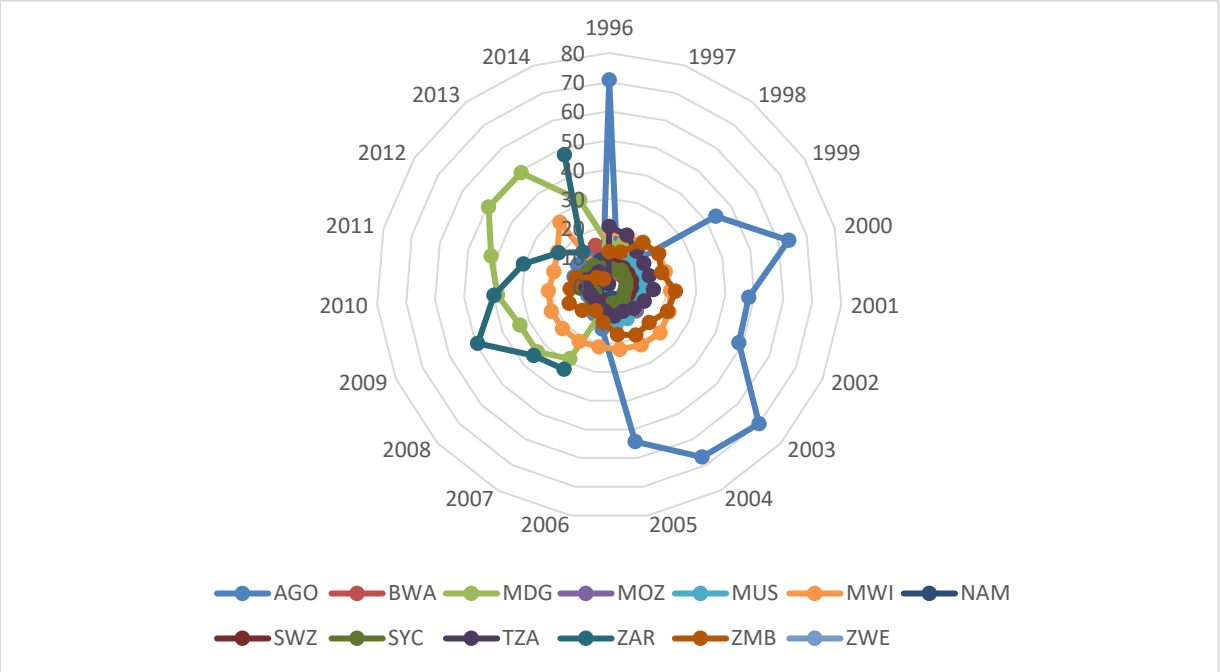
Bank Lending-Deposit Spread

This is the difference between the rate banks charge borrowers and what they pay to deposit clients – this is profit from the intermediation function. There has been an outcry against the high spread for many countries which, it is contended, limits deposits (as seen in Figure 2.11), and also discourages borrowing. This results in a shallow financial system, as both

deposits and domestic credit to the private sector go down while GDP remains the same or improves only marginally.

The spread for most SADC countries is generally low, except for Angola (with its highest spreads in 1996, 2000, '03 and '04), averaging about 70%. South Africa has also had episodes of very high spreads, in 2009 and '14. South Africa shows the highest spread as of 2014 (about 50%), from values of below 10% in 2013. This helped South Africa surpass economies like Madagascar and Malawi, which had higher spreads in 2013.
From the trend shown in Figure 2.11, it can be concluded that such a spread is only a problem in a few countries (essentially Angola; Madagascar and South Africa).

FIGURE 2.11: BANK LENDING-DEPOSIT SPREAD



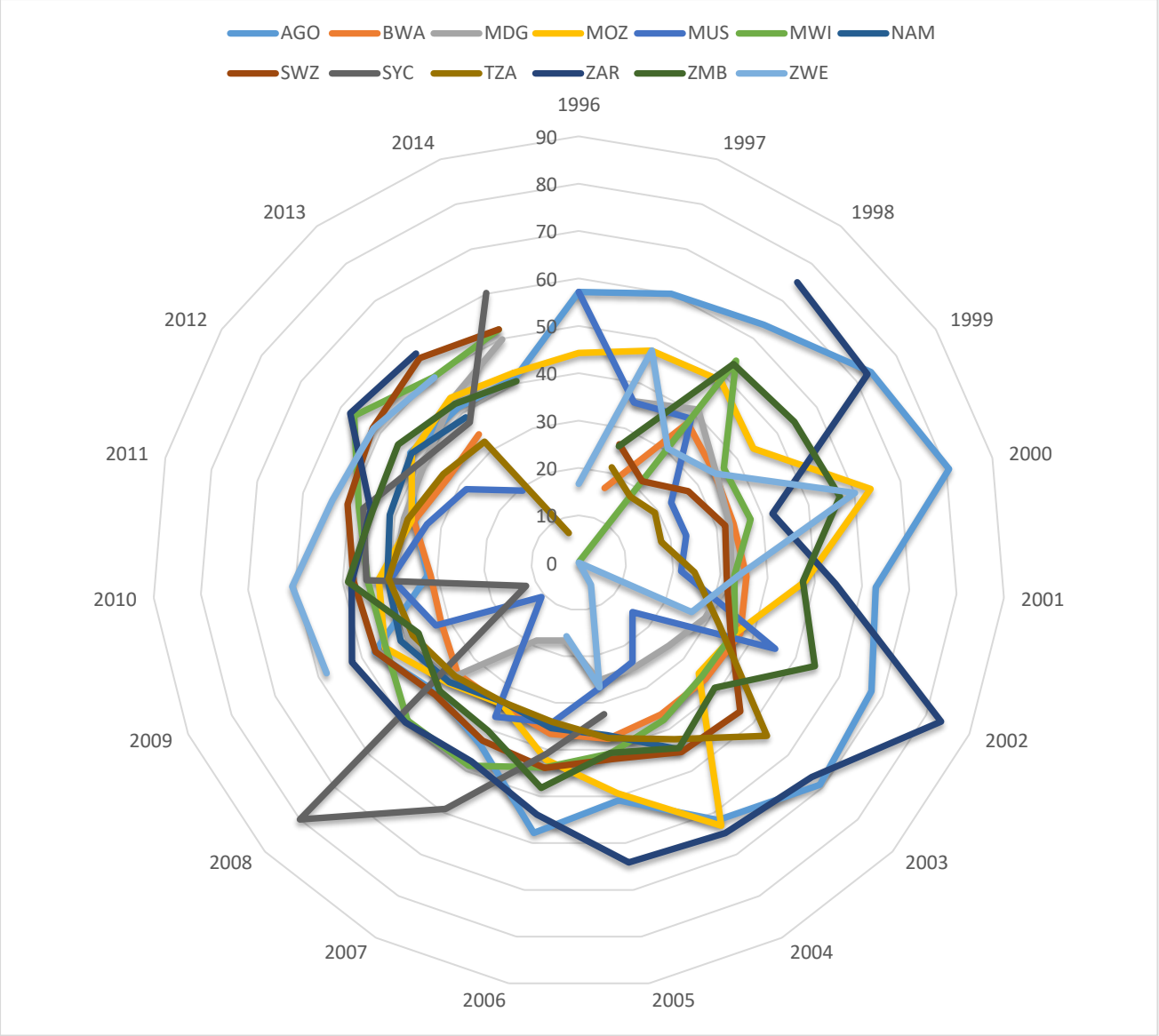
Source: Global Financial Development Data (GFDD), World Bank (2017)

Non-interest Income to Total Income

This measures the proportion of income generated from the non-traditional business of a bank to the total income. Well-diversified banks have higher non-interest income to total income ratio (Mishi, 2016). The countries observed have on average 40% of non-interest income to total income, which is relatively high. South Africa is a system that has persistently high levels of non-interest income, with Angola having been high prior to 2001. These

are two out of three countries (the third being Zimbabwe, mainly since 2009 – the dollarisation era) observed to be generating more income from interest, given the high lending-deposit spread discussed above. On the other hand, Madagascar and Mauritius have the lowest lending deposit spread, which may explain why in those countries considerable financial deepening is revealed in deposits to GDP in Figure 2.1. Lower spread implies a low profit motive among the banks, making them a sector focused on playing an intermediary role which in turn will result in high participation by the general populace.

FIGURE 2.12: NON-INTEREST INCOME TO TOTAL INCOME



Source: Global Financial Development Data (GFDD), World Bank (2017)

Bank Overhead Costs to Total Assets

Efficient systems would have lower values under this measure, implying that they have low overheads per given value of assets. Table 2.6 shows that Tanzania and Madagascar have the least efficient banking systems in SADC as of 2014. However, considering trends over time, South Africa, Zambia and Zimbabwe generally have higher values, and hence are least efficient. The same was observed using the non-interest income to total income measures displayed in Figure 2.12.

TABLE 2.6: BANK OVERHEAD COSTS TO TOTAL ASSETS (%)

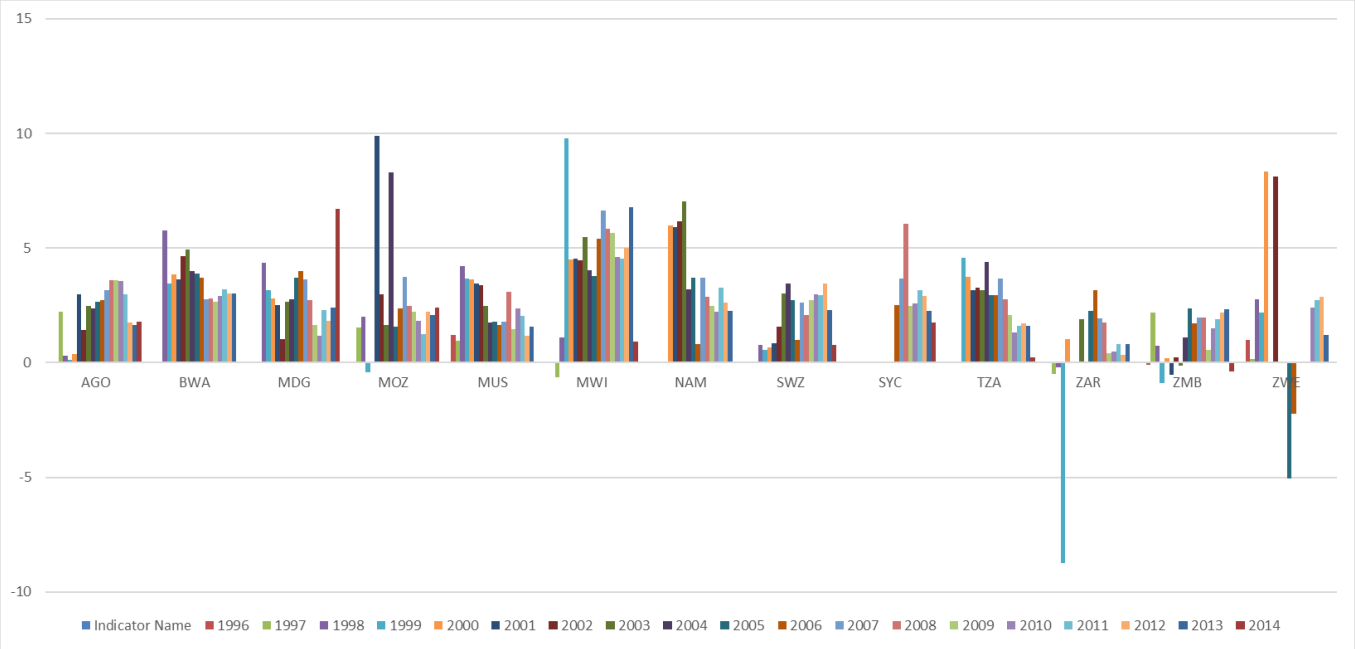
	AGO	BWA	MDG	MOZ	MUS	MWI	NAM	SWZ	SYC	TZA	ZAR	ZMB	ZWE
1996					1.96								
1997	2.94			6.76	2.47	52.84					21.19		
1998	6.71	7.58	3.71	12.21	4.45	2.62		9.21			0.66	15.84	7.86
1999	4.76	4.33	4.38	8.63	2.19	13.50		6.97		5.16	28.64	15.02	7.66
2000	6.79	4.11	4.08	10.86	1.26	6.79	2.98	6.69		5.12	18.90	10.38	7.29
2001	10.58	3.94	4.98	6.60	0.92	10.14	2.97	5.73		4.47	1.80	12.10	7.62
2002	4.09	5.50	4.04	8.18	1.39	8.69	2.81	8.26		4.49	11.84	10.50	5.96
2003	5.74	6.03	4.47	6.74	10.21	9.69	4.81	8.52		4.68	15.74	9.98	0.01
2004	5.22	4.90	3.33	8.81	4.41	10.56	7.41	7.61		7.49	10.98	9.16	30.47
2005	5.94	4.12	3.65	6.76	3.06	9.69	5.84	7.51		6.15	15.98	12.49	42.64
2006	5.40	3.30	3.24	7.54	1.72	7.15	4.31	7.25	0.97	5.63	12.73	8.14	18.12
2007	4.52	3.30	3.04	9.22	2.01	8.67	4.30	6.98	0.96	5.88	11.27	7.67	
2008	3.49	3.25	4.04	7.09	6.85	10.40	4.79	4.99	1.13	5.34	12.82	7.71	
2009	3.08	3.71	4.01	6.86	3.46	9.06	4.72	6.61	1.24	4.88	9.64	7.10	
2010	3.10	3.73	4.60	7.06	2.61	9.34	4.82	6.47	2.22	5.15	11.44	8.74	12.53
2011	3.60	3.89	5.28	8.13	2.81	8.59	4.38	5.50	3.09	6.16	10.51	7.86	10.51
2012	3.24	4.12	4.71	7.33	2.93	6.84	4.08	6.65	2.52	5.69	9.85	7.87	9.81
2013	3.40	4.22	5.05	5.88	2.48	8.69	3.66	5.52	2.54	5.81	9.49	6.35	9.45
2014	2.05		8.67	2.84		1.99		1.29	3.85	17.00		3.79	

Source: Global Financial Development Data (GFDD), World Bank (2017)

Return on Assets

This is a profitability measure with higher scores, revealing highly profitable banking systems. Figure 2.13 below shows that most of the countries have experienced positive returns on assets, albeit mostly volatile, with few exceptions in the form of negative returns – sharply for South Africa in 1999, then Zimbabwe (2005, '06), Zambia (1999, 2001) and Mozambique (1999). It looks as if the Asian financial crisis of 1997-'98 could have had repercussions in the connected SADC banking systems.

FIGURE 2.13: RETURN ON ASSETS

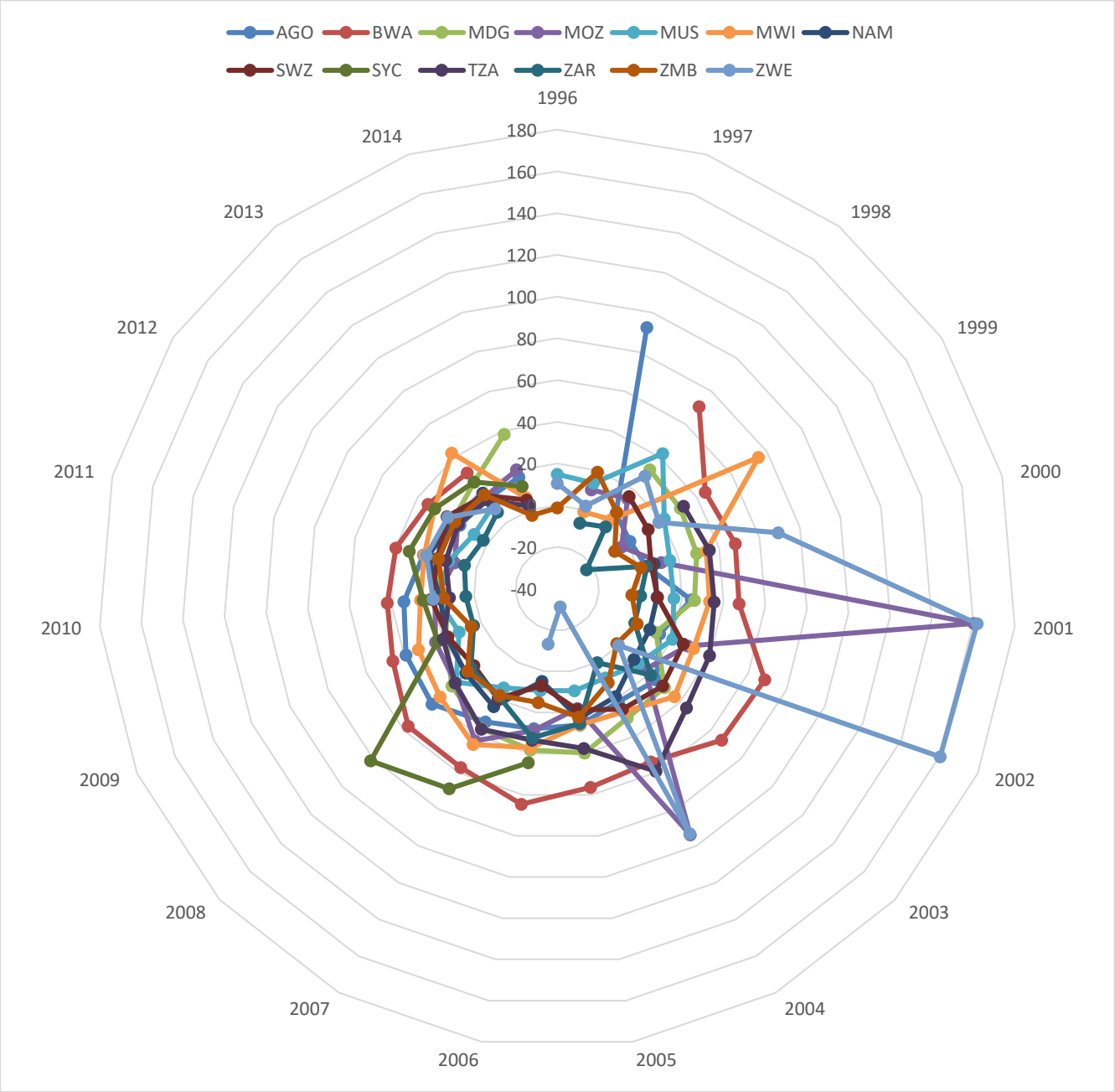


Source: Global Financial Development Data (GFDD), World Bank (2017)

Return on Equity

This is also a measure of profitability, computed as net income divided by shareholders' equity. It provides the return on net worth. Positive and negative extremes are observable in the data – see Figure 2.14 below. Zimbabwe recorded one of the most positive returns in the region during 2001, '02 and '04, a period in which it recorded the highest net interest margin for the region too. Mozambique matched Zimbabwe in 2002 and '04. In 2005 and '06 Zimbabwe had the most negative values – the economic deterioration contributed to an immense swing, which stabilised only after the dollarisation of its financial economy in 2009. Botswana, however, presents a persistent and steady trend over time, averaging about 30%.

FIGURE 2.14: RETURN ON EQUITY



Source: Global Financial Development Data (GFDD), World Bank (2017)

Having looked at the trends in the banking sector, the next section looks at macroeconomic performance indicators.

2.3 MACROECONOMIC PERFORMANCE

SADC as a formal grouping had its members signing a memorandum of understanding on macroeconomic convergence, with each member country expected to strive for macroeconomic stability. The understanding is that once the region as a whole has macroeconomic stability, introduced through low and stable inflation, prudent fiscal policies and reduced market distortions, among other indicators, economic growth and development will naturally follow. Criteria were then set to assess the progress of implementing the various stages of economic integration outlined in the Regional Indicative Strategic Development Plan (RISDP).

2.3.1 Economic Growth

A minimum of 7% real GDP growth was set as a target, which has been difficult for many members to achieve, apart from Tanzania and the DRC. On average, SADC member states registered a slowing real GDP growth rate from an average of 5.6% in 2013 to 4.7% in ’14, and further down to 3.6% in ’15. This is about 3.4 percentage points below the convergence target mentioned above. The low growth rate registered is attributable to a reliance on commodities by most SADC economies. Commodity prices have been on the decline and severe droughts were also experienced over the same period. As net commodity exporters, most of the countries encountered serious setbacks.

In relation to the financial sector developments reviewed above, a question that naturally follows is: what is the link between financial sector developments and economic growth? Testing the direction of causality between financial sector development and economic growth has recently received renewed attention among developing economies (Odhiambo, 2011). There is a long-standing debate on whether there is a demand-following or a supply-leading phenomenon when it comes to finance and economic growth. According to Patrick (1966), demand-following phenomena and poor financial sector developments are a result of poor demand for services, as the economy is underperforming. On the other hand, the second view (supply-leading) argues that financial sector developments are those that pave the way for robust economic growth, playing a critical intermediation role, linking savers to borrowers and allowing optimal use of resources (Jung, 1986). It has been argued, however, that the direction of causality changes over the course of development. Bi-directional causality has been touted as a third possibility, as evidence on the above two factors is highly mixed and inconclusive.

Table 2.7 below displays GDP *per capita* values of SADC countries over the period 1996-2014 including five year period averages. Seychelles tops the region with regard to GDP per capita. It is important to recall that this is one of the economies that displayed great performance among the banking sector development variables. The other countries with better-developed economies are Mauritius (which had high domestic credit to private sector as a percentage of GDP) and Botswana (which has been witnessed financial deepening strongly over the years) – see sections above for reference. Zimbabwe is the only economy to have registered persistently declining per capita income over the period.

TABLE 2.7: GDP *PER CAPITA (USD $)*

Year/country	BWA	MDG	MOZ	MUS	MWI	NAM	SWZ	SYC	TZA	ZAR	ZMB	ZWE
1996	4237,77	274,51	226,18	3801,28	221,88	2906,32	2133,84	9720,37	338,84	276,23	577,21	700,19
1997	4483,29	275,78	243,83	3967,48	224,60	2938,10	2151,42	10756,10	341,91	254,09	583,19	708,09
1998	4428,84	277,69	265,75	4164,32	226,65	2947,91	2160,38	11434,20	345,95	243,99	565,27	718,58
1999	4770,97	281,63	279,18	4219,06	226,70	2969,47	2182,84	11421,70	353,84	227,88	575,78	704,22
2000	4786,75	286,00	276,24	4554,92	223,88	3007,37	2188,76	11491,60	361,97	206,57	582,63	675,80
Average 1997-2007	**4541,52**	**279,12**	**258,24**	**4141,41**	**224,74**	**2953,83**	**2163,45**	**10964,79**	**348,50**	**241,75**	**576,81**	**701,38**
2001	4728,09	294,05	302,64	4635,38	207,22	2990,72	2191,34	11220,80	373,72	196,50	598,01	679,87
2002	4947,30	249,10	319,78	4700,59	205,43	3091,12	2214,97	11017,90	389,84	196,25	609,32	615,14
2003	5108,21	265,40	330,66	4837,35	211,32	3185,11	2252,61	10482,00	405,28	200,78	635,32	507,29
2004	5174,09	271,21	346,16	5083,32	215,91	3536,25	2303,64	10220,20	424,71	207,55	662,62	474,35
2005	5327,85	275,52	365,60	5116,04	216,12	3582,26	2339,30	11086,90	446,16	213,31	691,81	443,24
Average 2001-2005	**5057,11**	**271,06**	**332,97**	**4874,54**	**211,20**	**3277,09**	**2260,37**	**10805,56**	**407,94**	**202,88**	**639,42**	**543,98**
2006	5677,02	281,12	390,32	5293,26	214,44	3785,42	2387,25	11886,00	453,11	217,54	726,12	423,22
2007	6036,40	290,26	407,65	5579,58	228,08	3979,22	2434,64	13057,40	476,56	223,78	764,70	402,55
2008	6291,20	302,28	423,64	5865,83	239,88	4021,86	2451,60	12495,30	487,59	230,12	800,53	326,57
2009	5695,89	282,09	438,11	6028,65	253,81	3965,07	2440,42	12308,60	497,85	229,14	848,88	340,42
2010	6061,01	275,00	454,46	6260,92	262,32	4125,40	2440,64	12681,30	512,99	237,57	908,75	372,29
Average 2006-2010	**5952,30**	**286,15**	**422,84**	**5805,65**	**239,70**	**3975,39**	**2430,91**	**12485,72**	**485,62**	**227,63**	**809,80**	**373,01**
2011	6298,80	271,29	473,28	6493,83	265,51	4245,41	2433,64	14046,90	536,25	245,87	937,64	408,38
2012	6469,65	271,79	493,23	6683,07	262,35	4360,19	2468,16	14749,90	546,20	255,21	970,77	441,92
2013	6930,79	270,30	513,79	6881,75	267,65	4499,97	2502,46	15447,30	567,61	268,28	1004,72	451,42
2014	283,47	274,35	4674,63	535,73	7116,59	15697,60	1032,80	2526,46		271,59	458,10	
Average 2011-2014	**4995,68**	**271,93**	**1538,73**	**5148,59**	**1978,03**	**7200,79**	**2109,27**	**11692,64**	**550,02**	**260,24**	**842,81**	**433,91**

Source: Global Financial Development Data (GFDD), World Bank (2017)

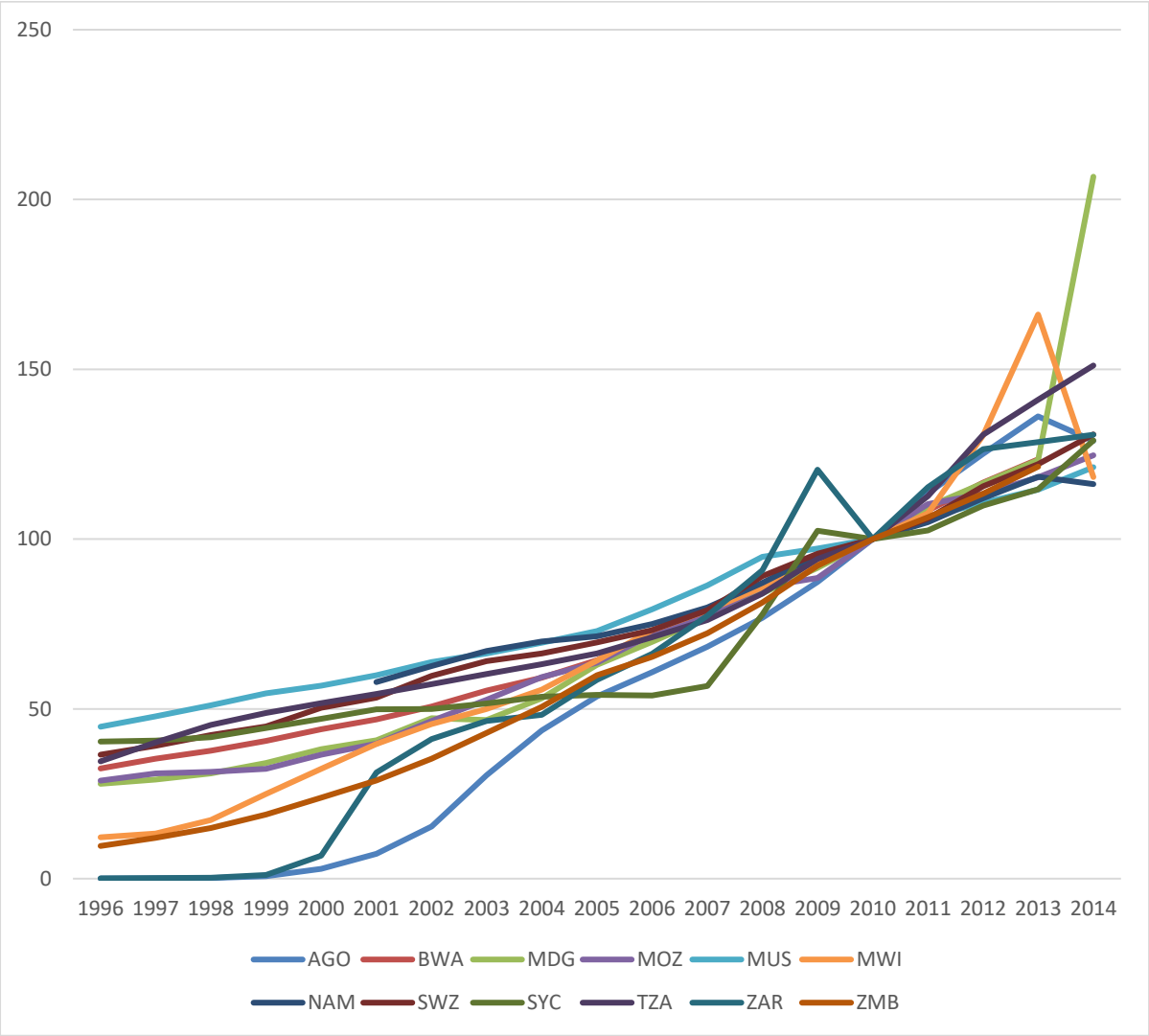
Another indicator considered, for which the SADC countries also set targets, is inflation. The trends in the variables are discussed in the next section.

2.3.2 Inflation

Apart from Zimbabwe, which had a long episode of hyperinflation from 2000 until dollarisation in ’09, all the SADC countries appear to have inflation figures that converge over time. Figure 2.15 below shows inflation changes for SADC countries as measured by consumer price index (CPI) changes. Madagascar showed a sharp spike in 2014 which, if unabated, could lead to hyperinflation and weaken the convergence that was being established.

The SADC member states have signed an understanding to work towards attaining convergence through attaining the same levels in the key macroeconomic indicators like inflation, GDP growth and interest rate. For inflation, the set target was to achieve less than 10% by 2008 and below 5% after that. As a result, if Madagascar's inflation trend is not monitored and corrected, it will make such efforts redundant.

FIGURE 2.14: CONSUMER PRICE INDEX (2010 = 100)



Source: Global Financial Development Data (GFDD), World Bank (2017)

2.4 CONCLUSION

This chapter opened with an overview of the banking sector developments, specifically focusing on regulations, financial depth, financial inclusion, competition and ownership, and financial stability and efficiency for the SADC region. The second part of the chapter reviewed the macroeconomic performance of the SADC region, paying special attention to economic growth as measured by real GDP *per capita* and inflation as measured by changes in the consumer price index. Consequently, this chapter focused primarily on the exposition of banking sector development issues within the SADC region, covering among other issues financial deepening and banking inclusion.

CHAPTER THREE

LITERATURE REVIEW

3.1 INTRODUCTION

It is acknowledged in the literature that there is a repertoire of studies (Bardhan, 2013; Baten & Kamil, 2010; Chang, Hasan, & Hunter, 1998; Debasish, 2006; Drake, Hall, & Simpler, 2006; Fu & Heffernan, 2007; Hasan, Kamil, Mustafa *et al.*, 2012; Karimzadeh, 2012; Khalil, Mehmood, & Ahmad, 2014; Khankhoje & Sathye, 2008; Louati & Boujelbene, 2015; Mahesh, 2006; Manlagñit, 2011; Ngan, 2014; Roy, 2014; Rozzani & Rahman, 2013; Samad, 2009; Sana, Bilal, & Nisar, 2015; Sreeramulu, Vaz, & Kumar, 2010), in the area of bank efficiency on a global scale, a significant number of them concentrating on the Western and South East Asian economies. However, there is little empirical evidence about bank efficiency in Africa, especially in the SADC region. This chapter reviews and discusses some of the theoretical and related empirical literature on banking efficiency. However, the chapter begins with a conceptualisation of efficiency.

3.2 CONCEPTUALISATION OF EFFICIENCY

Efficiency measurement comprises two basic frontier approaches: the production frontier approach and the cost frontier approach. Efficiency can be measured by analysing the boundary or frontier of a cost or production function. The duality principle confirms this connection. For example, given that observed production cannot exceed its potential level or maximum possible, relative inefficiency would be captured by the amount by which observed production falls short of the production frontier. Likewise, it is not feasible to achieve costs below the minimum or cost frontier. However, observed cost can be equal to or greater than the minimum cost frontier. Relative cost inefficiency would be measured by the amount of the excess of observed costs above the minimum or cost frontier.

3.2.1 The Production Frontier

The conception of a production frontier, as distinct from a production function, began with Farrell (1957). A production function simply involves the conversion of inputs into outputs. For instance, a bank is a financial intermediary institution that converts deposit funds into loans or interest income. Hence, a production function essentially represents efficient transformation possibilities that satisfy certain constraints.

A production function exhibiting inefficiency can be stated in inequality form as:

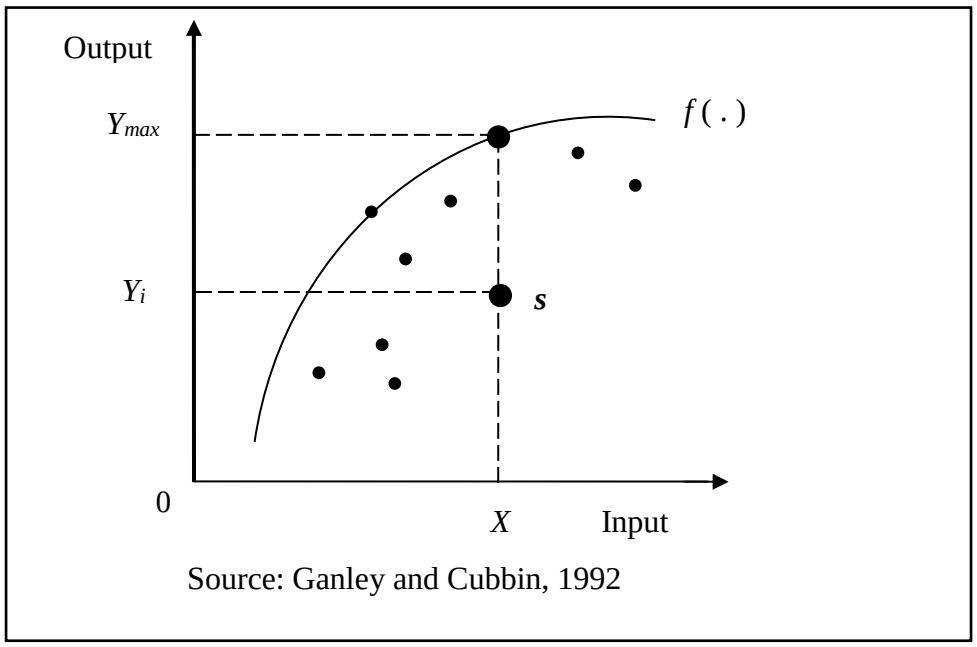
$$y_i \leq f(X_i; \alpha) \quad \ldots\ldots \quad \textbf{(3.1)}$$

where y_i denotes observed output at bank *i*, and X_i is a vector of inputs and α a vector of parameters which describe the production process. $f(.)$ is the production function, which can be regarded as an efficiency frontier or y_{max}. Inefficiency would imply that potential output $(y_{\max})$ is greater than observed performance (y_i). So technical inefficiency entails that $(y_i - y_{max})$ is non-positive or simply negative. The residual (ε_i) can be regarded as the variation between potential and observed performance and can be regarded as an indication of inefficiency.

$$\varepsilon_i = y_i - y_{max} \quad \ldots\ldots \quad \textbf{(3.2)}$$

The residual ε_i is strictly non-positive to ensure that observed or actual output is not greater than potential output. Put differently, $y_i > y_{\max}$ is not possible because it is impractical to achieve output greater than the maximum output defined by the production frontier. In Figure 3.1 below, bank *i* is producing output (y_i) using input allocation *OX*. However, with input resources *OX* an efficient bank has the potential to produce maximum output $(y_{\max})$. The difference between potential and actual output, ε_i is negative, so bank *i* is relatively inefficient in its production. A residual of 0 would imply that the bank is efficient, since potential and actual outputs will be same.

FIGURE. 3.1: THE PRODUCTION FRONTIER: EFFICIENCY



Source: Ganley and Cubbin, 1992

3.2.2 The Cost Frontier

Due to the principle of duality, Ganley and Cubbin (1992) state that it necessitates the existence of a cost function that relates to the production function specified in (3.1). A cost function connects the minimised total cost of a bank to its output and factor prices. Here, it is possible that observed or actual costs can be greater than the minimum cost possible:

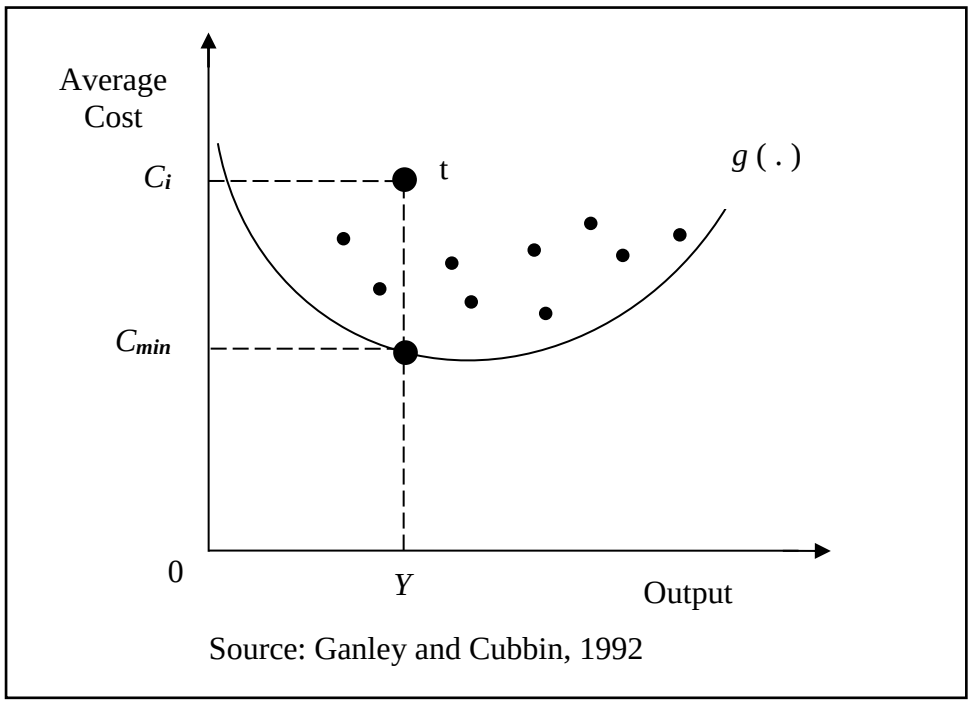
$$c_i \geq g(z_i;\beta). \qquad \ldots\ldots \qquad \textbf{(3.3)}$$

where c_i denotes bank cost at bank *i*, z_i are contributing factors of costs, $g(.)$ defines the minimum costs $(c_{\min})$ and α is a vector of parameters. Efficiency in ratio form is denoted by θ_i in (3.4) below as follows:

$$\theta_i = \frac{c_i}{g(z_i;\beta)} \qquad \ldots\ldots \qquad \textbf{(3.4)}$$

When a given bank is inefficient, its observed costs will be greater than the minimum costs and the efficiency residual is positive. This means that the efficiency ratio is greater than unity. Therefore, the amount in excess of unity captures inefficiency. In the absence of inefficiency, actual costs and minimum costs are the same.

FIGURE 3.2: THE COST FRONTIER: EFFICIENCY



Source: Ganley and Cubbin, 1992

Figure 3.2 illustrates efficiency using the cost frontier approach in which observed costs, c_i for bank *i* are greater than the minimum costs, C_{min}. Since frontier costs are the least amount possible, actual costs cannot decrease below this frontier, i.e. $c_i \geq c_{\min}$.

3.3 THE THEORETICAL FOUNDATION OF EFFICIENCY

3.3.1 Technical, Allocative, Scale and Economic Efficiency

Farrell (1957) who is considered to have pioneered and contributed a great deal to efficiency literature, states that the efficiency of a firm comprises two components: allocative and technical efficiency. A firm is deemed technically efficient if the greatest output amount is achieved with the minimum input amount, or if its use of input resources generates maximum output. Allocative or price efficiency attempts to capture the degree to which a firm employs its input factors in their optimum proportion, given input prices and transformation technology. It entails selecting among the different technically efficient input combinations that generate the highest achievable outputs. The concept of scale efficiency relates to whether a firm operates at its optimal size, which is at the minimum point of its long-run cost curve. A combination of both technical and allocative efficiency captures total economic efficiency or overall efficiency.

3.3.2 Cost Efficiency and Profit Efficiency

Depending on the researcher`s viewpoint and purpose of analysis, a choice can be made between profit and cost efficiency. Cost efficiency is a measure of the extent to which a bank's actual cost varies with that of the most efficient bank for generating an identical output vector under the same conditions of operation. Thus a bank is considered inefficient if it has more costs than the most cost-efficient bank. For instance, a cost efficiency score of 0.88 means that a bank`s costs are 12% in excess of the minimum defined by the frontier. Put differently, it implies that 12% of its costs are being wasted, compared with best practice. Similarly, profit efficiency assesses the ability of a bank to generate the maximum attainable profit given input prices and outputs. Therefore, a given bank is categorised as inefficient if its profits are less compared with the profits of the best-practice bank.

3.4 MODELS OF BANKING EFFICIENCY

Measuring a bank`s efficiency is essentially evaluating the connection between the outputs it produces and the inputs it employs. Various techniques for evaluating the efficiency of an organisation or decision-making unit (DMU) are classified into parametric and non-parametric. Efficiency is estimated either from a *stochastic* frontier or a *deterministic* frontier. Parametric or stochastic techniques assume that some deviations from the efficiency boundary are ascribed partly to random elements or exogenous factors, and partly to inefficiency. Mullineux and Murinde (2003) state that the major drawback with parametric frontier approaches is that they demand identification of the specific functional form regarding either the production or cost function. As a result, the accuracy of the generated efficiency measures depends on the precision of the specified functional form in approximating the correct underlying cost or production function. Three common parametric methods include the distribution-free approach (DFA), the thick frontier approach (TFA), and the stochastic frontier approach (SFA). However under the deterministic method, essentially a non-parametric approach, all variations from the efficiency frontier are ascribed to inefficiency. The main non-parametric methods include the free disposable hull (FDH) and data envelopment analysis (DEA).

3.4.1 Parametric Approaches

Distribution Free Approach (DFA)

The development of the DFA is attributed to Schmidt and Sickles (1984) and Berger (1993) and serves as an alternative to the conventional stochastic frontier technique, especially when several years of data are available. While the SFA makes restrictive assumptions regarding the distribution of the error term, the distribution-free approach (DFA) makes no assumptions concerning the error term. Troutt *et al* (2005) state that the DFA is distribution-free and completely data-driven, and demonstrate that such a model is capable of producing meaningful parameter estimates without making restrictive distributional assumptions. Mullineux and Murinde (2003) state that the classical error term under the parametric SFA framework is random and would be expected to average out to zero over time.

Berger (1993) recommends a period of five years to be generally appropriate for allowing the errors to average out. Koutsomanoli-Filippaki (2007) cautions that if the selected period is too short, the random errors might not average out, thereby over-estimating inefficiency. Again, if the selected period is too long, the bank`s average efficiency may fluctuate over the period due to variations in environmental conditions, rendering the derived efficiency measures meaningless. Assuming that these random errors indeed average out, this process eventually produces average levels of efficiency across the sample of DMUs (Mullineux and Murinde, 2003). So these efficiency measures are generally standardised in comparison with the best-practice DMU in the sample.

The Thick Frontier Approach (TFA)

The thick frontier approach (TFA), which is not commonly applied, particularly in banking, was developed by Berger and Humphrey (1991). Lang and Welzel (1998) claim that the TFA has the characteristics of both the non-parametric DEA and the parametric SFA. However, Bauer *et al* (1998) maintain that the TFA and the SFA adopt the same functional form for the cost function. Bauer *et al* (1998) state that the difference comes about in that the TFA applies regression analysis that is estimated using only those DMUs that form the lowest average cost quartile in each size category. These DMUs are considered to possess better-than-average efficiency measures and as such define a thick frontier of efficient DMUs.

Likewise, DMUs in the highest average cost quartile are regarded as below-average-efficiency performers. The procedure under the TFA framework is that the DMUs to be evaluated are initially placed into quartiles according to their sizes. Their average cost over the time period is calculated. Then only those banks in each class size whose average cost is lowest define the data subset that is applied in the estimation of the thick frontier. The classification is done to ensure that an equivalent number of banks of all size categories is taken into account. The differences in error terms *within* the highest and lowest quartiles are taken to reflect random error, whereas the predicted cost differences *between* the highest and lowest quartiles are assumed to capture inefficiencies and external differences in input prices and output quantities (Bauer *et al*, 1991).

Efficiency results generated by TFA have been regarded with suspicion since they are based on somewhat subjective assumptions. Bauer *et al* (1998) criticise the fact that the lowest average cost quartile for all class sizes is taken to be a sufficiently thick frontier of efficient DMUs. In addition, Bauer *et al* (1998) also point out that by estimating the difference between the highest and lowest quartile, the TFA only provides an indication of the broader level of total efficiency, not point efficiency estimates for each DMU. So it is essential to ascertain estimates of efficiency for each DMU for each period so as to enable comparison with other frontier efficiency methods. Bauer *et al* (1998) suggest adjustments to be made to the TFA approach to facilitate this objective.

Stochastic Frontier Approach (SFA)

The parametric stochastic frontier approach is founded on econometric techniques. Kablan (2010) states that by specifying a Cobb-Douglas CES or trans-logarithmic function, the SFA essentially estimates the objective frontier function, which may take the form of a cost or production function. Within this econometric approach any deviation from a specified technology is measured by a disturbance term which comprises two components, one accounting for noise or randomness and the other representing inefficiency. In inefficiency measurement the major challenge is to isolate actual inefficient behaviour from random elements that may influence performance. Hence the SFA recognises that any given firm`s costs may diverge from the boundary or minimum cost due to random variations or inefficiency. This

property has made the parametric SFA become more attractive compared with non-parametric approaches. According to Aigner *et al* (1977), the stochastic frontier production function can be stated as:

$$y_i = x_i\beta + (\nu_i - \mu_i) \qquad \text{.....(3.5)}$$

where μ_i represents random variables and so represents inefficiency.
v_i represents random variables which are assumed to be *i.i.d*[9] N (0, δ^2) and independent of μ_i.

β *is* a vector of unknown parameters.

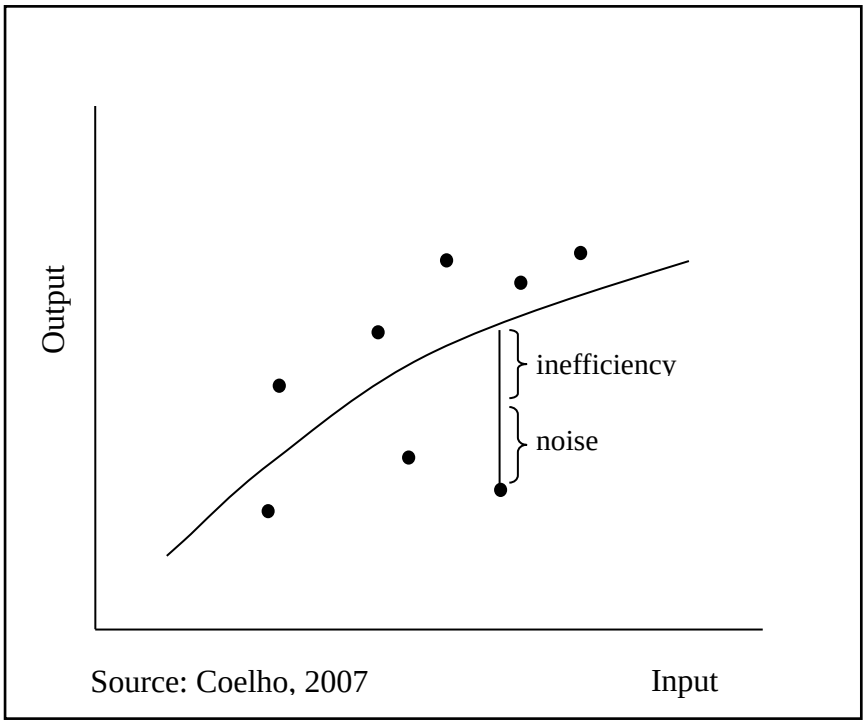
x_i is a vector of input quantities of unit *i*.

y_i is the average maximum output.

All elements beyond the control of the firm are captured by the disturbance or error term. These elements include unmanageable factors that affect the production function, namely diverse operating environments and econometric factors like measurement errors or mis-specification of the functional form. To guarantee reliable and robust results with SFA, a sufficiently large sample size is a requirement. The distance between the observation and the estimated function captures inefficiency. However, the attractiveness of this approach is its ability to isolate measurement errors, noise and external shocks outside the control of a production entity. The main disadvantage is that the reliability and precision of the efficiency estimates obtained depends on the accuracy of the selected functional form in representing the actual underlying production or cost function.

[9] Independent and identically distributed.

FIGURE 3.3: THE STOCHASTIC FRONTIER APPROACH (SFA)



Source: Coelho, 2007

3.4.2 Non-parametric Approaches

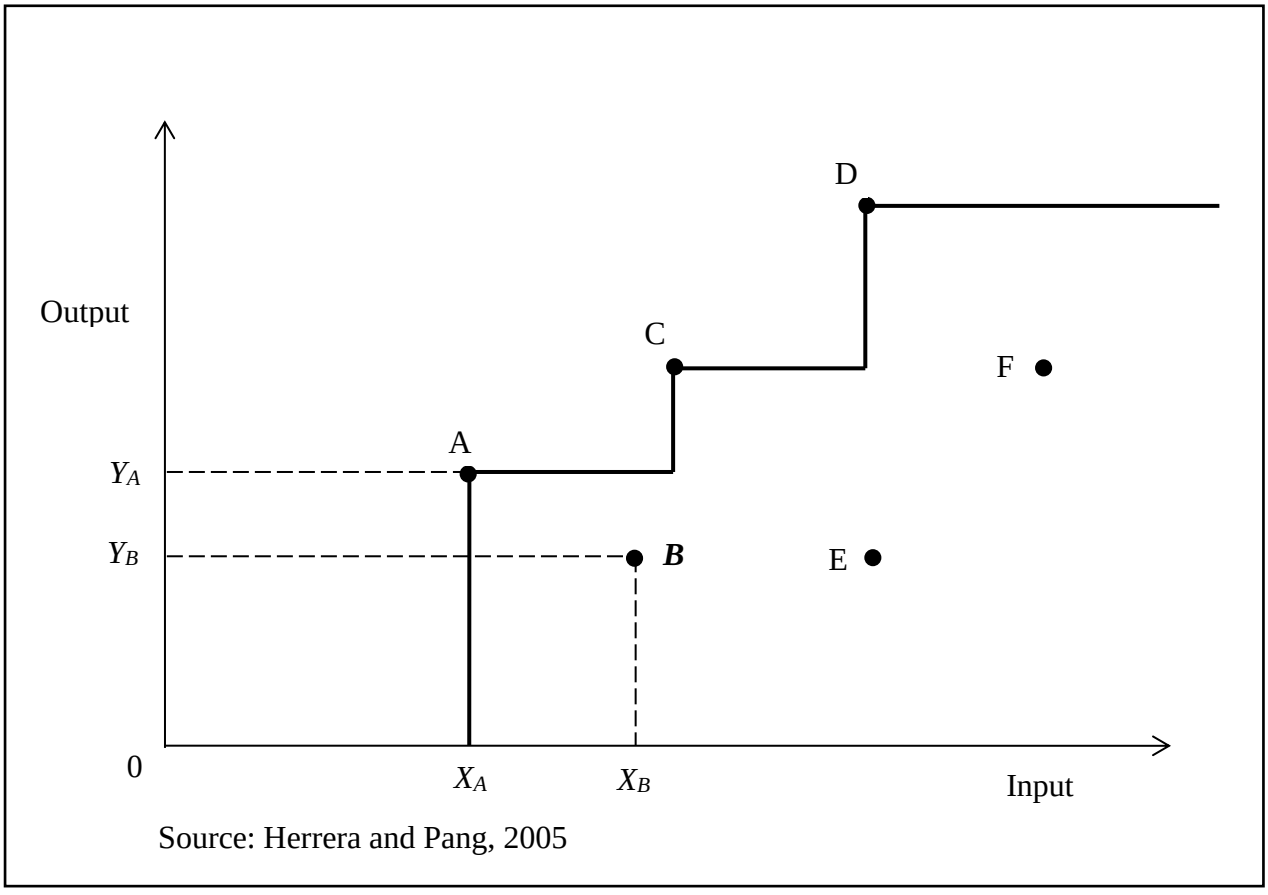
Free Disposable Hull Analysis (FDH)

The FDH was originally proposed by Deprins *et al* (1984) to serve as an alternative to the popular DEA approach. The FDH differs from the DEA in that it does not require convexity of the underlying technology, but maintains restriction of strong disposability of inputs and outputs (Walden and Tomberlin, 2010). Hence, the FDH approach can be considered to be a special case of the DEA approach with the least restrictions. Cherchye *et al* (2001) regard non-convexity as an attractive property of FDH on the basis that in efficiency analysis, one hardly finds any solid theoretical or empirical justification for proposing convex production sets. In addition, the convexity assumption has been criticised on the premise that the convex DEA model compares an inefficient DMU with an unobservable, non-existent and fictitious linear combination of efficient DMUs (Henderson, 2003). On the other hand, the FDH is not susceptible to this critique. The FDH identifies a single dominating (efficient) DMU for each inefficient DMU.

In the terminology of FDH analysis, a DMU is efficient if it is not "dominated by any other DMU" (De Sousa and Schwengber, 2005, p3). Hence under the FDH approach, the efficient frontier is defined by non-dominated firms. Considering an efficiency evaluation for a panel

of banks, bank A is said to dominate bank B (*i*) if there is no input for bank A that exceeds the corresponding input for bank B or (*ii*) if there is no output for bank A that is less than the corresponding output for bank B and (*iii*) if there is at least one input for bank A that is less than the corresponding one for bank B and (*iv*) if there is at least one output for bank A that exceeds the output for bank B (Walden and Tomberlin, 2010). So for each inefficient DMU located in the interior of an FDH set, an existing reference DMU can be identified that proves superior in all input or output dimensions (Cherchye *et al*, 2001). Dlouhy (2009) has shown that efficiency scores derived using the FDH approaches are relatively higher than the DEA-derived efficiency scores due to the relaxation of the convexity assumption of the FDH approach. Hence, Thrall (1999) states that DEA efficiency implies FDH efficiency, but FDH efficiency does not imply DEA efficiency. Henderson (2003) argues that because of the convexity assumptions DEA calls too many DMUs inefficient. This approach is illustrated in Figure 3.4 using a single input, single output production possibility frontier for simplicity.

FIGURE 3.4: FREE DISPOSABLE HULL (FDH) PRODUCTION POSSIBILITY FRONTIER.



Source: Herrera and Pang, 2005

Suppose that bank A and bank B require input X_A and X_B so as to generate output Y_A and Y_B in that order. The input efficiency of bank B would be given by the proportion $\frac{X_A}{X_B}$ while the corresponding output efficiency score would be defined as the proportion $\frac{Y_B}{Y_A}$. An efficiency score of unity means that the bank is operating on the efficiency boundary and therefore efficient. From the above illustration, it is clear that bank A dominates bank B, as bank A uses less input compared with the corresponding input factor for bank B ($X_A < X_B$) and bank A is producing more output compared with the corresponding output for bank B ($Y_A > Y_B$). Hence, bank A is superior in its use of input and output production. Bank B is said to be non-dominating and hence regarded as inefficient.

The major benefit of the FDH method is that for each inefficient DMU an existing best practice reference DMU is identified. However, the FDH is not without its disadvantages. Firstly, random or exogenous factors that might affect production are unaccounted for and so are included in the calculation of inefficiencies. So like the DEA approach, the deterministic FDH approach fails to separate deviations from the frontier into genuine inefficiency and random or exogenous factors. Secondly, the FDH has been criticised for allowing too many efficient DMUs or observations. Henderson (2003) states that a particular DMU with less of a certain input as well as output quantity that is significantly less relative to an efficient DMU may be considered efficient, while the same DMU evaluated under the DEA framework would be deemed highly inefficient. Finally, it has been shown that this particular non-parametric FDH technique is sensitive to outliers, thereby weakening its inferential power. In a nutshell, the distinction between DEA and FDH is that the FDH maintains free disposability while relaxing convexity, whereas the DEA assumes both the free disposability of resources and the convexity of the production set. Many empirical studies seem to favour the DEA approach over the FDH method.

Data Envelopment Analysis (DEA)

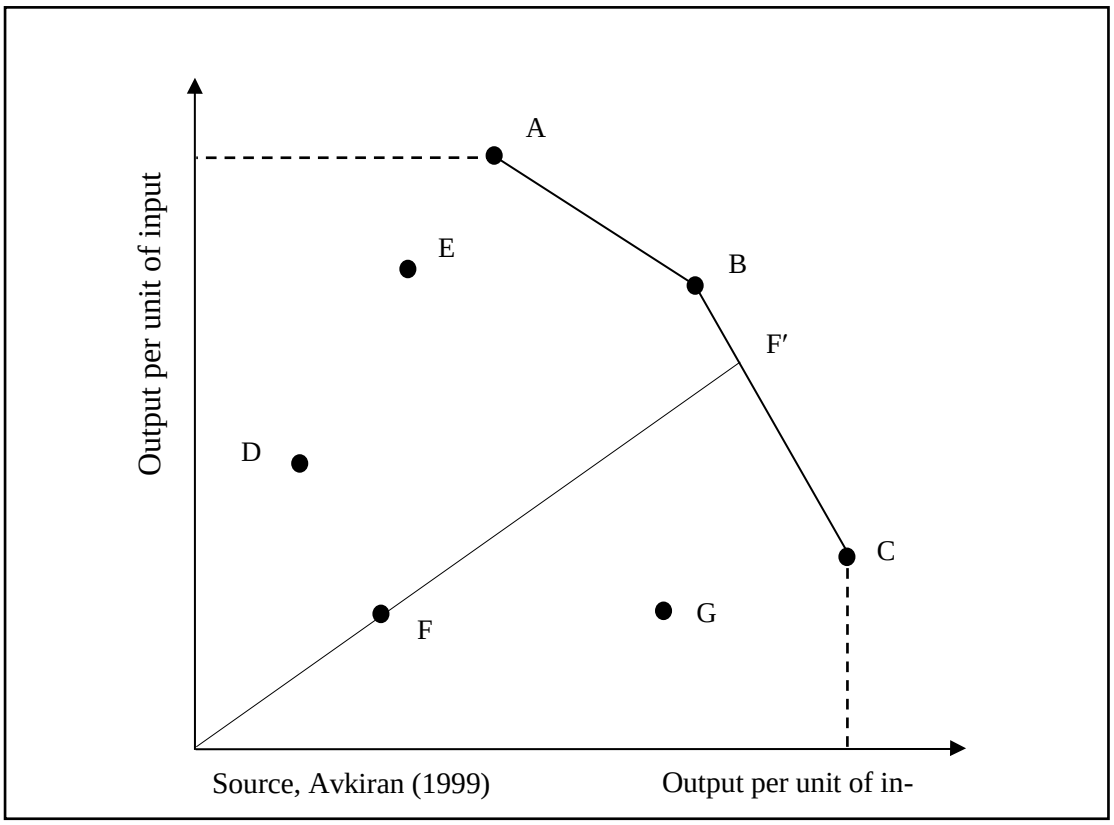
Data envelopment analysis assesses the performance of similar production or service entities which transform many inputs into many outputs (Cooper *et al*, 2011). The linear programming DEA technique was originally developed by Farrell (1957) and further modified by Charnes *et al* (1978) to estimate the efficiency of non-profit entities. The original intention

was for application within the non-profit sector, particularly government establishments such as public departments, public hospitals and schools. However, since DEA was first devised, many improvements have been made to adapt it for various uses, including application in profit-oriented businesses. In recent years, DEA has proved a popular tool of performance evaluation with wide application in banking, universities, hospitals and other service industries.

DEA provides an overall evaluation of technical and allocative[10] efficiency for a multiple-input-output firm (Coelli, 1996). The DEA model is input-oriented and had constant returns to scale (CRS) technology. However, subsequent developments to the CRS model by Banker *et al* (1984) gave rise to a more representative variable returns to scale (VRS) model. Diewert and Parkan (1983, p1) state that the DEA technique is considered *non-parametric* because it makes no assumptions regarding the underlying technology, for example that it "belongs to a certain class of specific functional form which depends on a finite number of parameters, such as the well-known Cobb-Douglas functional form". Bowlin (1986) argues that the non-parametric nature of DEA is an important property because the functional relationships underlying production of public entities may be abnormally complex and difficult to specify. Again, the DEA is classified as *non-stochastic* because it makes no restrictive assumptions regarding the probability distribution of errors. It constructs a piecewise "envelope" or boundary (frontier) such that all observed data points lie either on or below this boundary (Coelli, 1996). So points lying on the boundary are regarded as fully efficient, whereas points below the efficiency boundary are considered inefficient. The degree of input or output inefficiency is then captured by the vertical distance from the frontier. This is demonstrated by the illustration in Figure 3.5 below which depicts a DEA model with a solid line connecting the efficient DMUs *A, B* and *C* that represent achieved efficiency. The rest of the inefficient DMUs, such as *D, E, F,* and *G*, are then evaluated relative to the constructed efficiency frontier. For instance, DMU *F* is classified as inefficient and as such needs to shift to point F' on the efficiency boundary to be classified as efficient.

[10] If prices of input and output variables are available, cost or allocative efficiency indices can be computed using the DEA.

FIGURE 3.5: A DEA MODEL SHOWING AN EFFICIENT FRONTIER



It is essential to state that DEA measures are relative and not indicate absolute efficiency. DEA helps the researcher determine: the most productive DMUs which define best practice; the less-productive DMUs relative to the best-practice DMUs; the quantity of wastage by each of the less-productive DMUs; and the quantity of excess capacity or the capacity to increase outputs in less-productive entities, while holding input resources constant.

The non-parametric DEA offers certain benefits over the parametric SFA: Firstly, it does not require the specification of the functional form that relates inputs and outputs as in standard estimations of regressions, and does not also require the researcher to express his/her own weighting structure for both inputs and outputs. Secondly, the DEA approach is not sensitive to units of measurement. In other words, the efficiency scores are computed unaffected by the units of measurement used on the variables. According to Coelli (1996, p23) "changing the unit of measurement, *e g* measuring quantity of labour in person-hours instead of person-years, will not change the value of the efficiency measure." Thirdly, the DEA approach can handle multiple outputs much better than parametric models of production, a useful property for analysing banking sector efficiency. Production in the banking industry is characterised by multiple inputs and multiple outputs. Finally, the DEA technique does

not require price data for inputs and outputs, which are difficult to obtain for most public institutions, including the banking service industry. The DEA approach requires only data for inputs and outputs. Despite the advantages mentioned, DEA is not without its drawbacks. Many researchers have criticised the DEA technique for interpreting every deviation from the efficiency boundary as being inefficiency. In so doing, DEA fails to account for randomness or exogenous factors that may affect organisational performance but which are not necessarily a reflection of inefficient behaviour. In recent years, two main methods that have grown popular in performance or efficiency evaluation are DEA and SFA. The following section discusses the empirical literature around cost efficiency in African banking.

3.5 EMPIRICAL LITERATURE

There are a number of studies in the literature that have used the SFA, the DEA or both models to analyse bank efficiency. In this section, a presentation on those studies that have applied these methodologies in various contexts is provided.

3.5.1 Empirical Application of Stochastic Frontier Approach (SFA)

This section reviews previous studies that have used the stochastic frontier approach (SFA), from both a global and an African perspective.

Global Perspective

A number of the studies that have used the SFA are more focused on Asia (Bardhan, 2013; Baten & Kamil, 2010; Chang *et al.*, 1998; Fu & Heffernan, 2007; Hasan *et al.*, 2012; Khalil *et al.*, 2014; Louati & Boujelbene, 2015; Mahesh, 2006; Manlagñit, 2011; Ngan, 2014; Rozzani & Rahman, 2013; Samad, 2009; Sana *et al.*, 2015; Sreeramulu *et al.*, 2010).

There are studies that have focused on the issues surrounding efficiency/inefficiency and its determinants and other efficient factors (Khalil *et al.*, 2014; Mahesh, 2006; Manlagñit, 2011; Ngan, 2014). With regard to the causes of inefficiency, Ngan (2014) applied the SFA method in an attempt to measure the cost and profit efficiency of 45 commercial banks in Vietnam over the period 2007-'12. The study found risk and asset quality factors to be related to cost and profit inefficiency of the banks. Cost inefficiency was also found to be strongly related to bank concentration, mergers, and bank ownership. Based on these findings, the author concluded that mergers and acquisitions could attain potential cost inefficiency and promote competition in the banking system. Also, the study revealed that in terms of profit efficiency,

state-owned commercial banks (SCOB) were more efficient than other domestic commercial banks (JSCB) and foreign banks. However, with regard to cost efficiency, international banks were found to lead, compared with other national banks.

In another study, Manlagñit (2011) examined the relationship between risk and banking efficiency in Philippine commercial banks using the SFA, based on data over the period 1990-'99. The author used the one-step estimation using the risk and asset quality measures. The study revealed that the 1997 Asian financial crisis had adverse effects on cost efficiency, while banking and regulatory reforms enhanced the Philippine banking sector's strength. However, approved mergers and acquisitions were found to have a negative and significant relationship with cost efficiency.

Tellingly, based on the existing literature, the banks' efficiency could be a result of the risks associated with the bank's operations, the quality of assets, bank concentration, mergers and bank ownership.

Pertaining to the determinants of efficiency, Khalil *et al.* (2014) employed the SFA principles to estimate a translog cost frontier. The authors used quarterly panel data to evaluate the cost efficiency of Pakistan's banking sector over the period 2005-'13. The study found that the Pakistani banking sector had a high margin of improvement in its cost efficiency, which was achieved by maximising the output through either diversification or reduction in the price of input resources.

Mahesh (2006) employed the SFA to examine the efficiency level of Indian banks for the period 1985-2004. The estimated efficiencies were bank-specific cost, profit, and advance efficiencies. The results indicated that deregulation had a significant influence on all three types of efficiency measures. Regarding bank size, larger banks were found to be more efficient than smaller banks, suggesting a scale of economies advantage that comes with the size of the bank.

Therefore, from the assessment of past studies, what is apparent is that there are a number of factors that influence bank efficiency, including deregulation, diversification and low input prices. While these factors may influence banks' efficiency in varying degrees, no study

found has attempted to explain the extent to which each of these factors influences bank efficiency.

There is also a group of researchers whose interest was purely to investigate the extent to which banks are efficient (Baten & Kamil, 2010; Fu & Heffernan, 2007; Hasan *et al.*, 2012; Samad, 2009; Sana *et al.*, 2015). For example, Samad (2009) examined the inefficiencies of the Bangladeshi banking industry using the SFA production function model and time-invariant cross-sectional data. The findings suggest that the measure of the technical efficiency of Bangladesh's commercial banks lies between 12.7% and 94.7%, compared with the industry average of 69.5%. The study further found that roughly 30% of the commercial banks in Bangladesh were below the industry average.

Hasan *et al.* (2012) used the SFA to analyse the technical efficiency of Malaysia's domestic banks listed on the Kuala Lumpur Stock Exchange (KLSE) over the period 2005-'10. The study found that Malaysian domestic banks exhibited an average overall efficiency of 94%. This suggests that the sampled banks wasted an average of 6% of their inputs. The results also revealed that RHB Capital Berhad (RHBCAP) was highly efficient, with a score of 0.986 and that Public Bank Berhad (PBBANK) had the lowest efficiency with a score of 0.918. Over time, the study also found that the level of efficiency had increased during the period under review, with technical efficiency fluctuating considerably.

Baten and Kamil (2010) adopted the SFA in an attempt to investigate the efficiency of online bank-specific deposits and to determine various factors affecting the efficiency level of banks for the period 2001-'07 in Bangladesh. For the analysis, the authors used panel data collected from four bank categories: national, Islamic, foreign and private banks. In total, 20 banks were included in the study. The study found that the foreign banks were less efficient in producing deposits. However, the overall deposits efficiency of all bank groups increased steadily over time, except in 2007. The most efficient bank among the sample was found to be Islami Bank Ltd. and the most inefficient Pubali Bank, with respective efficiency scores of 0.96 and 0.52.

Sana *et al.* (2015) adopted translog SFA to estimate the cost function cost frontier on quarterly panel data to evaluate the cost efficiency of the Pakistan's banking sector over the period 2005-'13. The results revealed that Pakistan's banking sector had a high margin of

improvement in its cost efficiency. This is achieved by either maximising output through diversification or reducing the price of input resources.

Similarly, Fu and Heffernan (2007) used SFA to investigate cost X-efficiency in China's banking sector over the period 1985-2002. Core to this study was to investigate whether different ownership types and banking reforms affect X-efficiency. To do the analysis, the authors used a two-stage regression model estimate to identify the significant variables that could potentially influence X-efficiency. While the results indicated that the banks were operating at between 40% and 60% below the X-efficiency frontier, the joint-stock banks were found to be more X-efficient compared with the state-owned commercial banks. X-efficiency was also found to be higher during the first phase of bank reform.

Chang *et al.* (1998) used the translog (transcendental logarithmic) method of the stochastic cost frontier to estimate the cost inefficiency of domestic and multinational banks in the United States of America, within the Pakistani context. The authors analysed data for the period 1984-'89 and the results showed that US banks were more cost-efficient than foreign banks.

Recently, Mamonov and Vernikov (2017) used SFA to investigate the cost efficiency of Russian banks in terms of ownership form, capitalization and asset structure over a period 2005–2013. The study found that core state banks to be distinct from other state-controlled banks. Thus, core state banks were nearly as efficient as private domestic banks during and after the crisis of 2008–2009. Furthermore, the study found that core state banks gain cost efficiency when they lend less to the economy. Finally, the study revealed that private domestic banks outperform foreign banks when maintaining lower capitalization.

The results from these studies however remain inconclusive, in terms of the common acceptable level of technical and X-efficiency that could be achieved by the banks. Another shortcoming of the studies is that while they did a commendable job in trying to isolate the performance of domestic banks from that of foreign-owned banks, they failed to provide plausible explanations for these differences.

Some studies concentrated on bank efficiency based on ownership and bank size (Bardhan, 2013; Rozzani & Rahman, 2013; Sreeramulu *et al.*, 2010). For instance, Bardhan (2013) used the SFA method and estimated bank-specific profit efficiency of three broad ownership groups of Indian banks during the period 1995-'96 to 2011-'12. The study results revealed

that during the post-liberalisation period, public sector banks in India were the best performers in terms of estimated profit efficiency. Also, foreign banks operating in India recorded higher profit efficiency levels compared with domestic private banks. To this end, the introduction of prudential regulations such as capital adequacy ratios were found to have a significant positive influence on the profit efficiency of Indian banks, while loan defaults affected their profit efficiency adversely. It was also found that market power does not necessarily lead to an increase in profit efficiency, while bank mergers were found to have a significant positive effect. Another interesting finding from this study was that, contrary to the conventional belief that the Indian banking system is highly resilient and sufficiently robust to cope with external shocks, the global financial crisis had a significant adverse effect on the profit efficiency of Indian banks.

Similarly, Sreeramulu *et al.* (2010) used the Cobb-Douglas SFA to compare efficiency and ownership effects in determining the efficiency of the Indian banking industry over two periods, 1999-2003 and 2004-'08. The study found that there was a substantial efficiency improvement in the Indian banking sector during 2004-'08, compared with the 1999-2003 period. So the overall mean efficiency of Indian banks increased by 64% in 2004-'08 compared with 30% in the period 1999-2003. Labour was found to be the dominant input factor in determining overall banking efficiency compared with capital inputs. In this regard, the study revealed that labour efficiency improved significantly from 74% in 1999-'03 to 98% in 2004-'08. Domestic private sector banks were also found to be the most efficient in generating banking output, measured in terms of total business and total income.

Also, Rozzani and Rahman (2013) employed the SFA and assessed the determinants that affect the efficiency of conventional and Islamic banks' efficiency, with a special focus on banks in Malaysia over the period 2008-'11. The study found that the levels of profit efficiency for both conventional and Islamic banks in Malaysia were highly similar. The study also found that efficiency for conventional banks was correlated with bank size and the decrement of both operational cost and credit risk. On the other hand, efficiency for Islamic banks was found to improve in line with decrement of operational cost.

Louati and Boujelbene (2015) used the SFA to examine and compare the market power and the efficiency stability of Islamic and conventional banks in the MENA zone and South East Asia over the period 2005-'12. The authors estimated the Lerner indicator to generate a

measure of competition and later regressed the measure of competition with other explanatory variables on the banking "stability-efficiency" from the estimation of a stability stochastic frontier. The study found that growing competition in the Islamic banking sector promotes overall banking stability, and that the size of the bank is positively related to financial stability. However, the study also revealed that large conventional banks that operate in a market with limited competitiveness are more inclined to engage in risky behaviour. Finally the authors, based on the findings of the study, observed that low competitiveness is a precondition for capitalisation to have a positive effect on stability.

There are important considerations that can be drawn from this assessment of the existing literature as it pertains to the Asian economies. Of importance was the realisation that domestic (private) banks were found to be more efficient than foreign-owned banks. The existing literature also revealed that mergers, bank size and credit risk were positively correlated with bank efficiency. It also emanated from previous studies that labour costs have a dominant effect on bank efficiency, compared with capital inputs. What this suggests is that if the bank intends to be more efficient, it should concentrate more on labour costs. Finally, we have learnt from the review that the global financial crises did indeed have an effect on the banks' efficiency as far as the Asian economies are concerned.

Another stream of researchers focused their attention on Europe (Apergis & Rezitis, 2003; Aysan, Karakaya, & Uyanik, 2011; Battese, Heshmati, & Hjalmarsson, 2000; Kristo, 2013; Řepková & Miglietti, 2013; Sarmiento & Galán, 2014).

Aysan *et al.* (2011) employed panel SFA to examine efficiency and its relationship with profitability in the Turkish banking sector. In this study, panel data comprising 32 banks over the period 2002-'07 was analysed. The results indicate that there is cost efficiency gain and convergence in the efficiency levels of banks. The results also revealed that state banks were more efficient, compared with foreign banks.

Battese *et al.* (2000) analysed the effect of the deregulation of the Swedish banking industry over the period 1984-'95 using the SFA method based on 1 275 observations from 156 banks. The study also aimed to assess the consequences of the banking crisis on productive efficiency and productivity growth in the banking industry. The authors adopted a translog SFA to estimate the labour-use requirements in terms of loans, deposits, guarantees, number of branches and total inventories, and the year of observation. The study found technical

inefficiencies of labour use of Swedish banks to be significant, with mean inefficiencies per year estimated to be between about 8% and 15% over the years of the study.

Řepková and Miglietti (2013) used the SFA to estimate the cost and profit efficiency of individual banks in Slovakia over the period 2003–'12. The banks sampled represented 80% of the banks in the Slovak banking sector in terms of total banking assets. The authors then categorised the banks into three groups according to size: large, medium and small banks. The study found that average cost and profit efficiency was decreasing in the Slovak banking sector during the period reviewed. Based on the analysis carried out, the results showed that while the average cost efficiency values ranged between 29% and 92%, the average profit efficiency values ranged from 56% to 93%. The study also found that small and medium-sized banks were more efficient compared with the largest banks in the Slovak banking sector.

Apergis and Rezitis (2003) employed the SFA to measure the X-efficiency of the banking industry in Greece. The results of the study show that despite substantial deregulation policies in the monetary sector, Greek banks were characterised by a significant inefficiency measure of about 29%. Based on the error decomposition tests, the authors were able to detect that the main sources of inefficiency were high operating costs as defined by the costs of administration, personnel, and the monitoring of loans.

Kristo (2013) used the SFA to estimate the cost efficiency of the Albanian banking system since 2007. The study found that the largest banks (with the largest market share G3 group) were more efficient than the smaller banks. However, the authors could not clearly establish the nature and strength of the relationship between ROA and size of the bank showing cost efficiency.

Gjirja (2003) assessed the efficiency effects of bank mergers in Sweden using an unbalanced panel data of savings banks for the period 1984 to 2002. The author used the SFA cost function with a time-varying stochastic efficiency term to evaluate the efficiency-enhancing role of bank mergers. The study found no evidence to suggest that inefficient banks are likely to be acquired by more efficient ones. The author also performed a post-merger analysis which revealed no remarkable improvements in bank technical efficiency after consolidation.

Sarmiento and Galán (2014) estimated for the Colombian banking sector during the period 2002-'12 using SFA with random inefficiency parameters. The authors believed that using random inefficiency parameters allowed the identification of the role of bank risk-taking in driving cost and profit inefficiency, and to identify heterogeneous effects of risk exposure on banks with different characteristics. The study found that risk-taking drives inefficiency and that if it is omitted in the analysis, it will result in over- (or under-) estimation of cost (or profit) efficiency. Risk-taking was also found to have varying effects on the efficiency of banks depending on the size and affiliation, and those involved in mergers and acquisitions. Profit efficiency was found to be driven by greater exposures to credit and market risk. Furthermore, the study found that large, foreign and merged banks benefit more when assuming credit risk, compared with small, domestic and non-merged banking institutions, which take advantage of assuming higher market risk.

With regard to the European context, the results from some previous studies were contradictory, especially in relation to the effect of bank size on efficiency. For instance, while Řepková and Miglietti (2013) found smaller to medium-sized banks more efficient, Kristo (2013) found larger banks more efficient. It was, however, revealed that labour is the most important determinant of technical inefficiency, contributing between 8% and 15% of inefficiency. Another interesting observation from the literature was that there is no evidence to suggest that mergers translate into bank efficiency. High risk-taking by banks was also identified as a major driver of inefficiency. However, greater exposure to credit and market risk results in profit efficiency. In terms of ownership, the evidence suggests that domestic state banks are more efficient than foreign banks.

Niţoia and Spulbara (2014) used a heteroscedastic stochastic frontier model to investigate differences in commercial bank cost efficiency in six emerging countries in Central and Eastern Europe over the period 2005-'11. The study found that high macroeconomic stability supports the efficiency of commercial banks. On the other hand, the study found that high-risk undertakings by banks result in inefficiency. So bank inefficiency is determined by lower liquidity, a lower solvency rate and higher credit.

Cavallo and Rossi (2002) employed the stochastic cost frontier to compare the efficiency of European banking systems in the light of the formation of the European Monetary Union. Of interest in this study was measuring X-inefficiency and modelling it as a function of

environmental variables which might influence the efficiency of firms. In this regard, the study revealed the Middle-European model as the one that operates closest to the frontier. Deviation of the frontier within the European Monetary Union is determined by national barriers and the existing regulatory frameworks.

Mensah, Abor, Aboagye and Adjasi (2013) applied the stochastic frontier approach to estimate the relationship between banking sector efficiency and economic growth in Africa. The study found the banking sector efficiency to be 69%. The authors further found a positive relationship between banking sector efficiency and economic growth.

Ngo and Tripe (2017) examined alternative methods for treating nonperforming loans (NPLs) in bank cost-efficiency studies using SFA over the period 2003–2010. The study found that the first two methods are inappropriate for the analysis. While the first method could not provide a significant relationship between NPLs and the banks' total cost, the second method could not account for any inefficiency at all. However, the third method of separating NPLs from total loans can provide better insights. Overall, the study found that the cost-efficiency of Vietnamese banks over the study period was moderate with a slight decreasing trend. The implication of this study is that it provides an alternative method of accounting for NPLs in cost SFA studies in banking.

Also, Robin, Salim, and Bloch (2018) employed the SFA to estimate the cost efficiency of the commercial banks of Bangladesh in the context of financial reform over the period 1983–2012. The study found that the presence of politically linked directors on the bank board has an adverse effect on efficiency. This suggest that political influence have a negative effect on cost efficiency in the financial sector of Bangladesh.

African Perspective

Within the African context, Oteng-Abayie, Owusu-Ansah, and Amanor (2016) employed the Cobb-Douglas stochastic frontier model to examine technical efficiency of 66 credit unions (CUs) in Ghana over the period 2009-'12. The study also investigated the factors affecting the technical inefficiency of the CUs. To select the input and output variables that would generate the technical efficiencies, the authors applied the production and intermediation approaches to efficiency modelling. Consequently, the study found that during the

study period, the production and intermediation models showed average technical efficiencies of 53.4% and 57.96% respectively. The study also found that the CUs could improve their cost inputs, on average, by 47% and 42%, to increase outputs respectively through its production and intermediation channels. The results also highlighted that the technical efficiency of CUs is most influenced by staff numbers and productivity.

Ningaye, Mathilde, and Luc (2014) investigated the effect of competition on the cost and profit efficiency of banks in the Economic and Monetary Community of Central Africa (CEMAC), over the period 2003-'10, using the SFA. The authors found that competition had an influence on profit efficiency but not on cost efficiency.

Kablan (2010) employed the SFA and the generalised method of moments system to evaluate the determinants of banking efficiency in sub-Saharan Africa (SSA) and investigate explanations for the low level of financial development in the region. The study found that SSA banks were generally cost-efficient, but had been undermined by non-performing loans. Musonda (2008) used a single-stage maximum likelihood estimation procedure applied to a stochastic frontier cost function to investigate the cost efficiency of Zambia's banks since the banking crisis of the mid-1990s. The study found that Zambian banks were on average inefficient in the order of 11.4 %. Furthermore, the study found that foreign banks were more efficient compared with domestic banks. On the other hand, private banks were found to be closing the efficiency gap in recent years. An interesting finding from this study was that regulatory intensity in Zambia does not exacerbate inefficiency, as opposed to the universal belief that it has a negative effect.

Okeahalam (2006) used the Bayesian SFA to evaluate the production efficiency of 61 bank branches in the nine provinces of the Republic of South Africa. The study found that each branch was operating at increasing returns to scale and that the level of production efficiency of the bank branches was lower than it could be. The study also found that at current levels of output, on average, bank branches could reduce their costs by about 17% if they improved their efficiency level. The study showed that Gauteng Province had the lowest average level of returns to scale, while Free State Province had the highest average level of the nine provinces. In addition, the estimates suggested that the price of capital was the largest predicted proportion of costs.

Ncube (2009) employed the SFA method to evaluate the cost and profit efficiency of four large and four small South African banks over the period 2000-'05. The large banks were ABSA, FirstRand Bank, Nedbank and Standard Bank. The small banks included African Bank, Capitec Bank, Investec Bank and Teba Bank. The study found that South African banks had significantly improved their cost efficiencies during the study period. On the other side, efficiency gains on profitability, over the same period, were found not to be significant. Finally, the study found that in terms of achieving efficiency gains in cost reduction and profitability there were no differences among the banks studied.

So from an African perspective, while technical efficiency was found to be influenced mostly by staff members' productivity, cost efficiency was found to be determined by non-performing loans. On the other hand, competition was found to have an influence on profit efficiency but not on cost efficiency. In terms of ownership, foreign banks were found to be more efficient than domestic banks. Finally, regulatory intensity was found not to have a negative effect on efficiency.

3.5.2 Empirical Application of the Data Envelopment Analysis (DEA)

Global Perspective

Many of the studies that have applied the DEA are concentrated in Asia, particularly in India (Debasish, 2006; Drake *et al.*, 2006; Karimzadeh, 2012; Khankhoje & Sathye, 2008; Mohindra & Kaur, 2011; Qayyum & Riaz, 2012; Roy, 2014; Seiford & Zhu, 1999).

Qayyum and Riaz (2012) employed the data envelopment analysis (DEA) technique through boot trapping procedure to determine the efficiency of 28 commercial banks, including six Islamic banks. The authors adopted the Tobit model approach using data for 2003-'10. Commercial banks were found to be more efficient, followed by private conventional and Islamic banks. In other words, the results indicated that commercial banks were more efficient than Islamic banks.

Also using the DEA approach, Drake *et al.* (2006) examined the effect of macroeconomic and regulatory factors on bank efficiency in Hong Kong. The authors found that macroeconomic factors such as inflation, interest rate and real GDP determined bank efficiency significantly.

Satye (2003) employed the DEA to examine the relative efficiency of Indian banks in the late 1990s and compared it with that of banks operating in other countries. The study found that in India, public sector banks have a higher mean efficiency score compared with private sector banks. However, the author found mixed results when comparing public sector banks with foreign commercial banks.

Roy (2014) used the DEA to evaluate the efficiency of the Indian banking sector. The study used an unbalanced panel of 62 scheduled commercial banks divided across the four ownership structures: nationalised banks, private sector banks, foreign banks and the State Bank of India (SBI) and its associates. The period was divided into three eras: pre-Basel (1999-2002), which marks the era in between banking sector reforms and the implementation of Basel I norms with the market risk amendment; the Basel I era (2003-'08) and the Basel II era (2009-'12). The study found that the efficiency of the foreign banks had increased through manifolds over the three eras and were consistently efficient in terms of pure technical efficiency and scale efficiency across the three eras. The study also found that private sector banks showed marginal variation across the three eras with regard to all the efficiencies. However, with regard to the SBI group and the nationalised banks, the results showed a significant drop in OTE scores, the major cause of the inefficiency being improper size allocation.

Debasish (2006) used the output-oriented CRR DEA model to assess the relative performance of Indian banks over the period 1997-2004. In this study, the banks were segmented based on asset size, ownership status and years of operation. The study confirms that foreign-owned banks were on average most efficient and that new banks were more efficient compared with older ones. According to the author, inefficiency in older banks was associated with their being overburdened by debts. The study found further that the smaller banks were efficient on a global scale compared with large banks, which were efficient at a local scale.

Karimzadeh (2012) used the DEA to examine the efficiency of Indian commercial banks in the period 2000-'10, with data based on eight commercial banks. The results of the study revealed that the Bank of India and the Industrial Credit and Investment Corporation of India (ICICI) were more efficient compared with other banks in India. The study also confirmed that selected public sector banks were more efficient compared with private sector banks during the study period.

Khankhoje and Sathye (2008) employed the DEA to investigate the extent to which the restructuring of regional rural banks in India that took place during 1993 and '94 had improved the efficiency of these banks. The study found that efficiency had improved significantly following the restructuring. The study found further that the policy of restructuring India's rural banks had shown positive results.

Mohindra and Kaur (2011) applied the DEA and examined the relative efficiency of Indian regional rural banks (RRBs) during the post-reform period spanning the period 1991-'92 to 2006-'07. The study found that regional rural banks experienced technical efficiencies of 78% over the period 1992-2007. The study found that it was possible for banks to decrease their inputs by an average of 22% and still produce the same level of output. A comparative analysis of the average efficiency scores of 50 regional rural banks in the pre- and post-reform periods revealed that the degree of input waste was 24% in the time of the first-generation reforms, which then declined to 20% after the second-generation reforms.

Seiford and Zhu (1999) used a two-stage DEA approach to examine the performance of the top 55 banks in the United States (US). The study found that relatively large banks showed better performance on profitability, while smaller banks tended to perform better with respect to marketability.

Kourouche (2008) employed the DEA to investigate the technical efficiency and productivity of a balanced panel of 10 Australian banks during the period 1995-2005. The key variables of interest were profitability, operational efficiency and asset utilisation. The study found that the extent at which efficiency and productivity change varies across the banks and over the years. The study further found that the efficiency and productivity of the Australian banks had generally deteriorated over the period under analysis. To this end, the author recommended that to increase the efficiency and productivity levels of Australian banks, they needed to control their costs better and invest in new technology and capital equipment.

Maletić, Kreća, and Maletić (2013) adapted the DEA method to measure operational efficiency of the banking sector in Serbia, which at that time comprised 33 banks. The results indicated that seven banks were extremely efficient; two of these banks were public sector banks. In the light of these findings, the authors suggested that efficiency could be achieved

by focusing on cutting costs and boosting revenues and the employment structure. Another finding from this study was that efficiency is dependent on ownership (private, public or foreign). However, the size of the banks in terms of the number of branches was not considered in this study.

Abel and Le Roux (2016) used the DEA and the Tobit regression methods to evaluate the cost and revenue efficiency of the Zimbabwean banking sector during the period 2009-'14. The study found that revenue and cost efficiency increased during the period 2009-'12, in line with high positive growth rates and economic stability. However, there was a decline in efficiency 2013-'14, a period characterised by government controls on the banks' pricing system and the general economic slowdown. Private banks were found to be more cost- and revenue-efficient compared with public banks. Similarly, domestic banks were found to be more cost- and revenue-efficient compared with international banks, Commercial banks were also found to be relatively more cost- and revenue-efficient than building societies. The determinants of cost and revenue efficiency were identified as cost/income ratio, capital adequacy, macroeconomic growth, and inflation.

On other hand, Sharma, Sharma, and Barua (2012) applied a two stage non-parametric operation-based data envelopment analysis (DEA) technique to assess the determinants and to predict the relationship between firm-specific factors with the efficiency and productivity of the Indian banking sector over the period 2000-'10. Based on average annual efficiency scores, the study found that public banks in India were more efficient than private and foreign-owned banks. Due to bank-specific factors, large banks were found to be more efficient than smaller banks. These findings mirrored those of Fries and Taci (2005), who found that foreign-owned backs are more cost-efficient simply because have a larger share of total assets and lower operational costs. However, Fries and Taci (2005) found private banks to be more efficient than public banks. All in all the study found that foreign-owned private banks were even more efficient.

Avkiran (2009) used the DEA four-stage methodology, units-invariant efficient frontier analysis, Tobit regression, adjustment of data, and a repeat of the efficient frontier analysis respectively, to investigate the influence of the general level of interest rates on bank efficiency. The study used panel data drawn from Australian and New Zealand banks spanning a period of eight years. The study found that a bank becomes less efficient with rises in

interest rates and more efficient when interest rates fall. Also interesting in this study is the discovery of the distortionary effect of interest rates on efficiency measurements over time and across countries.

Iršová and Havránek (2010) used both parametric and non-parametric approaches to test the sensitivity of the reported estimates to the methodological design. The study found that the difference between the two methodological approaches arose when the Fourier-flexible functional form is used, which yields lower scores. Thus, average estimated efficiency is higher when the number of observations used is high.

Hermesa and Nhung (2010) employed the DEA to investigate the effect of financial liberalisation on bank efficiency over the period: 1991-2000. The study used data drawn from a sample of more than 4 000 bank-year observations. In this regard, the study found a positive linkage between financial liberalisation programmes and bank efficiency.

Similarly, Brissimis, Delis, and Papanikolaou (2008) examined the relationship between banking sector reform and bank performance. Bank performance was measured in terms of efficiency, total factor productivity growth and net interest margin. The study found both banking sector reform and competition having a positive link with bank efficiency while capital and credit risk having a negative influence on efficiency and productivity of banks.

Chronopoulos, Girardone, and Nankervis (2011) used the DEA estimator to estimate banks' cost and alternative profit efficiencies. The study focused on banks that were operating in the accession countries over the period: 2001-'07. The study found that banks are more affected by relatively high cost and profit inefficiencies. There were also noticeable differences in efficiency levels across countries. The study also demonstrated the existence of a link between the degree of diversification and the efficiency of costs and profits.

Ariff and Can (2000) investigated the cost and profit efficiency of 28 Chinese commercial banks using the DEA technique, with data spanning the period: 1995-2004. The study found that profit efficiency levels were lower than cost efficiency levels. Medium-sized banks were found to be significantly more efficient than small and large banks.

Using the DEA techniques, Repková (2015) analysed the efficiency of Czech commercial banks for the period: 2001-'11. The study found that the average efficiency computed under

the assumption of constant returns to scale reached a value of 86.7%, while average efficiency estimated under the assumption of variable returns to scale was 95.7%. There was however a slight increase in efficiency for the period under study. The main source of inefficiency was identified as the inaccurate size of the biggest banks and excess client deposits by Czech commercial banks.

Similarly, Abdul-Wahab and Haron (2017) used DEA methods to examine the efficiency of the banking sector in Qatar over the period 2007 to 2011. The study found that the Qatar banks were operating below optimum performance. However, the authors noted that there was still room for improvement. The study further found that conventional banks were the most efficient in Qatar in terms of technical and pure technical efficiencies while Islamic banks were most efficient in terms of scale efficiency. Another interesting finding from this study was that during the 2008/2009 global financial crisis, Islamic banks were found to be utilizing their resources properly as compared to the conventional and foreign banks in Qatar.

Some scholars compared bank efficiency based on the regions they operate. For example, Fukuyama and Matousek (2017) modelled and identified the differences between optimal and current bank revenue for the entire banking sector in Japan over the period 2001-2013. Thereafter, the authors examined the behavioural differences between Regional Banks I and Regional Banks II in terms of optimal and current revenue. The study found that, overall, the Japanese Regional Banks have not achieved the optimal levels in their production processes. The study also found that Regional Banks I achieved suboptimal revenue while Regional Banks II show a much bigger difference. The authors also confirmed that the major source of bank inefficiency during the study period was from allocative efficiency, suggesting the need to focus on improving operating costs. However, the study did not analyse how economic development in the country contribute to bank cost efficiency.

In terms of the effect of economic growth, Diallo (2018) utilised DEA to analyse the effect of bank efficiency on value-added growth of industries that were most dependent on external financing during the 2009 financial crisis. The study utilised data from 38 countries over a wide variety of industries. The study found that bank efficiency is positively related to economic growth for financially dependent industries during the financial crisis. The authors argues that efficiency contributes to bank robustness and resilience, which are important

ingredients for economic growth. This linkage is mediated through the ability of banks to provide financing. However, the results from this study were limited in the sense that the study was only confined to one period. Thus, the was no comparative periods to assess if the relationship could be otherwise and the study did not make use of a larger period sample so as to observe this linkage for different periods.

Similarly, Eyceyurt Batir, Volkman, and Gungor (2017) examined the technical, allocative, and cost efficiency of conventional and participation banks in Turkey using DEA method for the period between 2005-2013. The study found that average participation bank efficiency was higher than the average conventional bank efficiency each year. The authors also found that while expenses and loan quality had a negative effect on efficiency of conventional banks, they had a positive influence on efficiency of participation banks. Furthermore, external variables were found to have a negative relationship with efficiency of both types of the banks. The study revealed that technical efficiency was higher than allocative efficiency for both types of banks in Turkey, suggesting that technical efficiency was the main contributor to cost efficiency. For conventional banks, it was found that while loans contribute positively to efficiency, selected external variables such as, bank size, GDP growth and inflation, and selected internal variables such as expense, capital, total deposit and non-performing loans negatively affects the efficiency. On the other hand, pertaining participation banks, while expenses, loans and non-performing loans were found to have a positive influence on efficiency; profit, bank size, GDP growth and inflation operates were found to have a negative influence.

Aysan, Ertek, and Ozturk (2018) also employed the DEA to investigate the relationship between interbank funds and efficiencies for the commercial banks operating in Turkey between 2001 and 2006. The study observed that while interbank funds (ratio) had negative effects on bank efficiency; bank capitalization and loan ratio had positive effect, and profitability has insignificant effect.

African Perspective

In Africa, Eriki and OSifo (2015) focused on three performance measurers of efficiency: constant returns to scale (CRS), variable returns to scale (VRS) and scale efficiency models and employed the DEA approach to investigate the determinants of the performance efficiency of 19 selected banks in Nigeria in 2009. The study found that performance efficiency

was influenced by bank size and bank age, while board independence and board ownership structure were found to be related negatively to bank performance efficiency.

Moh'd al-Jarrah (2007) employed the DEA approach to investigate cost efficiency levels of banks operating in Jordan, Egypt, Saudi Arabia and Bahrain over the period 1992-2000. The author further decomposed the estimated cost efficiency into technical and allocative efficiency at both variable and constant return to scale. Technical efficiency was further decomposed into pure technical and scale efficiency. The study found that cost efficiency scores ranged from 50% to 70%. However, there were variations in scores depending on bank size and geographical location. The study further found that banks could produce the same level of output with roughly 50% to 70% of their current inputs if they were operating on the most efficient frontier.

Kamau (2011) used the DEA to analyse intermediation efficiency in the banking sector and the Malmquist productivity index (MPI) to measure productivity gains of banks in Kenya. The study found that the banks were not fully efficient in all respects. However, the banks performed fairly well during the period under study. Consequently, the author suggested that policies encouraging competition, product diversification to advance loans, risk minimisation through increased capital regulation and the privatisation of some banks should be considered.

Samy, Hichen, and Barbara (2009) used the DEA method to evaluate bank efficiency in MENA countries over the period 1993-2006. The main findings from the study indicated that despite similarities in the process of financial reform, the efficiency of the sampled commercial banks varied substantially across the market. So Morocco and Tunisia outperformed Egypt and Jordan. The differences in banking technologies were also observed to be crucial in explaining differences in efficiency.

Erasmus and Makina (2014) studied the efficiency of the major banks of South Africa using the standard and alternative approaches to DEA over the period 2006-'12. These scholars believed that this period also covered and allowed analysis of the efficiency of the banks during the global financial crisis of 2008-'09. Using these two approaches, the study found that most of the major banks in South Africa were efficient. However, alternative approaches were observed to improve the efficiency scores of those banks that were DEA-inefficient under the standard approach. Interestingly, the global financial crisis was found not to have

affected the efficiency of most of the banks. The authors argued that the banks' efficiency prior to the global crises was a contributory factor to their resilience during the financial crisis.

Aikaeli (2008) employed the DEA model to investigate efficiency of commercial banks in Tanzania, focusing mainly on technical, scale and cost efficiency of banks. The study found that overall bank efficiency was fair, and there was room for marked improvements on all the three aspects of efficiency examined. However, foreign banks ranked highest in terms of technical inefficiencies. On the other hand, cost inefficiencies of banks were attributed to inadequate fixed capital, poor labour compensation, less management capacity as banks expanded, and accumulated excess liquid assets.

Oberholzer, Van der Westhuizen, and Van Rooyen (2010) used the Du Pont analysis and two data envelopment analysis (DEA) models to estimate efficiency on JSE-listed banks over a 10-year period, 1998-2007, within the South African context. The authors aimed to determine the degree to which the banks' market performance, as measured by market value ratios, is affected by their internal performance. While Model 1 used only income statement data as outputs (the value of interest income and non-interest income), Model 2 only considered balance sheet data outputs (the value of deposits, loans and equity). In this respect, the study found that there is higher correlation between market value ratios and profitability ratios as compared with the correlation between the income statement output-based and balance sheet output-based efficiencies. Thus, the empirical evidence generated from the study revealed that, for Model 1, the average technical efficiency of all the banks was 89.5% as compared with 79% for Model 2. This suggests that banks have the potential to increase output by 10.5% and 21% without increasing their inputs. The study also found that the average allocative efficiencies of all the banks included in the study were 98.5% and 89.3%, respectively.

Van Heerden (2007) estimated the scale efficiency and technical efficiency of one of the largest banks in South Africa using the DEA. The study comprised 37 districts and all the provinces. The author employed the intermediation approach to incorporate both the input- and output-orientated approaches under variable returns to scale. Using this, the study found that 19 out of the 37 districts were not fully technically efficient (input- and output-orientated) during the 22 months. Similar results were also observed for scale efficiency, where

17 out of the 37 districts were not fully scale-efficient (input-orientated) and 19 out of the 37 districts were not fully scale-efficient (output-oriented) during those 22 months.

Yannicka, Hongzhongb, and Thierryc (2016) employed the DEA method over 2008-'10 to assess the efficiency of 14 banks in Côte d'Ivoire. The study found that Ivorian banks were not operating efficiently in terms of loans allocation. However, when taking ownership into account, foreign-owned private banks were found to be relatively more efficient compared with publicly owned ones. Contributing to banking inefficiency was an incompatibility of production scale.

Ally (2013) used the DEA and analysed the efficiency of regional and small commercial banks in Tanzania for the period 2006-'12. The study found that four banks were fully efficient in 2006, three banks in 2007 and '08, one bank in 2009, '10 and '11, and four banks in 2012. The study found the overall mean efficiency of banks to be 90.4%, suggesting that it was possible for banks to reduce their inputs by 9.6% without necessarily affecting the level of output.

Eman (2012) employed the DEA to examine commercial banks efficiency in three north African countries (Libya, Tunisia and Algeria) for the period 2002-'09. The study found striking differences in the banks' technical efficiency. So for Libya, the banks indicated a higher mean technical efficiency at 0.94. For Tunisia and Algeria, the mean technical efficiencies were 0.78 and 0.47, respectively. The study also found that the technical efficiency changed (grew) by an average of 1.238% a year for all the banks included in the study.

Frimpong (2010) used the DEA to examine the relative efficiency of the banks in Ghana in 2007. The study investigated the efficiency linkage between profitability for three state-owned sector banks, eight private domestic banks and 11 foreign banks. The study found that only four out of the 22 banks were efficient. The 18 inefficient banks had efficiencies ranging from 33% to 89%. The study also found that the average technical efficiency for the banking sector was 74%. Domestic private banks were found to be the most efficient in Ghana with an average efficiency level of 87%. This was followed by foreign banks, with an average of 72%, and state-owned banks with an average score of 51%.

Iddrisu, Aboagye, and Osei (2014) employed the DEA to investigate the extent to which the establishment of the ARB Apex Bank, which started business in 2002, had contributed to

the improvement of the production and technical efficiency of rural and community banks (RCBs) in Ghana for the period 2000-'10. The study found that two RCBs were relatively efficient throughout the study period, with an average efficiency score of 1, or 100%, while the yearly average efficiency of all RCBs for the period varied from 0.734 to 0.920. The study also found that the efficiency of the RCBs has improved significantly after the establishment of the ARB Apex Bank in 2002. Eight RCBs were identified as the best-practice banks in the industry. Finally, the study found that expenditure on inputs could be reduced by 14.5% at the current output level.

Akoena, Aboagye, Antwi-Asare, and Gockel (2017) used the DEA to investigate the technical efficiency and economies of scale of Ghanaian banks over the period 2000-'06. Of interest in this study was examining the efficiencies of banks as they grew; there was a comparison of bigger and smaller banks in this respect. The study found that the technical efficiencies of large banks and small banks were similar. This suggests that efforts to grow banks does not affect their technical efficiency.

Adusei (2016) used the DEA to investigate the determinants of the technical efficiency of rural and community banks in Ghana. The study found that only 20 rural and community banks were technically efficient. The main determinants of this technical efficiency were size, profitability, and bank funding. Thus, while an increase in the size and funding quality results in a decrease in technical efficiency, an increase in profitability improves technical efficiency.

Haq, Skully, and Pathan (2010) employed the DEA to assess the cost efficiency of 39 microfinance institutions across Africa, Asia and Latin America. The study found that non-governmental microfinance institutions particularly; under the production approach, were the most efficient. This finding was consistent with the fulfilment of dual function of microfinance institutions of alleviating poverty and financial sustainability. Also, under the intermediation approach, bank microfinance institutions were found to perform in terms of efficiency. This suggests the important financial intermediary role of channelling capital to the most productive areas of the economy.

Ngu and Mesfin (2007) used the DEA approach to assess the efficiency of banks in sub-Saharan Africa and its determining input and output factors. The study found that sub-Saharan African banks were about 98.35% efficient. The input and output factors were found to include shareholders' equity (input), loans (output) and deposits with other banks.

In a case study by Muthoni (2011), a DEA analysis was employed to measure banks' operational efficiency in 168 branches of Kenyan commercial banks in 2010. The inputs used for the study were interest payable, staff costs, other operating expenses and depreciation costs. The outputs used were interest receivable, fees and commissions earned and other operating income. The study found that the mean operational efficiency score for the banks to be roughly 65%. The major contributing factor to bank inefficiency was found to be staff cost input.

Raphael (2013) used the DEA to estimate the relative efficiency of 58 selected commercial banks operating in the East African Community (Tanzania, Kenya, Uganda, Rwanda and Burundi) for the period 2008-'11. The study found a sharp decline in technical efficiency from 0.81 in 2008 to 0.56 in 2009. There was a rising trend in technical efficiency to 0.73 in 2011. The study also found that most commercial banks in East Africa were operating under a decreasing return to scale. The identified contributing factor to this was the inefficient use of input resources.

A study by Sobodu and Akiode (1998) applied the DEA approach to investigate bank performance and supervision in Nigeria during transition to a deregulated economy. It was found that the efficiency of banking industry intermediation declined significantly during the years immediately following deregulation, with slight improvements noticed only in recent times. The study concluded that this could have been a result of inconsistent policies to which the sector was subjected during this period. The study also found that private and government banks differed in their technical efficiency. The average efficiency measures were found to be higher for private banks, compared with government banks.

Desta (2016) used DEA and the Malmquist total factor productivity index in an attempt to distinguish between productive banks from those that are not. The study sample comprised 19 commercial banks from among the 30 best African banks as identified by the magazine *Global Finance*. The study found that out of the 19 banks, five were not productive and that

technology drives bank productivity. Surprisingly, Standard Bank of South Africa, the regional winner according to *Global Finance*, was ranked No 9 in the study, while Namibia's Bank Windhoek Ltd was ranked first.

Kipesha (2012) evaluated the efficiency of microfinance institutions operating in East Africa, using DEA approach. The average technical efficiency scores were 0.706 in 2009, 0.798 in 2010 and 0.852 under constant return to scale and 0.823, 0.892 and 0.891 under variable returns to scale for three years respectively. Furthermore, the average efficiency trend was found to be positive, with low efficiency scores in 2009 and high scores in 2011. Also, banks and non-bank financial institutions were found to be relatively more efficient compared with non-governmental organisations (NGOs) and cooperatives. On the other hand, country efficiency averages revealed that Kenya and Rwanda had higher average efficiency scores for three years under constant return to scale, while Tanzania and Uganda had higher average efficiency scores under variable return to scale.

Recently, Banya, and Biekpe (2018) used the DEA to measure the degree of bank efficiency in ten frontier African countries over a period 2008–2012. The focus was to estimate technical, pure technical and scale bank efficiency and the study found the banking sector of these countries efficient. However, bank size was found to be associated negatively to banking sector efficiency and the degree of risk was found to be positively related to bank efficiency. The study also found that the source of overall technical inefficiency for commercial banks in the Frontier African countries studied was managerial inefficiency and the failure to operate at most productive scale size (scale inefficiency). However, these banks were found to be operating at high level of scale efficiency. Furthermore, the study found a negative relationship to exist between financial leverage and banks' performance. However, the study was however limited in the sense that it did not make a comparison between local banks and foreign banks, it did not also take bank size and technological innovation into consideration.

In another study, Kouki and Al-Nasser (2017) utilised the DEA technique to examine how bank efficiency and stability were affected by the market power in 31 African countries for 127 banks over a period between 2005-2010. The study found the higher degree of market power to be associated with high level of efficiency and stability. Thus, from this study, it could be concluded that increased market power could benefit banking performance and its stability.

Also, Lema (2017) examined the determinants of the technical efficiency of commercial banks in Ethiopia using the DEA over the period from 2011-2014. Three local banks were found to be less efficient as compared to international banks that were found to be efficient, based on both the constant returns to scale and variables returns to scale assumptions. In terms of the determinants of technical efficiency, the study found that the level of capitalization, liquidity risk, return on asset and market share have positive effects on technical efficiency.

3.5.3 Empirical Application of SFA and DEA

Global Perspective

Gayval and Bajaj (2015) employed both SFA and DEA to estimate the efficiency of Indian commercial banks, using data from 19 nationalised Indian banks. The authors used the BCC model of DEA and SFA production frontier estimate. The results indicated moderate consistency between parametric and nonparametric frontier methods in efficiency score rankings, identification of best- and worst-performing banks, the stability of efficiency scores over time and correlation between frontier efficiency and accounting-based performance measures. DEA and SFA efficiency estimates were also found to be positively and significantly correlated with key financial performance ratios.

Dong, Hamilton, and Tippett (2014) used the SFA and the DEA methods to study the consistency of efficiency scores of Chinese banks over the period 1994-2007. The analysis involved an estimation of cost efficiency and economies of scale based on unbalanced panel data from the banks. As expected, the results of the study suggested moderate consistency between parametric and non-parametric frontier methods in efficiency scores rankings, identification of best- and worst-practice banks, the stability of efficiency scores over time and correlation between frontier efficiency and accounting-based performance measures.

Andrieù and Cocriù (2010) analysed the efficiency of the main banks in Romania, the Czech Republic and Hungary for the period 2000-’06 using both the SFA and DEA methods. The study found that banks in the three east European countries have low levels of technical efficiency and cost efficiency, especially those in Romania. The study found further that the main factors influencing the level of bank efficiency in these countries were quality of assets;

bank size, annual inflation rate, banking reform, interest rate liberalisation level and the form of ownership.

Soori, Garshasbi, and Oryani (2005) employed the both SFA and DEA to investigate the comparative efficiency of commercial banks in Iran over the period 1996-2004. The study found a significant difference between non–parametric and parametric methods in measuring the efficiency of commercial banks of Iran.

Recently, Nguyen, Nghiem, Roca *et al.* (2016) examined the cost efficiency of Vietnamese banks from 2000 to 2014 using a two-stage SFA and DEA approach. The study was concerned about the first stage dynamic effects of two governance reforms, foreign partial acquisition and listing on the stock exchange on the efficiency in the second stage. From the analysis, the study concluded that the two-stage SFA results were highly consistent with those from the two-stage DEA. In the first stage first-stage efficiency estimation, cost efficiency exhibited an upward trend over the period 2000–2014. Thus, cost efficiency score was 0.93 and state-owned banks outperformed joint-stock banks (JSBs). Furthermore, the study found that banks selected by foreign investors for partial acquisition and banks selected for public listing were more cost-efficient as compared to those not selected. In addition, the study found that the cost efficiency of the Vietnamese banks post-partial acquisition was lower than pre-partial acquisition, and it follows a decreasing trend since partial acquisition.

Silva, Tabak, Cajueiro *et al.* (2017) investigated the extent to which results produced by a single frontier model are reliable, based on the application of DEA analysis and SFA to a sample of 85 Chinese local commercial banks for the period 2001-2012. In this regard, the study found that while these models produce a consistent trend on global efficiency scores over the years, they become divergent at the individual level. However, the study failed to take the contagion effect due to the interconnectedness of banks, which at times generate exposures with an effect on bank efficiency.

African Perspective

Banking efficiency studies in African countries particularly are severely limited. The available empirical literature is rich with studies mostly from developed countries. In this section,

a concise empirical literature review relating to banking cost efficiency, banking sector development and economic growth is presented. Three closely related studies are by Chen (2009), Kiyota (2009) and Kablan (2010). This current study complements these studies by including a vector of institutional variables to evaluate their effect on the level of banking efficiency as well as SADC economic growth. Another issue which this study addresses that has not been dealt with previously in the literature is to establish the magnitude, direction, and significance of the relationship between banking cost efficiency and economic growth in the SADC.

In a study of 10 middle-income sub-Saharan African countries covering the period 2000-'06, Chen (2009) applied SFA and found that banks were operating at 20% to 30% above their minimum or best practice cost frontier. This current study expands on this work by focusing on a relatively larger sample of countries solely from the SADC bloc, using data from 2005-'16. More importantly, this present study covers the period of the sub-prime financial crisis and particularly the post-crisis period. Here, we hope to capture the effect of any post-crisis financial sector reform that might have an effect on cost efficiency.

In 2009, Kiyota (2009) conducted a study to determine the profit and cost efficiency of commercial banks in 29 sub-Saharan African (SSA) countries for the period 2000-'07. A two-stage methodology approach was adopted in which, in the first stage, SFA was employed to calculate the profit and cost efficiency scores. In the second stage, the Tobit model was used to examine the effect of environmental factors on the banks' efficiency. More important to their study was to establish whether foreign SSA banks performed better compared with domestic SSA banks. Regarding profit efficiencies, their findings revealed that foreign banks were more efficient than domestic banks. Non-SSA foreign banks were also found to be relatively more cost-efficient in comparison with SSA foreign banks and SSA domestic banks. Generally and with the support of empirical evidence [Bonin *et al* (2004), Boubakri *et al* (2005), Cosset *et al* (2005), Kirkpatrick *et al* (2008) and Kiyota (2009)] it is argued that foreign banks benefit developing countries in the form of better human capital, high management skills, better risk-taking strategies, and cheaper sources of funds, among other reasons. This study includes an ownership structure to capture differences that may arise due to the type of ownership of domestic and foreign banks. The paper by Kiyota also showed that medium-sized and large banks were cost-efficient while smaller banks were profit-efficient.

Kablan (2010) adopted a similar SFA methodology to investigate the factors that affect the degree of cost efficiency among sub-Saharan African (SSA) countries. First stage SFA results showed that SSA banks were generally cost-efficient with an estimated efficiency score of 76%. An analysis by region showed that Southern Africa presented the highest efficiency score of 76%, followed by Western Africa with 75% and 74% for the East African region. Their study found bank capitalisation and non-performing loans to be associated negatively with efficiency. Contrary to expectation, GDP *per capita* had a marginal but significant negative effect on efficiency, and the share of the population in rural areas exerted a negative effect on cost efficiency. Other notable panel cost efficiency studies in Africa include those of Bonin *et al* (2004), and Kirkpatrick *et al* (2008). Other distinguished cost efficiency studies related to the present study irrespective of country of origin are discussed next.

Regarding macroeconomic factors and other determinants, Maudos *et al* (2002) investigated both bank cost and profit efficiency levels for a panel of 10 EU countries for the four-year period 1993-'96. Their results showed evidence that an increase in GDP was correlated positively with profit efficiency but negatively with cost efficiency. This corroborated results obtained by Adjei-Frimpong *et al* (2014) that showed a negative correlation between economic growth and cost efficiency. Maudos *et al* (n d) explained that under "expansive demand conditions" banks feel less pressure to control their costs, resulting in reduced cost efficiency. In addition, their study revealed that the degree of concentration had a negative effect on cost efficiency but a positive effect on profit efficiency. Finally, they found medium-sized banks in comparison with large and very large banks to be correlated with the highest levels of cost and profit efficiencies.

With regard to institutional variables and other determinants, Eisazadeh and Shaeri (2012) applied SFA and the Tobit model to determine the effect of institutional, financial and bank-specific factors on efficiency in banking institutions of the MENA (Middle East and North Africa) region. In a study involving 19 MENA countries covering the period 1995-2008, they found that MENA banks had the potential to reduce their total costs by 20% if they operated as efficiently as possible. Cost efficiency was positively associated with greater political stability and quality of public services. Moreover, a better legal framework within a country was found to be beneficial to enhancing cost efficiency. There was also evidence that higher income levels, as approximated by *per capita* GDP, had a positive causal effect on higher cost efficiency. On account of the direct relationship between inflation and interest

rate levels, they found inflation, an indicator of macroeconomic instability, to be significant and negatively related to cost efficiency.

In a recent study of the Ghanaian banking industry, Adjei-Frimpong *et al* (2014) investigated the effects of bank size, bank capitalisation, loan loss provision, inflation rate and GDP growth rate on cost efficiency over the period 2001-'10. The authors justified their choice of the DEA technique over SFA, citing the reasons that DEA works well with small samples relative to SFA and that no specification of functional form underlying cost function is required with the DEA approach. Static and dynamic panel data models were applied in the second stage to model bank cost efficiency as a function of bank-specific and macroeconomic variables. Their results showed evidence that Ghanaian bank cost efficiency persisted from year to year and that bank size had no significant effect on CE. Economic growth, bank capitalisation and loan loss provisions were found to be correlated negatively with cost efficiency. The loan loss provision coefficient proved to be insignificant. As for economic growth, they pointed out that during periods of economic expansion, banks relax their assessment standards for borrowers and reduce their monitoring of loans. So there is a need for policy-makers to monitor supervision and regulation closely during boom periods. Their study also argued that while bank capitalisation provides a buffer against risk, it has the tendency to increase moral hazard, leading to higher costs.

On the other hand, studying a panel of 4 050 banks in 72 countries, Barth *et al* (2013) found stringent capital regulation to correlate positively with bank efficiency. However, Eisazadeh and Shaeri (2012) concluded that for MENA countries, bank cost inefficiency could be improved up to 10% through a fair balance of deregulation and carefully tuned competition rules.

A similar efficiency-generating technique was conducted in East Africa by Gwahula (2013), who employed the DEA technique to evaluate the level of bank technical efficiency for five countries in East Africa over 2008-'11. In a sample of 58 commercial banks under study, most were found to exhibit decreasing returns to scale. One distinguished single SADC country study of cost efficiency was by Ncube (2009) who investigated cost and profit efficiency levels of South African banks using translog SFA. A sample of the four largest commercial banks and four small South African banks was examined over the period 2000-'05. The cost and profit efficiencies obtained over the six-year period were 92% and 55% respectively. In conclusion South African banks were found to be better at controlling costs than

generating profits. The study also found cost efficiency to be correlated negatively with bank size. Most single-country studies have examined bank efficiency and bank ownership; bank efficiency and bank size; bank efficiency and financial sector reforms, and so on.

3.5.4 Cost Efficiency of Banking Institutions of the SADC Countries

When it comes to the cost efficiency of banks in the SADC countries, the evidence suggests that most are efficient. For example, a study by Kiyota (2009) found that non-SSA foreign banks are more cost-efficient than SSA foreign as well as domestic banks in terms of cost efficiency. The study also found that SSA foreign banks were the most cost-efficient over 2005-'06. Although Kablan (2010) found the banks in SSA to be cost-efficient, this has been undermined by non-performing loans. However, the studies mentioned focused on the SSA counties, which might suggest that while SADC countries were part of the studies, the results pertaining specifically to these countries may be diluted. The aim of this study is assess the isolated cases of bank efficiency specifically for the SADC countries.

Within the SADC countries, there is evidence to suggest that foreign and privately owned banks are more cost-efficient compared with publicly owned banks (Nyantakyi and Sy, 2015). In this regard, Chen (2009) postulated that if the banks were to operate efficiently, they could save total costs by between 20% to 30%. Chen (2009) also stressed that Angola had the lowest level of efficiency and was second-last in terms of foreign ownership, compared with Cape Verde, whose banks were the second-least efficient but were associated with high levels of ownership. This suggests that bank ownership is an important variable that needs to be taken into account when assessing banks' cost efficiency across banks and across countries.

3.5.5 Determinants of Bank Cost Efficiency

A number of studies (Aiello and Bonanno, 2016, Andries, 2011, Delis and Papanikolaou, 2009, Girardone, Molyneux and Gardener, 2000, Pancurova and Lyocsa, 2013, Tecles and Tabak, 2010) appear to have assessed the efficiency of banks without providing a clear demarcation of the type of efficiency they are assessing. As such, these studies failed to identify the determinants of cost efficiency for the banking institutions. Ultimately, their recommendations remained general and sometimes not implementable. To counter this shortcoming in the literature, this section focuses on those studies that have been forthright about the fact that they have been assessing the banks' cost efficiency. This will assist the researcher

to single out and narrow the argument in line with the specific objective of the study, which is to assess the cost efficiency of the banking institutions within the SADC region.

However, due to the limited number of studies that have assessed this phenomenon, specifically within the SADC region, this section provides a holistic approach by extending its review of the relevant literature on a global scale. The outcomes of the assessment are envisaged as providing some guidelines in terms of recommendations.

Within the SADC region, the determinants could be identified as endogenous, *i e* within the control of the banks as well as exogenous, *i e* beyond the control of the banks. For example, Musonda (2008) identified four drivers of bank cost efficiency in Zimbabwe as cost reduction, improved management practices, management of resources and technological progress. Many of these factors are within the control of the banks and as a result could be regarded as easier to control as they do not rely on other external forces. Kariuki (2011) indicated the introduction of expansionary fiscal and monetary policies and bank size as determinants of cost efficiency in Kenya. These factors are exogenous, and it is difficult for a bank to have a direct influence in its endeavour to realise cost efficiency.

In other African countries, a study by Hassan and Jreisat (2016) in Egypt found that age, loan to net interest margin, return on equity and good management practices affected bank cost efficiency positively. These determinants are more operational in nature as well as within the control of the banks themselves, *i e* endogenous.

In Asia, a study by Jreisat, Barghouthi and Othman (2015) revealed that ownership structure, size, number of branches and ATMs, bad loans and the age of the bank affected the cost efficiency levels of Jordanian banks significantly. Another study, by Viverita and Ariff (2011) stated that size as measured by the value of market capitalisation, and banking risk as measured by non-performing loans, were the determinants of bank cost efficiency in Indonesia. Spulbar and Niţoi (2014) investigated the cost efficiency of banks in Latin America, Central and Eastern Europe and South East Asia. The authors found that bank cost efficiency in these countries is mainly determined by a more cautious strategy by banks that is characterised by lower risk appetite and average expectations on profitability. Likewise, the determinants of the banks' cost efficiency from an Asian perspective are endogenous in nature as indicated by the bank's strategic direction.

In Europe, Girardone *et al.* (2000) found bank size and technological improvements to be the main determinants of cost efficiency in Italy. These factors could be categorised as exogenous.

Elsewhere, Koutsomanoli-Filippaki, Margaritis, and Staikouras (2009) found higher competition and more concentrated markets as determinants of banks' cost efficiency. Similarly, Fries and Taci (2004) highlighted that banks' cost efficiency is affected by greater macroeconomic stability and competition in banking from foreign entry, and the development of supportive institutions within a country. Asaftei and Kumbhakar (2008) demonstrated that regulations implemented by the Romanian central bank had an implication for the cost-efficiency of other banks. In a another study by Dong (2009), ownership structure, deregulation, market structure, size, and market discipline were identified as the determinants of bank cost efficiency.

This review serves to shed more light on the factors that determine bank cost efficiency. This section reviews the determinants of bank cost efficiency from a wide spectrum. While the literature in this area is sparse, the assessment revealed that determinants of bank cost efficiency could be grouped into endogenous (bank-specific variables/determinants) and exogenous (banking/financial sector variables, macro-economic variables and institutional variables). So in the SADC cost efficiency is largely determined by both endogenous and exogenous factors. In other African counties as well as Asian countries, bank cost efficiency is driven predominantly by endogenous factors. In Europe, bank cost efficiency is based on exogenous factors. This then suggests a distinction between banks operating in developing countries and those operating in developed lands. Banks in developing countries are still grappling with internal issues, which if addressed will assist them to operate cost-effectively. In comparison, banks operating in developed nations appear to fare well in terms of their internal operations, and what hinders them from achieving cost efficiency are factors beyond their control, like regulations and policies.

3.5.6 The Influence of Cost Efficiency Measures on Economic Growth

There is a smaller pool of studies that have narrowed the issue of financial reforms down specifically to cost efficiency and analysed how it influences economic growth (Ferreira, 2012; Hasan, Koetter, & Wedow, 2009; Hasana, Koetter, Lensink *et al.*, 2010; Koetter &

Wedow, 2010; Mwenda & Mutoti, 2011). Despite being few, these studies contribute immensely to the debate concerning bank cost efficiency and economic growth. Indeed, they unanimously confirm the importance of achieving cost efficiency for economic growth.

For instance, Hasan *et al.* (2009) studied the relationship between bank cost efficiency and economic growth from a sample of more than 100 countries, both developing and developed, over the period 1996-2005. The study showed a stronger linkage between bank cost efficiency and economic growth, suggesting that better banking and deeper capital markets are the most beneficial ingredients for economic growth. The study also found that the quality effect is stronger in developed nations, while the quantity effect is more beneficial for developing countries.

In the same vein, Koetter, and Wedow (2010) investigated the relationship between cost efficiency and economic growth, drawing from a sample of 97 German economic planning regions. The authors found that the quality of the financial system contributes to economic growth. However, the quantity as measured by credit volume was found not to be related to growth. The result indicated instead that economic growth requires better but not necessarily more credit.

Ferreira (2012) investigated the effect of bank efficiency on economic growth using DEA. The author focused on the concentration of bank markets as measured by the percentage share of the total assets held by the three largest banking institutions (C3) and the Herfindahl-Hirschman Index (HHI). The study used panel data collected from 27 EU countries for the period 1996-2008. The study specifically analysed the influence of these bank and market conditions on economic growth as measured by GDP, as well as its components (final consumption expenditure, gross fixed capital formation, exports of goods and services and imports of goods and services). The study found bank cost efficiency to have an influence on economic growth. The effect of bank cost efficiency was more pronounced for gross fixed capital formation.

Mwenda and Mutoti (2011) investigated the effects of market-based financial sector reforms on the competitiveness and efficiency of commercial banks and economic growth in Zambia. The study found that bank cost efficiency was significantly influenced by the strengthening of regulatory and supervisory, payments and settlements, and financial operations frameworks as well as the implementation of a comprehensive financial sector development plan.

Over and above this, the study also found that bank cost efficiency, the degree of economic openness, and rate of inflation have significant influence on economic growth.

Rousseau and Wachtel (2008) investigated how banking crises and liberalisations affect the influence of financial deepening on growth, using data from the 1960s, ’70s and’80s. The study found strong evidence to suggest that domestic banking and financial crises have an influence on financial deepening. To this end, financial deepening was also found to have a strong linkage with economic growth.

3.6 CONCLUSION

This chapter reviewed and discussed some of the theoretical and related empirical literature on banking efficiency. From a theoretical point of view, a number of efficiency parameters were revised – these included technical, allocative, scale and economic efficiency. Also discussed were cost efficiency and profit efficiency. The chapter also discussed two main approaches that have been used widely to analyse bank efficiency: the parametric approach and the non-parametric approach. In the parametric approach, three models were discussed, including DFA, TFA and SFA, while for the non-parametric approach, two models were assessed, FDH and DEA. While in recent years, DEA and SFA have been the two main popular methods for performance or efficiency evaluation, this study uses DEA for analysis. From an empirical perspective, a review of studies that have applied in models was assessed from both a global and an African perspective.

Also, noting that the issue of cost efficiency has not been addressed exclusively in the literature, a provision was made so as to gain a deeper understanding into the determinants of bank cost efficiency. The outcome of the review shows that in the SADC, cost efficiency is largely determined by both endogenous (bank-specific variables/determinants) and exogenous factors (banking/financial sector variables, macro-economic variables and institutional variables). In other African countries and in Asian countries, bank cost efficiency is predominantly driven by endogenous factors. In Europe, bank cost efficiency is based on exogenous factors. This then suggests a distinction between banks that operate in developing countries and those operating in developed nations. Banks in developing countries are still grappling with internal issues, which if addressed will assist them to operative cost efficiently. In comparison, banks operating in developed nations appear to fare well in terms of their internal operations; what hinders them from achieving cost efficiency are factors be-

yond their control, like regulations and policies. The chapter concludes by assessing previous studies that have investigated the bank cost efficiency/economic growth nexus. What is evident from these studies is that there is indeed a relationship between bank cost and economic efficiency. So there is an *a priori* expectation that bank cost efficiency promotes economic growth.

CHAPTER FOUR

METHODOLOGY

4.1 INTRODUCTION

The overarching objective of this study has been to determine the cost efficiency of banking institutions in the SADC region and their fundamental drivers, and to investigate the effect of these cost-efficiency measures on the economic growth of the SADC countries. The study also sought to provide a comprehensive review of progress made so far regarding the depth of banking sector development in the region, covering among other issues financial deepening and banking inclusion. This aspect was discussed intensively in the SADC banking overview and literature chapters, 2 and 3. The remaining quantitative sub-objectives whose model specifications and estimation methods are specifically to be investigated in this chapter can be restated sequentially as follows:

Sub-objective 1: to determine cost-efficiency measures of banking institutions in the SADC region using the deterministic DEA technique.

Sub-objective 2: to examine whether there have been any significant changes in the cost efficiency of SADC banks between the pre-global financial crisis period and the post-crisis period.

Sub-objective 3: to analyse the fundamental environmental factors (bank-specific, macroeconomic and institutional variables) driving cost efficiency in the SADC region.

Sub-objective 4: to establish the nature of the relationship between banking cost efficiency, other banking sector development indicators and economic growth in the region.

This chapter discusses various methodological approaches to be used to accomplish the sub-objectives outlined above. In the subsequent sections of this chapter, three model specifications, categorised into first stage and second stage analysis, are explored. At each respective stage of analysis, definition of variables and critical justifications behind their inclusion, data issues, estimation techniques and procedures are discussed. Sub-objectives 1 and 2 are addressed in models 1 and 2 respectively. Similarly, model 3 and 4 correspondingly address the last two sub-objectives.

4.1.1 Underlying Philosophy of the Study

The guiding philosophy of this study is positivism. The rationale for this choice is based on the fact that this present study attempts to understand economic phenomena through quantitative methods of statistical significance testing. Fox and Miller (1998, p1 718) define positivism as "research approaches that employ empirical methods, make extensive use of quantitative analysis or develop logical calculi to build formal explanatory theory". The study seeks to describe reality from an objective viewpoint and the study is also replicable.

4.2 FIRST-STAGE ANALYSIS

4.2.1 Introduction

This study follows a two-stage methodology framework. In the first stage, the efficiency generating model is specified and briefly discussed, banking input and output variables are described and their selection is critically justified. The deterministic DEA technique is applied to a sample of selected SADC banks over the study period to generate cost-efficiency scores. An exposition of the traditional DEA and the revised DEA technique is presented. Data issues, specifically the span of the time period of analysis, data frequency, data sources, countries sampled and number of banking institutions, and representativeness of the sample for the region conclude the first stage analysis.

4.2.2 Efficiency Concept Definition & DEA Model Choice

There are six main types of efficiencies that commonly dominate literature on banking performance: technical efficiency, allocative efficiency, economic efficiency, cost efficiency, revenue efficiency and profit efficiency. A bank is considered *technically* efficient if it produces a given set of outputs (such as customer loans, interest revenue, non-interest revenue) using the fewest possible input resources (such as labour, deposits, capital and operating costs). In contrast, *allocative* efficiency measures the degree to which a bank's resources are directed towards activities with the highest societal value (Ncube, 2009). *Economic* efficiency is then the result of technical and allocative efficiency combined. Economic efficiency is further differentiated into cost, revenue and profit efficiencies.

Conditional on the objective at hand, the investigator can decide to explore efficiency from the cost, revenue, or profit viewpoint. *Cost* efficiency assesses the degree to which a bank's actual costs are close to the best-practice bank's costs under similar conditions. An inefficient bank produces at costs higher than the cost of the best-practice bank. This concept of

cost efficiency constitutes the main focus of this study. Similar to cost efficiency in concept is revenue efficiency, which measures the extent to which a bank generates the maximum attainable revenue given prices of its output. Alternatively, it is a measure of the difference between current revenues and optimal revenues, given prices and output. *Profit* efficiency measures the extent to which a bank generates the maximum attainable profit given the prices of its inputs and outputs. Hence, if the profits of a given bank are less compared with those of the best-practice bank under comparable conditions, that bank is deemed as profit inefficient. The concept of efficiency adopted in this study is input-oriented cost efficiency, which assesses the ability to produce current outputs at minimal costs. The choice of input orientation approach over output orientation was informed by the fact that the bank management is highly likely to have more control over costs than outputs.

This study chose the non-parametric DEA approach over the parametric SFA. This was motivated by the fact that DEA does not impose any restrictions regarding the functional form or the distributional properties of the inefficiency error term. This non-parametric nature of DEA presents an important advantage because, as Bowlin (1986) argues, the functional form or relationship underlying the business activities of banking institutions may be abnormally complex and difficult to specify.

The revised DEA option by Tone (2002) – which incorporates input prices and allows the prices to vary from one DMU to another – was specifically used to compute cost efficiency scores. The original DEA, first developed by Charnes, Cooper and Rhodes (1978) (also referred to as the CCR model), had a constant returns-to-scale specification which was restrictive in the sense that it assumed that the DMUs to be evaluated operated at optimal size and unit cost were not allowed to vary from one DMU to another. However, in this study, the BCC model, an advanced form of the CCR model proposed by Banker, Charnes and Cooper (1984) to permit variable returns to scale, is followed and is unpacked in the next section.

4.2.3 Model Specification

4.2.3.1 Traditional Cost Data Envelopment Analysis (DEA)

The objective of DEA is to construct a boundary to envelop all the data points so that all observations lie on or above the cost frontier. It is not possible to realise costs that are less than the minimum possible as defined by the efficient cost frontier. To derive cost efficiency

(CE) levels of all the banks under analysis using the DEA, the variable returns-to-scale (VRS) cost minimisation and input orientation is employed. Specifically, the input-oriented cost efficiency VRS DEA model for bank ***i*** is represented in linear programming form as:

$$Min \sum_{i=1}^{m} c_{io} x_i$$

subject to

$$x_i \geq \sum_{j=1}^{n} x_{ij} \lambda_j, \quad (i = 1,... m)$$

$$y_{ro} \leq \sum_{j=1}^{n} y_{rj} \lambda_j, \quad (r = 1,... s) \qquad \ldots(4.1)$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0, \quad j = 1, 2, ...n$$

In the above specification, the objective is to select values of x_i and λ_j that minimise the total cost and satisfy the output constraints. The c_{io} in the objective represents unit costs. There are $j = 1, 2 \ldots n$ banks to be assessed and each bank consumes different amounts of m inputs to produce s outputs. In particular, bank$_j$ or DMU$_j$ consumes amount x_{ij} of input i and produces amount y_{rj} of output r. An additional condition is that the amounts of these input resource factors and outputs must be greater than zero – that is $x_{ij} > 0$ and $y_{rj} > 0$. It is also assumed that each bank has at least one positive input and one positive output value. Finally, a measure of relative cost efficiency (CE) can be obtained by optimising the following ratio:

$$0 \leq \frac{\sum_{i=1}^{m} c_{ij} x_i^*}{\sum_{i=1}^{m} c_{ij} x_{io}} \leq 1 \qquad \ldots 4.2$$

Where x_i^* are the optimal values obtained from **4.1** and the x_{io} the observed values for DMU$_O$. DMU$_j$ = DMU$_o$ refers to the bank (in this case) that is to be evaluated relative to all the other $j = 1, 2, \ldots n$ DMU*s*.

4.2.3.2 Revised Cost Data Envelopment Analysis (DEA)

The traditional cost efficiency by Fare *et al* (1985), indicated in formulation **4.2**, constitutes the traditional DEA for evaluating cost efficiency, which contains a major drawback in the sense that by its construction unit costs are not allowed to vary from one DMU to another. This shortcoming emanates from the unrealistic assumption of perfect competitive markets in which firms face homogenous or identical input prices. In other words each bank under evaluation is assigned the same input prices as the other banks in the same industry. However, within banking, the assumption of perfect competition is not a reflection of reality at, least for most developing economies. Depending on the level of concentration, the structure of most African banking industries is not perfectly competitive but is rather characterised by either monopolistic competition or oligopoly. So the traditional DEA necessitates adjustments to permit unit costs to vary from one DMU to another.

Tone (2002) argues that the traditional DEA as formulated in **4.2** does not account for the fact that costs can decrease by decreasing the input factor prices. Suppose two banks, **A** and **B**, both face the same inputs and outputs but that bank **A**`s input prices are twice those of bank **B**. It naturally implies that Bank **A`s** costs will be greater than those of bank **B**. However, under the traditional cost DEA, on account of the homogenous of degree one assumption, these two banks will be assigned the same measure of cost efficiency. This is despite the fact that both banks had considerably different input prices. However, to overcome this serious limitation, Tone (2002) proposed an alternative, herein referred to as the revised cost DEA, in which the assumption of homogeneity of degree one is not imposed on input prices as in the traditional DEA, but rather on total costs. This adjustment permits banks like bank **A** and bank **B**, facing different input factor prices, to retain different measures of cost efficiency. So the linear programming (LP) problem of the adjusted DEA is reformulated as follows:

$$Min \sum_{i=1}^{m} e\bar{x}_{io}^{*}$$

Subject to

$$\sum_{j=1}^{n} \bar{x}_{ij}\lambda_j \le \bar{x}_{io}^{*}, \quad i = 1,\ldots m$$

$$\sum_{j=1}^{n} y_{rj}\lambda_j \geq y_{ro}, \quad r = 1,\ldots s \qquad \ldots(4.3)$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0, \quad j = 1, 2, \ldots n$$

where $e \in R^m$ is a row vector with all elements equal to 1 and $\bar{x}_{ij} = \left(c_{1j}x_{ij}, \ldots c_{ij}x_{ij}\right)^T$. This means that the revised cost efficiency (RCE) is defined as

$$RCE = \frac{e\bar{x}_o^*}{e\bar{x}} \qquad \ldots(4.4)$$

In this study, a linear programming computer programme called DPIN ((*decomposing productivity index numbers*)) is run on the DEA cost minimisation specified in **4.4** further down to generate CE scores for each of the banks under study.

4.2.4 Pre-crisis Efficiency and Post-crisis Efficiency Comparison

With the exception of South Africa and Mauritius, whose banking systems are well developed, most developing economies in the SADC region are not fully integrated into the global financial system. It is on this account that Africa is generally argued to have managed to weather severe contagion effects of the global financial crisis of 2007-'09. To address objective 2, which is to ascertain empirically whether SADC banks exhibited any significant cost efficiency variations between the pre-GFC period and post-GFC period, the non-parametric Wilcoxon signed ranks test for paired changes is used. The Wilcoxon matched-pairs signed ranks test is the non-parametric equivalent of the student paired *t*-test. It was chosen over the *t*-test as to remain consistent with the non-parametric approach used in the computation of the cost efficiency measures. The Wilcoxon signed ranks test does not impose the normality restriction. Here we follow the study by Sufian (2009) who used the same technique to analyse the effect of the 1997 Malaysian financial crisis. The test is carried in these sequential steps:

Step 1:

Calculate for each bank the change between their pre-crisis score (*t* = 2005-'07) and their post-crisis efficiency score (*t* = 2011-'15).

Step 2:

Each absolute (ignoring the sign) difference is then allocated a rank, with the lowest difference assigned a rank of 1, second-lowest difference a rank of 2, and so forth up to the 12th rank, which is the sum of banking industries in the sample.

Step 3:

Find the total of the ranks of both the positive and negative differences separately. Intuitively, the larger the discrepancy between the two values, the greater the likelihood of rejecting the null hypothesis of equal means.

Step 4:

The smaller of the two values is considered to be the Wilcoxon statistic and is then compared with the Wilcoxon critical value at 5% level of significance using $n = 12$.

The decision is to reject the null hypothesis that there is no difference between the pre-crisis and the post-crisis mean efficiencies if the calculated W-statistic is less than or equal to the Wilcoxon critical value. Walker (2010) states that in contrast with most statistical procedures, the Wilcoxon and Mann-Whitney tests are the only ones in which a statistic is considered significant if it is below the critical value. In addition to this Wilcoxon approach, the censored Tobit regression is used for robustness check by using a crisis dummy variable and one for the post-crisis period in the model specification.

4.2.5 Measurement Issues in Banking

While there is general congruency in the classification of most banking variables, there is however notable controversy on whether customer deposits are more suitably treated as inputs or outputs. The choice of treatment of the bank deposit variable has a bearing on the computed CE measures. In banking literature there are four approaches to define banking inputs and outputs. However, predominantly only two main approaches are followed, the intermediation approach, also referred to as the asset approach, and the production approach. Other less prominent alternatives are the value-added and the user-cost approaches. Under the intermediation approach, bank deposits are treated as a category of input, whereas it is given output status under the production approach. In keeping with empirical literature and modern-day banking, the intermediation approach is chosen for this study. Renowned researchers like Elyasiani and Mehdian (1990) and Berger and Humphrey (1997) favour the

intermediation approach, maintaining the view that the approach is more inclusive of interest expenses, which generally account for more than half of total banking expenses. The other argument by Elyasiani and Mehdian (1990, p543) is that banks "buy rather than sell deposits" and for that reason they argue that deposits are more appropriately classified as inputs rather than outputs.

FIGURE 4.1: BANK LEVEL DATA VARIABLES FOR FIRST-STAGE ANALYSIS

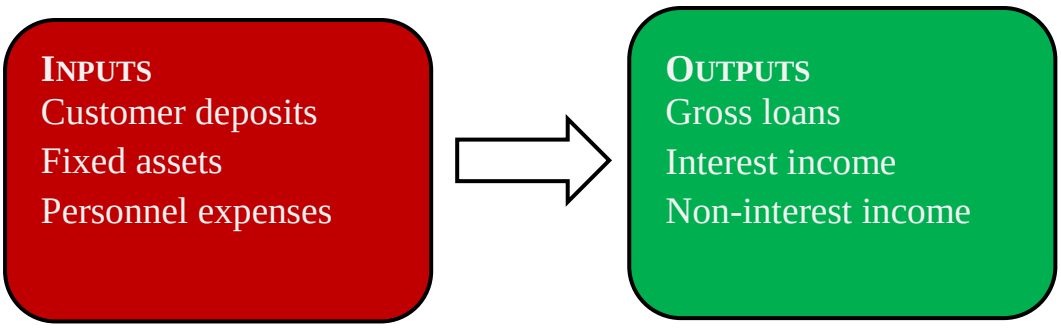


Figure 4.1 summarises the variables used in the first stage to estimate cost efficiency measures. All the variables have been chosen carefully to mirror salient aspects of modern-day banking as reflected in the SADC banking industry and elsewhere in the world, including empirical literature. In the next section, data issues are discussed.

4.2.6 Data Sources

Twelve of the 15 SADC countries were sampled for analysis: *Angola (6), Botswana (5), Lesotho (3), Madagascar (3), Malawi (4), Mauritius (7), Mozambique (3), Namibia (4), South Africa (12), Swaziland (4), Tanzania (6), and Zambia (6).* The number in parentheses represents the number of banks sampled in each respective country. In total 63 SADC banks were selected for analysis. The Democratic Republic of Congo (DRC) and Seychelles were omitted from the sample due to absence of data. In fact, DRC and Seychelles are not signatories on the Bankscope database. Cooper *et al* (2007) state that the rule of thumb regarding sufficiency of observations is that the number of DMUs should at least be three (3) times the number of inputs, plus outputs used in the analysis *i e: number of DMUs = 3 × (number of inputs + number of outputs)*. In the present study three (3) inputs plus three (3) outputs make a total number of six (6). Hence the minimum number of DMUs for this study must be at least 18. The number of DMUs to be analysed is 63, which is at least four times greater than that proposed by Cooper *et al* (2007).

The period of analysis is 2005-'15. This period was chosen as to capture the pre-crisis period of 2007/2008 and the most recent post-crisis period. The availability of data also played a role as periods with no complete data were omitted. All the data variables used in this paper were obtained from the Bankscope database and all monetary values are expressed in the currency of the country concerned. The sample in this study is fairly representative of banking in the SADC region, given that the number of banks sampled for each country represents at least 50% of total banking assets and liabilities in that particular country.

TABLE 4.1: SAMPLED COUNTRIES & BANKING INSTITUTIONS FOR ANALYSIS

N	COUNTRY	BANKS SAMPLED FOR ANALYSIS
1	**Angola (*6*)**	*Banco de Fomento, Banco BIC, Banco Sol, Banco Caixa Geral Totta de Angola, Banco Regional do Keve SARL and Banco Angolano de Investimentos.*
2	**Botswana (*5*)**	*FNB, BancABC, Standard Chartered, Bank Gaborone and BBS.*
3	**Lesotho (*3*)**	*Standard, Nedbank and First National Bank.*
4	**Madagascar (*3*)**	*Bank of Africa, Banque Malgache, and Mauritius Commercial Bank (MCB).*
5	**Malawi (*4*)**	*National Bank of Malawi (NBM), Standard, First Merchant Bank (FMB) and Nedbank.*
6	**Mauritius (*7*)**	*Bank One, Investec Bank, Mauritius Commercial Bank (MCB), Standard, State Bank International (SBI), State Bank of Mauritius (SBM) and Standard Chartered.*
7	**Mozambique (*3*)**	*ABC, Barclays and Standard.*
8	**Namibia (*4*)**	*Bank Windhoek, FNB, Nedbank and NedNamibia.*
9	**South Africa (*12*)**	*ABSA, African Bank, Standard, FRB, Nedbank, Investec, Capitec, Sasfin, Bidvest, Mercantile, GBS and Habib.*
10	**Swaziland (*4*)**	*FNB, Nedbank, Standard, & Swaziland Development and Savings Bank.*
11	**Tanzania (*6*)**	*Barclays Bank, Citibank, Commercial Bank of Africa, Diamond Trust Bank, Standard Chartered Bank and Stanbic.*
12	**Zambia (*6*)**	*Barclays Bank, Standard Chartered, Zambia National Commercial Bank, ABC, Citibank Zambia and Cavmont Bank.*

The actual banking institutions chosen are tabulated in **Table 4.1.** The programme of analysis, DPIN, for generating cost efficiency indices, does not handle missing observations. So

the choice of selected countries and the number of banks sampled in each country for examination was informed by consistent availability of observations throughout the span of the study period. Bank-level data variables to be used in the first stage are presented and described in **Table 4.2.**

TABLE 4.2 DESCRIPTION OUTPUTS, OUTPUT PRICES, INPUTS & INPUT PRICES

OUTPUTS		
Y_1	Customer loans	*total loans to customers*
Y_2	Interest revenue	*total interest revenue earned by the bank*
Y_3	Non-interest revenue	*fee income + commission income + other*
INPUTS		
X_1	Labour	*personnel expenses*
X_2	Capital	*fixed assets*
X_3	Deposits	*deposits + other funding + borrowing*
INPUT PRICES		
W_1	Price of labour	*personnel expenses/total fixed assets*
W_2	Price of capital	*non-interest expenses/total fixed asset*
W_3	Price of deposits	*interest expenses/deposits*

4.3 SECOND-STAGE ANALYSIS OF CONTEXTUAL VARIABLES

4.3.1 Introduction

In the second stage, the aim is to further explore the computed cost efficiency scores from first-stage DEA analysis to establish its relationship empirically with a number of environmental factors: bank-specific, banking sector, institutional and macroeconomic variables. Chen (2009) states among other reasons that the depths of financial development and macroeconomic stability have an important role in affecting bank efficiency levels. Having ascertained the drivers of bank cost efficiency, the cost efficiency scores of all the SADC banks under study are then treated as regressors in the economic growth model, together with other banking industry development indicators. An unstudied but important issue within finance and banking literature is the contribution of banking cost efficiency to economic growth using panels. It would be worthwhile to compute the "efficiency elasticity of

growth" for the SADC region – that is, the responsiveness of economic growth to variations in bank cost efficiency. Banking institutions play a critical role in driving growth and for that reason are regarded as the lifeblood of the economy.

4.3.2 Model Specification

One critical assumption of classical linear regression model is that the model to be used for analysis must be "correctly specified". Model specification involves the determination of regressor variables to be included in or excluded from a regression equation (Allen, 1997). Although there is no such thing as a perfect model, Gujarati (2012, p114) maintains that an econometric model must at least attempt to capture the salient features of an economic phenomenon guided by the underlying economic theory, prior empirical literature, intuition and research skills. Related to this are two basic types of specification errors: misspecification by including a theoretically irrelevant regressor or explanatory variable, called over-fitting a model, and misspecification by omitting a theoretically relevant variable, also referred to as under-fitting the model. While over-fitting a model results in inefficient (but unbiased and consistent) parameter estimates, under-fitting a model actually results in biased and inconsistent estimates. The variables used in the models have been guided by both theoretical and empirical literature, as discussed in the chapter on literature. However each variable included is argued for critically and its hypothesised impact on the outcome variable indicated.

4.3.2.1 Modelling Fundamental Determinants of Banking Efficiency

Worldwide, banking sectors have undergone significant developments over the past decade due to changes in the environment in which they operate, which in turn affects the way they conduct their businesses. Over-regulation, financial innovation, financial globalisation, changes in macroeconomic outlook, institutional policy changes and financial crises have had a substantial influence on banking performance globally.

A censored Tobit model specified in equation 4.5 below is applied on the derived DEA first-stage CE scores so as to take into account the effects of the differing industry and country operating environments. The Tobit model is considered censored in the sense that it is applied to a dependant variable whose values are constrained within a given range. As discussed earlier, CE measures the difference between the minimum cost possible and the observed or actual cost incurred; its values lie between 0 and 1. Hence there are no observations

less than the lower bound or greater than the upper bound. In contrast with ordinary least squares (OLS), Irsova and Havranek (2010), state that censored models produce consistent coefficient estimates under conditions of dependent variables with restricted values. To distinguish it from a statistic model, a dynamic model is specified by adding a persistent one-year lagged CE variable among the regressor variables, as follows:

$$CE_{i,t} = \eta_0 + \eta_1 CE_{i,t-1} + \eta_2 B_{i,t} + \eta_3 F_{i,t} + \eta_4 M_{i,t} + \eta_5 I_{i,t} + \varepsilon_{i,t} \qquad \text{……..(4.5)}$$

where CE_{it} is cost efficiency score for bank *i* in period *t* estimated in the first stage by the DEA; CE_{it-1} is a one-year lagged cost efficiency, B_{it} represents bank specific factors; F_{it} represents banking or financial sector development factors; M_{it} is a vector of macroeconomic variables; I_{it} includes institutional variables and ε_{it} is a residual. Two main groups of variables and their expected influence on CE, taking into account economic theory, are discussed. The first group relates to variables specific to individual banks. The second relates to the external environment that banking institutions operate in: banking/financial sector-specific, macro-economic and institutional variables. Some variables are interacted with other variables to ascertain their combined effect on economic growth. One interaction variable of particular interest to this present study is *cost efficiency and volume of credit*, to determine not only the influence of "quantity" of credit but also "quality" (efficient) credit. The dynamic panel Tobit model is estimated using EViews 9.5. The application of the Tobit second stage methodology approach is line with recent studies, those by Abel and Le Roux, (2016), Casu and Molyneux (2003), Grigorian and Manole (2002) and Jackson and Fethi (2000). The expected influence of the chosen regressors on bank cost efficiency is discussed in Tables 4.3 and 4.4 in the next section.

4.3.2.2 Modelling Bank Cost Efficiency and Real Economic Growth

The primary objective driving this research has been to investigate the link between changes in bank cost efficiency and real economic growth of SADC countries. To study this relationship the researcher estimated the following model:

$$lnGDP_{i,t} = \eta_0 + \eta_1 lnGDP_{i,t-1} + \eta_2 lnCE_{i,t} + \eta_3 lnB_{i,t} + \eta_4 M_{i,t} + \varepsilon_{i,t} \qquad \text{…..(4.6)}$$

where**:**

GDP_{it} - GDP at constant prices for country *i* in time *t*

CE_{it} - average cost efficiency for country *i* in time *t* for all the countries

$\mathbf{B}_{it}$ - a vector of banking sector development indicators variables for country *i* in time *t*

$\mathbf{M}_{it}$ - a vector of macroeconomic variable(s) for country *i* in time *t*

ε_{it} - Error term.

4.3.3 Description of Variables and their Expected Impact

4.3.3.1 Expected Influence of Efficiency Driving Factors

TABLE 4.3: BANK-SPECIFIC VARIABLES AND THEIR EXPECTED SIGNS.

COST EFFICIENCY (CE) AGAINST INTERNAL BANK VARIABLES		
VARIABLE	**ECONOMIC THEORY**	**EXPECTED SIGN**
NLCD	An increase in net loans to customer deposits (NLCD) captures the efficiency with which deposits are converted to loans. A greater ratio implies high efficiency in converting deposits into loans.	+
ROAA	Return on average assets is a proxy for bank profitability. Generally profitable banks are regarded as more cost-efficient in their operations.	+
LADSF	The ratio of liquid assets to deposits and short-term funding is used to capture liquidity. An increase in the ratio means low liquidity risk. We also argue that holding high liquidity may imply greater opportunity costs in terms of forfeited returns. A negative or positive sign is expected.	+ / –
LLP	An increase in (loan loss provision/net interest revenue) loan loss provision to net interest revenues captures decreasing quality of loans or an increase in credit risk, which decreases CE. An increase in this ratio represents inefficiency in lending and inability to manage risk efficiently.	–
EQTY	An increase in ratio of equity to total assets is related to bank capitalisation. Its effect is inconclusive. A high ratio may increase customer confidence due to risk reduction. Alternatively, it may imply over-regulation on capital requirements, thereby restricting a bank from expanding operations to their efficient level.	+ / –
DIV	Non-interest revenue captures income diversification. Diversification may imply reduction in risk exposure, or that a bank is shifting into riskier activities (Demsetz and Strahan, 1995).	+ / –

LARG	A dummy variable is used to capture relatively large banks, based on gross loans and total asset size. Large banks can exhibit either economies or diseconomies of scale. In that case an ambiguous sign is expected.	+ / –

TABLE 4.4: INSTITUTIONAL VARIABLES AND THEIR EXPECTED SIGNS

COST EFFICIENCY AGAINST INSTITUTIONAL VARIABLES		
VARIABLE	**ECONOMIC THEORY**	**EXPECTED SIGN**
POLS	Political instability is an important dimension of governance or institutional quality. Klomp and Haan (2013) state that institutional quality (IQ) has an indirect effect on risk. Demirguc-Kunt and Detragiache (1998) also maintain that financial fragility is correlated with weaker institutions. We expect banking institutions in less politically stable countries to be susceptible to high costs. The expected relationship between negative perception of political stability and economic growth is negativeck.	–
CRIS	We included a crisis dummy to capture the period 2008-'10. We expect cost efficiency to have decreased on average during this period of the global financial crisis, due to a number of factors: decreased demand for banking services, high non-performing loans, low or negative growth.	–

TABLE 4.5: MACROECONOMIC VARIABLES AND THEIR EXPECTED SIGNS

COST EFFICIENCY AGAINST MACROECONOMIC VARIABLES		
VARIABLE	**ECONOMIC THEORY**	**EXPECTED SIGN**
GDPG	We hypothesise that generally wealthy countries have efficient institutions. So banks operating in wealthier countries as approximated by growth in gross domestic product are expected to be cost efficient, hence a positive relationship.	+
INFL	A proxy for macroeconomic instability. In inflationary times, banks lower their cost of intermediation to stimulate credit demand, while in booming economic times, demand for credit is generally high, providing an incentive for banks to increase their cost of intermediation. Generally, an increase in inflation puts pressure for banks to pass on the increased cost to customers in a bid to maintain their margins.	+ / –

4.3.3.2 Expected Influence of Growth-Efficiency Factors

Economic growth refers to an increase in the economy`s capacity to produce goods and services from one year to another. There are two types of indicator variables that are used to measure economic growth: change in nominal GDP and change in real GDP. In this study, real GDP per capita – that is, real GDP divided by each country`s population is used as the dependent variable. However, even though the primary focus is on the nexus between banking cost efficiency and real economic growth, a number of control regressors are also considered in the model. *Control variables* are extraneous variables that the investigator does not wish to examine in a study. Control variables for the growth model include general government final consumption (GOV) as a percentage of GDP; population growth (POP) as a proxy for labour force growth; capital growth (CAP) as measured by growth rate of gross fixed capital formation; inflation (INFL) measured using the change in the consumer price index (CPI), degree of openness or trade (TRAD) approximated by the proportion of the sum of exports and imports to GDP. These previously mentioned macro-variables enter the model as mere controls (to prevent an under-fitted model) and hence their particular in-depth discussion is of little consequence.

We hypothesise that the possible channels by which banking cost efficiency is expected to affect or contribute to real economic growth is through its influence on reduced cost, improved capital productivity and increased volume of capital, leading to increased investment and hence economic growth. This is also consistent with the celebrated Cobb-Douglas production function, which links the output produced in an economy to technology, capital and labour. It is also expected that these reduced costs are then passed on to the general public, the business sector, the government and the international business community. Closely related to this channel is banking inclusion, which is linked to affordability for previously disadvantaged groups. Several indicators of financial or banking sector development and control variables and their expected influence on growth are discussed in **Table 4.6** below.

TABLE 4.6: BANK EFFICIENCY, FINANCIAL-RELATED FACTORS AND ECONOMIC GROWTH.

GDP PER CAPITA AS A DEPENDENT VARIABLE		
VARIABLE	**ECONOMIC THEORY**	**EXPECTED SIGN**

CE	We hypothesise that cost-efficient banks contribute positively to real economic growth via their effect on reduced cost, and therefore increased benefit to different stakeholders. It is expected that the reduced costs are then passed on to the general public, the business sector, the government and the international business community. As growth is strongly and positively linked to investment, an increase in bank cost efficiency (decrease in banking costs) should theoretically accelerate growth primarily via capital productivity or total factor productivity channel.	+
BIN	Banking inclusion (BIN) as captured by the proportion of adults with a formal bank account is expected to have a positive sign. An increase in access means that overhead costs are spread over a wider or larger customer base, reducing costs.	+
DEEP	In keeping with most empirical studies financial deepening entered the model as broad money as a proportion of GDP. Existing literature on the nexus between financial deepening and growth show conflicting results. However, while the inflationary component of financial deepening has the potential to inhibit growth, we expect the net positive effect of the finance-investment channel to be dominant resulting in a positive impact on economic growth.	+
CRED	We hypothesise that an increase in the volume of credit extended to the private sector as a proportion of GDP is associated positively with cost efficiency. Here we have used this variable as a proxy for one of the dimensions of banking sector development.	+
CRED*CE	An interaction term is included CRED*CE which is intended to capture the interaction between volume of credit (financial development) and efficiency on economic growth. We expect that the greater the increase in credit to the private sector, the more efficient the banks. A positive effect on economic growth is expected.	+

GDPP(-1)	Lagged dependent variables are included in econometric modelling to improve robustness of the model. In our growth model, the one period lagged GDP per capita variable, GDPP (-1), is included to capture dynamic effects and to rid the model of any auto-correlation. A positive sign is expected.	+
POP	In keeping with the neo-classical Cobb-Douglas production function, the labour variable was included in the model to capture the importance of labour productivity on growth. Labour productivity or a population variable is used in this study and is expected to exert a positive effect on growth.	+
CAP	In line with the Cobb-Douglas production function, capital plays a critical role in the realisation of increased growth in the country. Gross fixed capital formation is used as a proxy for capital or investment. A positive sign is expected.	+
INFL	Inflation, measured in this study as the change in the consumer price index is expected to enter the model negative and as a control variable. Economic theory acknowledges the role of price stability as an important pre-condition for economic growth.	–
TRAD	International trade as captured by the percentage volume over GDP of exports and imports entered the growth model as another control variable. Its expected impact on growth is positive. However, existing literature on trade states that the greater the quality and variety of the traded basket, the greater the positive effect of trade on economic growth.	+
GOV	The impact of government consumption on economic growth is inconclusive and idiosyncratic depending on a number of variables. Consequently, its direction of impact on economic growth is ambiguous in the sense that it yields a positive effect if it is targeted towards worthwhile and productive investments, negative if channelled on worthless and mainly recurrent expenditures.	+/–

4.3.4 Data Sources

Bank-specific data used in second-stage modelling are obtained from the Bankscope database, while regressor-variable data categorized as financial sector, institutional and macroeconomic is obtained from various sources namely the World Bank (World Development Indicators), the International Monetary Fund (IMF), and International Financial Statistics (IFS). For consistency of reporting, this secondary data is sourced from common data banks for all the countries.

TABLE 4.7*:* SUMMARY OF SECOND-STAGE ENVIRONMENTAL VARIABLES

Bank-specific **variables (B)**	***Financial sector*** **variables (F)**	***Macroeconomic*** **variables (M)**	***Institutional*** **variables (I)**
Individual-bank characteristics:	*Banking environment:*	*Macroeconomic environment:*	*Governance dimensions:*
Intermediation efficiency	Banking cost efficiency	Lagged GDP	Political instability
Profitability	Banking inclusion	Labour force growth	Financial crisis
Liquidity	Financial deepening	Capital growth	
Credit risk or asset quality	Credit volume*Cost efficiency	Inflation	
Capitalisation		Trade	
Diversification		Government consumption	
Bank size			

4.4 SECOND-STAGE PANEL ESTIMATION TECHNIQUES

4.4.1. Panel Data Modelling

Baltagi (2008) defines panel data as pooling of observations on cross-sections over many time periods. These cross-sections can take the form of individuals, households, firms, states, or countries. There are two basic types of panels, micro-panels and macro-panels. Micro-panels are characterised by large number of individuals ***N*** and short time dimension ***T*** while by contrast macro-panels have long ***T*** time periods and fewer ***N*** entities. Each of

these types of panel data warrants different econometric attention. For instance, with long time periods of macro-panel data, there is a need to handle the challenge of non-stationarity common with time series and to account for potential cross-country dependence issues. Baltagi (2008) states that this might not be an issue with micro panels, where cross-sections are sampled randomly and hence not likely to be correlated.

Baltagi (2008, p7) states that by employing a combination of cross-sections and time series, panel data provides "more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency". Other benefits of panel data modelling include its ability to control for individual heterogeneity which, if not accounted for, leads to biased results and wrong inference. Again, most economic relationships are dynamic in nature and the involved dynamics of adjustment are better handled with panel data than with the other two alternatives. Baltagi (2008, p8) also maintains that panel data allows better construction and testing of complicated behavioural models than pure time series or cross-section data. The author cites technical efficiency studies as one such focus area that is better studied and modelled with panels. The other advantage, also mentioned by Brooks (2008), is that panel data by nature means more observations by reason of cross-sections that are pooled over time, which then increase the degrees of freedom, so improving the power of econometric tests. Several other merits of using panel data are well explained by Baltagi (2008, pp6-8). However, Baltagi (2008) cautions that panel data is not without its limitations, citing the common failure by many researchers to account for cross-country dependence, which is prevalent in most macro-panels, leading to wrong inferences.

4.4.2 Censored Panel Tobit Regression

On account of the parameterised nature of efficiency scores whose values are constrained to some range, the censored Tobit regression model, also known as the limited dependent variable model, is applied to analyse the various driving contextual variables of banking cost efficiency in the SADC region. Once estimated using the DEA technique in the first stage, the DEA cost efficiency scores obtained are then used as a dependent variable in determining the drivers of cost efficiency among SADC banks in the second stage. Censored panel Tobit models are specifically designed to estimate equations whose dependant variable values are restricted within some range, since by definition efficiency scores are confined or limited to a particular range. Estimating such models involving restricted or limited dependent variables using the celebrated ordinary least squares (OLS) technique results in biased parameter

estimates, the primary reason being violation of the condition of normality and homoscedasticity of the variance of the error term.

Irsova and Havranek (2010) state that with limited dependent variables, censored regression models – in comparison with OLS – generate consistent estimates of coefficients. Within the banking literature, other renowned studies – those of Avkiran (2009), and Abel & Le Roux (2016) – also explored efficiency in the second stage using the Tobit regression. The dynamic panel version of the Tobit model that was first proposed by Tobin (1958) can be formulated as follows:

$$CE^{*}_{i,t} = \eta_0 + \eta_1 CE_{i,t-1} + \eta_2 B_{i,t} + \eta_3 F_{i,t} + \eta_4 M_{i,t} + \eta_5 I_{i,t} + \varepsilon_{i,t} \quad \ldots (4.7)$$

$$CE_{i,t} = 0 \; if \; CE^{*} \leq 0 \;\; ; \;\; CE = CE^{*}_{i,t} \; if \; 0 \leq CE^{*} \leq 1 \;\; ; \;\; CE_{i,t} = 1 \; if \; CE^{*} \geq 1$$

The restrictions are to ensure that *CE* stay confined within the 0 to 1 boundary. So negative values below 0 are reported as 0 while those above 1 are reported as 1. *CE* is a cost efficiency limited dependent variable from DEA which depends on previous periods' cost efficiency CE_{t-1}, and ***B, F, M*** and ***I***, which are different vectors of contextual variables classified into bank-specific factors, financial/industry factors, macroeconomic factors and institutional factors respectively. ε is the usual error term. The marginal effect of ***B*** on *CE* for instance is captured by the value of η_2 (coefficient of ***B***) which indicates by how much the cost efficiency of bank *i* in period *t* tends to increase (or decrease) if η_2 is increased by one unit. Therefore $\boldsymbol{\eta}$ is a vector of coefficients to be estimated. The next section discusses panel data estimation techniques, a critical justification for this choice over other alternatives, panel estimation procedures and diagnostic tests.

Within the space of efficiency and productivity analysis, one of the areas that have generated controversy with second-stage analysis of contextual variables is centred on the classification of DEA as a "non-statistical" technique. The general concern is that statistical (parametric) techniques like maximum likelihood estimation (MLE), ordinary least squares (OLS) or censored Tobit models are not suitable for use with the "non-parametric" DEA. However, recent developments in DEA have proved otherwise. Banker and Natarajan (2011) argue that despite its extensive use, DEA has continued to be classified inappropriately as a non-statistical approach. Secondly, Banker and Natarajan (2008) identified "independence of contextual variables with respect to input variables" as a necessary condition under which

second stage regression analysis yields consistent estimators. The authors also maintain that the contextual variables themselves need not be uncorrelated with each other. Monte Carlo simulations done by Banker and Natarajan (2008) showed that two-stage procedures involving DEA, followed by OLS, MLE or Tobit estimations, produce consistent results in the estimation of contextual factors on productivity. However, it is critical that DEA first-stage estimations be performed on large samples, since the DEA estimator tends to be biased in finite samples, but converges to the true parameter in relatively large samples.

4.4.3 Conventional Panel Estimation Methods of Growth Modelling

The extent to which the private sector contributes to increased economic growth in the economy is among other things dependent on the degree to which it can gain access to efficient and quality financial services. These financial services range from affordable credit, like overdraft and loan facilities, savings mobilisation, risk management services such as an assortment of insurance products, project evaluation, efficient payment services, investment options and a host of other support services provided at competitive prices. In this section of the chapter, the task is to analyse the link between banking cost efficiency and economic growth using unbalanced panel data for selected SADC countries during the period 2005-'15. Bank cost efficiency scores, bank-specific factors, financial sector development variables (commercial banks' credit to the private sector), and interaction terms (efficient and well developed banks).

Petkovski and Kjosevski (2014, p57) states that economic growth is a "complex process affected by a number of factors and that theory provides no clear or single answer to the question about the right model specification". In this study, we follow and modify the framework proposed by Odedokun (1996), which is based on the neo-classical production function in which financial development constitutes an input as follows:

$$Y_{it} = f\left(L_{it}, K_{it}, F_{it,} Z_{it}\right) \qquad \ldots(4.8)$$

where:

Y = Aggregate output or real GDP
L = Labour force
K = Capital stock
F = Bank cost efficiency and a vector of indicators of financial development
Z = vector of other inputs that can be regarded as inputs in the output process.

A neo-classical Cobb-Douglas production-type model is derived from the specification in 4.8 above:

$$Y_{it} = e^{A} K_{it}^{\alpha} L_{it}^{\beta} F_{it}^{\theta} Z_{it}^{\delta} \quad \ldots (4.9)$$

Taking natural logs both sides, we get:

$$LnY_{it} = A + \alpha LnK_{it} + \beta LnL_{it} + \theta LnF_{it} + \delta LnZ_{it} \quad \ldots (4.10)$$

To run this model, two conventional panel methods are performed: the dynamic generalised method of moments (GMM), and the fixed effects (FE) model (or the random effects model depending on the Hausman test outcome). The aim for testing different methods is to establish their performance and choose the best and most robust approach. However, our primary model is the dynamic GMM estimator in line with a number of studies: Ayadi *et al* (2013), Barajasi *et al* (2012), Hasan *et al* (2008), Ben *et al* (2007), Pinar and Damar (2006) and Levine *et al* (2000). In particular, this study emulates the study by Ayadi *et al* (2013) who explored the linkage between financial development, bank efficiency and economic growth of countries in the northern and southern Mediterranean, covering the period 1985-2009. Three approaches were applied in their paper: the FE panel regression, RE and GMM. A detailed discussion of these econometric methods is presented in the following sections.

4.4.3.1 Dynamic Generalised Methods of Moments (GMM)

Many real economic relationships are dynamic in nature, necessitating the application of econometric models that capture the dynamic interactions involved. In this study, the GMM dynamic panel method proposed by Arellano and Bond (1991) is used to estimate the growth model specified in **4.6**. A GMM is a dynamic panel data estimator that uses lagged terms of the dependent variable as exogenous and instrumental variables to handle the problem of endogeneity. The merit of this approach is that it is designed to handle econometric challenges caused by unobserved individual-specific/entity-specific effects and endogeneity of regressor variables in lagged dependent variable models such as in economic growth modelling (Petkovski and Kjosevski, 2014). Yusifzada and Mammadova (2015) state that the GMM overcomes problems of endogeneity, reverse causation, autocorrelation due to lagged terms, and most panel data problems that complicate estimation.

A moment is a statistical characteristic of a sample of population data. For instance, the first four moments provide information about the population mean (first moment), variance (second moment), skewness (third moment) and kurtosis (fourth moment) respectively. The GMM methodology employs the use of instrumental variables that are uncorrelated with the error term of the differenced model. The model is specified as follows:

$$y_{i,t} = \alpha y_{i,t-1} + \beta x_{i,t} + u_{i,t} \qquad u_{i,t} = \mu_i + \nu_{i,t} \qquad \ldots (4.11)$$

where y_{it} is real per capita GDP in country i in period t, x_{it} is a vector of explanatory variables discussed before including control variables, u_{it} is the error term which comprises μ_i an unobservable individual-specific effect, and ν_{it} represents the remaining disturbance. As suggested by Anderson and Hsiao (1981) y_{it-1} can be instrumented by y_{it-2}. However, equation 4.11 can be transformed using a two-step difference GMM developed by Arellano and Bond (1991). This first difference transformation eliminates the constant term and the individual effect to yield:

$$y_{i,t} - y_{i,t-1} = \alpha\left(y_{i,t-1} - y_{i,t-2}\right) + \beta\left(x_{i,1} - x_{i,2}\right) + \left(\nu_{i,t} - \nu_{i,t-1}\right) \qquad \ldots (4.12)$$

This approach "differences out" the μ_i. y_{it-2} is considered to be a good instrument because it is not correlated with $\Delta\nu_{it}$. Although the primary objective is to estimate β, the difficulty is to estimate α correctly. The GMM estimator chooses the value of α so that it minimises the following quadratic criterion function:

$$Q_N(\alpha) = \left[\frac{1}{N}\sum_{i=1}^{N} h(y_i, \alpha)\right]' W_N \left[\frac{1}{N}\sum_{i=1}^{N} h(y_i, \alpha)\right] \qquad \ldots (4.13)$$

where $h(\cdot)$ are the (unconditional) sample moment conditions and W_N is a weighting matrix. The mathematical formulations and derivations involved with GMM are very complex and are detailed in the previously cited work of the respective pioneers.

4.4.3.1.1 Difference-GMM v System-GMM

There are basically two GMM ways to analyse dynamic economic relationships in panel data econometrically: the first-difference GMM and the system GMM. Both approaches use instruments which are given from within the equations. The *difference GMM* was first introduced by Arellano and Bond (1991); its estimator uses the first differencing technique. A

potential weakness of the difference GMM is that the lagged levels which are used as instruments are regarded as poor instruments, especially if the variables are close to a random walk. The modification proposed by Arellano and Bover (1995) and Blundell and Bond (1998) is to consider lagged levels and lagged differences.

To address potential biases and imprecision associated with the difference estimator, a *system GMM* technique developed by Arellano and Bover (1995) and Blundell and Bond (1998) is considered. This approach combines the regression in differences and the regression in levels. The instruments for the regression in difference remain as before, but the instruments for the regression in levels now comprise lagged differences of the corresponding variables.

4.4.3.1.2 The Attractiveness of GMM over other Approaches?

Within the space of macro-econometric modelling, there has been a remarkable increase in the number of studies that have applied the GMM estimator technique to analyse growth models. The use of the GMM model was not chosen for its fanciness but for these reasons:

If one suspects potential endogeneity issues in one's model, GMM is well suited to deal with endogeneity in a better way than most models.

Getting external valid instruments from both a theoretical and an empirical point of view can be a tedious task. Under such circumstances, the GMM technique becomes a handy tool, as it relies on internally generated instruments.

Contrary to other estimators, GMM is a robust technique that does not require specification of the exact distribution of the errors. Hence the researcher when modelling can avoid the often unwanted specification regarding distribution of errors.

Among the class of all estimators that do not require any additional information besides that which is contained in the moment conditions, the GMM estimator has been proved to be consistent, asymptotically normal and efficient.

If heteroscedasticity or serial correlation is present in the error terms, using the GMM approach is more efficient than applying the two-stage least squares (2SLS) or other alternative instrumental variable (IV) techniques.

4.4.3.2 Pooled OLS regression (POLS)

A POLS involves pooling both time series and cross-sectional data and then running a common ordinary least squares regression equation ignoring possible entity-specific heterogeneity. By ignoring the panel structure of the data, POLS fails to account for heterogeneity. As such the estimators of the pooled OLS regression become biased and inconsistent due to

omitted factors or influences that are potentially correlated with other regressors included in the model. So the analysis of cross sections that exhibit "uniqueness" using pooled OLS constitutes a serious misspecification. Gujarati (2012, p292) states: "Lumping together different individuals at different times camouflages the existing heterogeneity or distinctiveness of these individuals or entities." This unaccounted heterogeneity is then absorbed by the error term. And as in most economic relationships, this heterogeneity – which is likely to be correlated with the included regressors – implies that the error term will also be correlated with the included regressors, causing biased estimated coefficients that are also inconsistent. This constitutes the major weakness of the pooled OLS regression. For this reason, in this study the POLS will not be treated as an econometrically robust model worthy of consideration on account of this weakness in handling individual heterogeneity. However, if there is no unobserved heterogeneity in the cross sections (which is highly unlikely) or if the unobserved heterogeneity is uncorrelated with all the regressors, one can use POLS as it is consistent under this condition.

To determine whether pooled OLS or an individual entity-specific model is appropriate, an **F**-test is employed. The **F**-test investigates the null hypothesis that the individual constant terms are all equal against the alternative that at least one is not equal to zero. If the null hypothesis is rejected, it implies that individual heterogeneity must be accounted for. In that case an informed choice has to be made between a fixed effects or a random effects model. This is the rationale for the Hausman test, which is discussed later in detail.

4.4.3.3 Fixed Effects (FE) Model

One way to model the heterogeneity that may exist among cross-sections, in this case countries, is to consider the use of the fixed effects method by adding an intercept for each cross-section to capture the special features peculiar to that entity. The term "fixed effects" is owing to the fact that although each assigned intercept is different for each entity, it does not change over time – that is, the intercept is fixed. Hence, in panel data analysis the fixed effects (FE) technique is used to control for omitted variables when these omitted variables differ across entities (countries) but are fixed over time. Stock and Watson (2012) derive the fixed effects model as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Z_i + \mu_{it} \quad \ldots (4.14)$$

Z_i is an unobserved variable that varies from one country to another but is time-invariant. β_1 measures the effect of X on Y holding Z constant. The specification **4.14** can be rewritten by substituting $\alpha_i = \beta_0 + \beta_2 Z_i$ to become:

$$Y_{it} = \beta_1 X_{it} + \alpha_i + \mu_{it} \quad \ldots (4.15)$$

Equation 4.15 represents a FE model with $\alpha_1 \ldots \alpha_n$ intercepts that represents entity or country-specific effects to be estimated one for each country. In empirical analysis two main estimation techniques are used to estimate the FE model: the least squares dummy variable (LSDV) technique and the within-group estimator technique. Both approaches produce the same outcome.

4.4.3.3.1 Least Squares Dummy Variable (LSDV)

The LSDV estimator is simply a pooled OLS regression model with a set of *N – 1* dummy variables and hence *N – 1* additional parameters as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} \ldots + \beta_k X_{k,it} + \gamma_2 D_{2i} + \gamma_3 D_{3i} \ldots + \gamma_N D_{Ni} + \mu_{it} \quad \ldots (4.16)$$

With the LSDV, differential intercepts dummies (binary variables) are introduced to the model to represent *N – 1* cross-sections in order to avoid the dummy variable trap, where *N* represents the total number of entities under study and the omitted entity becomes the benchmark or reference entity or category. Hence, the differential intercept dummy coefficients indicate by how much the intercept coefficient of the entity assigned a variable differs from the reference category. Its limitation is that every additional dummy variable consumes an additional degree of freedom leaving only a few observations with which to conduct meaningful statistical analysis. This challenge can be overcome by having a large sample.

4.4.3.3.2 Within-Group Estimator (WG)

An alternative to the LSDV is to apply the WG estimator by expressing both the regressand and regressors in this equation as deviations from their respective (group) mean values and then run the regression on the mean corrected variables. One of its advantages is that it is economical in terms of the degrees of freedom. However, the conversion to using mean-corrected variables means that time-invariant variables like race or gender are wiped out from the model. Thus equation **4.15** is converted to:

$$Y_{it} - \bar{Y}_i = \beta_1 \left(X_{it} - X_i \right) + \left(\mu_{it} - \bar{u}_i \right) \quad \ldots (4.17)$$

"Entity-demeaned" variables are created as shown below:

$\tilde{Y}_{it} = Y_{it} - \bar{Y}_i$, $\tilde{X}_{it} = X_{it} - \bar{X}_i$ and $\tilde{\mu}_{it} = \mu_{it} - \bar{\mu}_i$

Equation 4.17 is re-written to yield:

$$\tilde{Y}_{it} = \beta_1 \tilde{X}_{it} + \tilde{\mu}_{it} \quad \ldots (4.18)$$

After transforming the variables, the task is now to run OLS on the entity-demeaned variables as specified in equation **4.18** to obtain the estimate of β_1. The estimate of β_1 obtained using the WG estimator will be identical to that obtained by the LSDV estimator in equation **4.16**.

4.4.3.4 Random Effects (RE) Model

An optional method to the FE regression is the random effects (RE) regression, also known as the error component model (ECM). The RE model assumes that the individual error term is not correlated with the regressors, which permits time-invariant variables to play a role as explanatory variables. Unlike the FE which allows each entity to have its own time-invariant (fixed) intercept dummy, the RE assumes that the intercept values of all entities are random drawings from a much greater population of entities with a constant mean (Gujarati, 2012). The individual intercept is expressed as a deviation from the constant mean value. One advantage of the RE model over the FE model is that time-invariant variables like gender, geographic location or race – which are "swept away" in the FE model – are not "washed out" but included for direct estimation. One would recall that while the FE model is able to control for such time-invariant factors, it cannot estimate them directly. A critical assumption of the RE model is that its application is only suitable in circumstances where the random intercept of the entity is uncorrelated with the explanatory variables.

4.4.3.5 The Hausman Test: Fixed v Random

The reason for choosing the GMM technique over other options has been motivated by the need to address possible endogeneity problems (or violations of the exogeneity condition among regressors) which is common in most growth models. We have therefore decided in advance to use the GMM approach. However, to be absolutely certain that endogeneity is present in the model, the formal Hausman test of correlated random effects is performed. Many empirical studies use the Hausman to decide between adopting the FE and RE. However, in essence the Hausman test is performed under the null hypothesis that the individual

unique errors are uncorrelated with the regressors. Put differently, the null hypothesis is that the preferred model is RE (errors are uncorrelated with regressors) against the alternative FE (errors are correlated with regressors).

4.4.4 Panel Estimation Procedures

4.4.4.1 Panel Unit Root Test

An important initial step in constructing a robust econometric model is first to understand the data involved – whether it is stationary or not. For this reason each panel series to be used in this study is subjected to this unit root test. A series is deemed stationary if its mean, variance and covariance structures do not change over time. Ignoring non-stationarity (unit root) when it actually exists has serious consequences for the validity of the estimates and inferences. Several panel data unit root tests are followed in panel data analysis: the IPS unit root, which is accredited to Im, Pesaran and Shin (2003); Levin, Lin and Chu (2002), ADF-Fisher and PP-Fisher. The IPS unit root is preferred over the LLC because it preserves small sample properties and is generally more intuitive in its structure than most tests (Baltagi, 2008). In other words, it retains its power even in small samples. With most tests, the power of the tests improves with large samples and diminishes as sample size decreases. For robustness and consistency check, two unit root tests are to be applied to our data.

4.4.4.2 Cross-Sectional Dependence

Baltagi (2015) states that the nature of regional data (due to migration and international trade) implies that countries depend on each other. However, generally correlations decrease with geographical or economic distance among the member countries. Chudik and Pesaran (2013) show that cross-sectional dependence – cross-correlations of errors – is due to omitted common effects, spatial effects or interactions within socioeconomic networks. The authors caution that failure to account for cross-sectional dependence of errors can have negative consequences on panel estimators like fixed and random effects, resulting in inconsistent estimators and invalidating inferences. This, however, depends on the degree of cross-sectional dependence and on whether the source generating the cross-sectional dependence is correlated with regressors [Chudik and Pesaran (2013), Sarafidis and Robertson (2009), Phillips and Sul (2007)].

Baltagi (2008) states that cross-sectional dependence (CD) is a problem in macro-panels that exhibit a long time dimension. However it is generally acknowledged that the CD problem

is not much of an issue with micro-panels (few time periods and large entities). The structure of the panel data in this study is micro-panel comprising **T** = 11 and **N** = 75, making a total of 825 observations. As stated by Baltagi (2008) it is highly unlikely that micro-panels exhibit the CD problem. However, as a precaution, a number of tests – the *Breusch-Pagan LM*, the *Pesaran Scaled LM* and the *Pesaran CD test* – will be performed to test whether residuals across entities are correlated. Against the null hypothesis that residuals are not correlated across entities, these tests will be performed using EViews 9.5.

4.4.4.3 Serial Correlation Test

As in the case of CD, the problem of serial correlation is common with macro-panels characterised by long time periods and less of a problem with micro-panels, due to their short time series component. Testing for the presence of serial correlation in the error terms of a fixed effects regression model is critical for obvious reasons. The presence of serial correlation in panel data models biases the standard errors, causing the results to be less efficient and inferences to be misleading. So it is recommended that tests be done to check this problem. In this study, the Breusch-Godfrey LM (BG-LM) test is run to check for the presence of serial correlation in the fixed effects model. Unlike the Durbin-Watson (DW) test, which tests only for first-order serial correlation, the BG-LM tests for higher-order serial correlation.

When estimating a fixed effects model it is essential that the residuals be devoid of the problem of serial correlation. One important condition fundamental to classical linear regression is that residuals be independent of (uncorrelated with) one another. The challenge of serial correlation is primarily a time series issue, which becomes a concern even with panel data analysis due to the time-series element of panel data. Gujarati (2009) states that if the assumption of independence of residuals is not satisfied, OLS estimators – although unbiased and consistent – cease to be efficient. Efficiency implies that the variance is no longer minimal, meaning that the standard errors of obtained estimates become biased. Consequently, conclusions reached as a result of the outcomes of standard *t*-tests, *F*-tests and χ^2-tests become unreliable and invalid. However, if serial correlation is found in the model, there are necessary corrective procedures that can be performed on the data. In this study, the Arrelano-Bond serial correlation test will be considered. Under the serial correlation tests, the null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation.

4.4.4.4 The Sargan-Hansen Test

The consistency of the GMM estimator is dependent on the validity of the instruments chosen, as well as the condition that the error term is free from serial correlation. For the GMM estimator to be "identified", there must be at least as many instruments as there are parameters in the model. The instruments used, using GMM, are selected from lagged endogenous and explanatory variables and the validity of these instruments needs to be checked when constructing a dynamic GMM model. So besides the Arrelano-Bond serial correlation test, one such critical test is the Sargan-Hansen test.

The efficiency of the instruments is validated using the Sargan-Hansen test, which uses the *J*-statistic. The Sargan-Hansen test, or Sargan`s *J* test, proposed by Sargan (1958) and Hansen (1982) is a statistical test used for testing over-identifying restrictions in a model. The *J*-statistic is actually the Sargan statistic, which is the value of the GMM objective function at estimated parameters. The null hypothesis of the Sargan tests is that the over-identifying restrictions are valid. The Sargan statistic follows a chi-squares distribution $\chi^2(p-k)$, k being the number of estimated coefficients and p the instrument rank. Both the *J*-statistic and the instrument rank are reported in EViews. As a rule of thumb, the larger the *J*-statistic the better the model.

4.5 CONCLUSION

This chapter has outlined a two-stage methodological framework in which the first stage, the bank cost efficiency of 12 selected SADC countries, will be generated for the period 2005-'15 using DPIN. The study period and selected SADC countries were contingent on the availability of data. The intermediation hypothesis was followed, in which bank deposits are treated as an input rather than output, in line with the empirical literature. Customer deposits and other funding, number of employees, total operating expenses, and fixed assets constitute banking inputs, while loans and advances and interest and non-interest income were defined as banking outputs. These banking inputs and outputs were chosen carefully to reflect important characteristics of the main activities of modern banking, as indicated in the SADC banking industry and banking literature in general. The BCC model was chosen over the CCR model due to its practical merits. The input and output orientation results are reported in the next chapter. To address one of the objectives of the study, which is to determine the significance of change in the efficiency of SADC banks as a result of the global

financial crisis, the non-parametric Wilcoxon signed ranks test was suggested and its procedure discussed in detail.

In the second stage, contextual variables classified into bank-specific, industrial/sectoral factors, institutional and macroeconomic factors that theoretically affect bank efficiency are investigated using the panel Tobit model. Lastly, various conventional panel estimation approaches were explored critically for application in the investigation of the nature of the relationship between economic growth and banking cost efficiency and other banking or financially related drivers. Three panel data estimation techniques – the dynamic GMM, FE and RE models – were selected for consideration in the analysis of the growth-efficiency nexus for the SADC region. The dynamic GMM approach is commonly applied in panel data analysis of economic growth models due to its ability to handle the problem of endogeneity. Both the FE and RE models were considered for robustness check. Several diagnostic tests were also discussed and will be performed to ascertain the validity of the model and reliability of results. The next chapter runs the DEA model discussed in this chapter, using *DPIN version 3.0*. For second-stage analysis, *EViews 9*.5 or the analysis software *R* is used to run the models discussed; the results are presented in the next chapter.

CHAPTER FIVE

MEASUREMENT OF BANKING COST EFFICIENCY IN THE SADC REGION

5.1 INTRODUCTION

The previous chapter discussed various methodological approaches to be used to accomplish the primary objective and associated sub-objectives of this study as outlined in the introductory chapter. The purpose of this chapter is to measure and discuss the variations in the banking cost efficiency performances of SADC countries. To do this, we apply the revised non-parametric DEA technique proposed by Tone (2002) to derive cost efficiency measures with the aim of identifying fundamental sources of inefficiency and put forward policy recommendations. The performance measures to be generated provide the foundation needed for further exploration in subsequent chapters. Hence this chapter constitutes the first stage analysis within a broader three-stage process of investigating (*1*) cost efficiency levels → (*2*) cost efficiency drivers → (*3*) growth-efficiency nexus.

As discussed in the previous methodology chapter, the revised DEA – as opposed to the traditional DEA – is applied to circumvent the limitations of the unrealistic perfect market conditionality of price homogeneity imposed by the traditional DEA approach. Under the modified DEA approach, price variation is permissible for all banks under consideration in the computation of cost efficiency measures. The input orientation is adopted since bank managers have greater control over the use of their inputs in comparison with outputs. A sample of the banking data for 12 countries (out of the SADC's 15) is examined over the period 2005-'15, aggregating to 63 selected banks under study for the region. Ultimately, we explore 693 observations of SADC banking data. The data variables and their summarised statistical descriptors are tabulated in the appendices.

5.2 FIRST-STAGE COMPUTATION OF COST EFFICIENCY USING DEA

All the data used to evaluate cost efficiency were extracted from the financial income and balance sheet statements reported in the Bankscope database. The values are reported in millions of the domestic currencies of the respective countries under study. However, a few important caveats are worth consideration. To preserve uniformity and maintain consistency in data collection, the DRC and the Seychelles were omitted from the analysis, because these two countries are not signatories to the Bankscope database, so their banking data was miss-

ing. In the case of Zimbabwe there was insufficient data coverage since the financial statements reported by Bankscope date back only to 2009, a period that coincides with dollarisation. The DPIN programme to be used in this study for the computation of cost efficiency measures does not handle missing data values. As a result, a number of banks in each country were omitted from the analysis on account of missing data observations in one or more years. However, every effort was made to ensure fair representation in terms of sufficient number of banks and/or total value of banking assets and liabilities in each of the respective countries. As such the empirical results in this study may be regarded statistically as fairly representative of SADC banking.

The banking variables to be used for this analysis comprise three (3) inputs and three (3) outputs, including their respective input and output prices as discussed and presented in the previous chapter in **Table 4.2**. The DPIN programme which uses the revised DEA framework to generate productivity and efficiency measures was then applied to run this data for each of the 12 countries in **Table 4.1**. Summarised results are tabulated in **Table 5.1**.

TABLE 5.1: SUMMARY OF EFFICIENCY RESULTS FOR THE SADC REGION

COUNTRY	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	MEAN	STD DEV
Angola	0.56	0.65	0.81	0.82	0.85	0.78	0.76	0.82	0.89	0.76	0.78	**0.77**	**0.09**
Botswana	0.73	0.80	0.62	0.69	0.68	0.68	0.80	0.86	0.90	0.83	0.73	**0.76**	**0.09**
Lesotho	0.66	0.79	0.82	0.88	0.93	0.95	0.95	0.89	0.85	0.91	0.87	**0.86**	**0.08**
Madagascar	0.79	0.91	0.87	0.74	0.85	0.74	0.76	0.81	0.91	0.97	0.98	**0.85**	**0.09**
Malawi	0.88	0.85	0.87	0.85	0.86	0.90	0.84	0.84	0.87	0.84	0.85	**0.86**	**0.02**
Mauritius	0.31	0.26	0.25	0.21	0.27	0.33	0.45	0.58	0.49	0.50	0.55	**0.38**	**0.13**
Mozambique	0.69	0.78	0.67	0.76	0.91	0.97	0.84	0.74	0.73	0.86	0.81	**0.80**	**0.09**
Namibia	0.76	0.93	0.90	0.93	0.94	0.90	0.94	0.95	0.93	0.94	0.90	**0.91**	**0.05**
South Africa	0.19	0.17	0.81	0.78	0.74	0.62	0.59	0.60	0.64	0.60	0.78	**0.59**	**0.22**
Swaziland	0.88	0.97	0.98	0.92	0.89	0.92	0.84	0.87	0.86	0.87	0.87	**0.90**	**0.04**
Tanzania	0.83	0.69	0.79	0.85	0.87	0.88	0.79	0.85	0.90	0.85	0.93	**0.84**	**0.07**
Zambia	0.75	0.81	0.77	0.85	0.77	0.58	0.56	0.69	0.65	0.74	0.65	**0.71**	**0.09**
AVERAGE	**0.67**	**0.72**	**0.76**	**0.77**	**0.80**	**0.77**	**0.76**	**0.79**	**0.80**	**0.81**	**0.81**	**0.77**	
STD DEV	**0.22**	**0.25**	**0.19**	**0.19**	**0.18**	**0.19**	**0.15**	**0.12**	**0.14**	**0.14**	**0.12**	**0.15**	
MAX	**0.88**	**0.97**	**0.98**	**0.93**	**0.94**	**0.97**	**0.95**	**0.95**	**0.93**	**0.97**	**0.98**	**0.91**	
MIN	**0.19**	**0.17**	**0.25**	**0.21**	**0.27**	**0.33**	**0.45**	**0.58**	**0.49**	**0.50**	**0.55**	**0.38**	

FIGURE 5.1: COST EFFICIENCY BY PERIOD

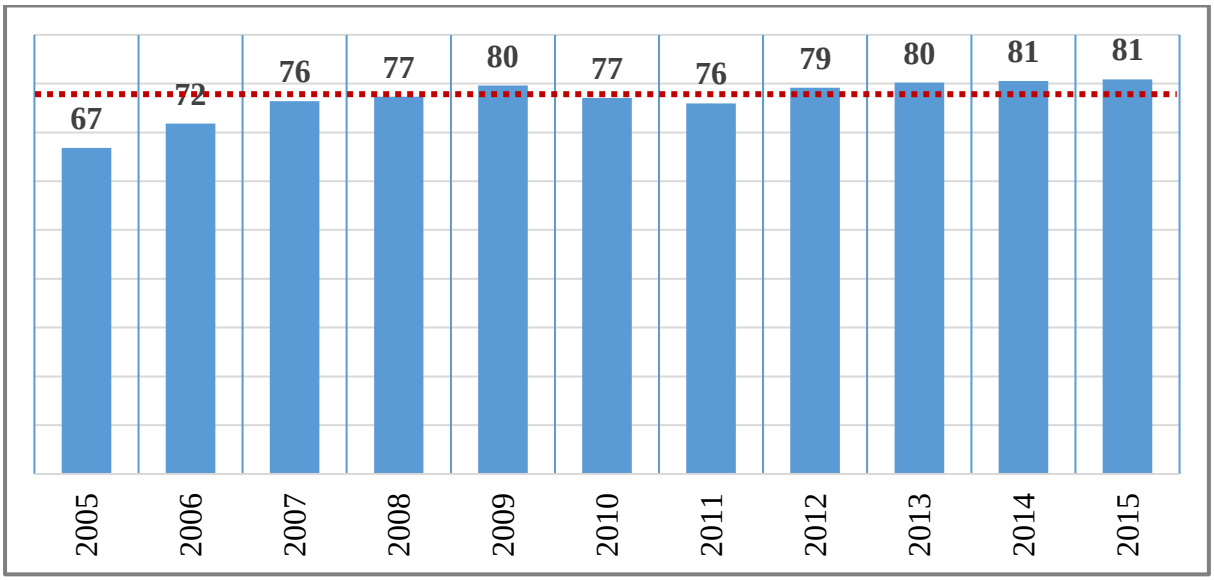
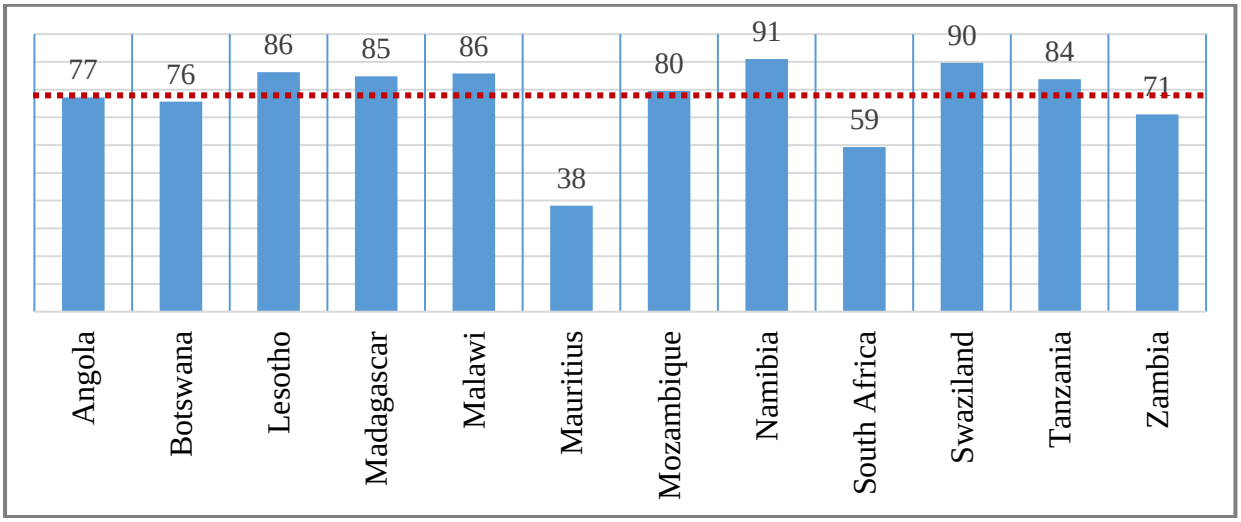


FIGURE 5.2: COST EFFICIENCY BY COUNTRY



5.3 DISCUSSION OF RESULTS

5.3.1 DEA Bank Cost Efficiency Estimates

This sub-section presents, analyses and discusses the cost efficiency scores generated for 63 banks from selected SADC countries. The results show that overall the banks are 77% efficient, ranging between 38% and 91%, with Namibia being the most efficient and Mauritius the least. This is not unique, as it compares well with other regional performances (see work by Kablan 2010). The results show that overall, Namibia is the most efficient while Mauritius and South Africa are the least and second-least respectively. In a recent study by Desta (2016) in which 19 commercial banks were sampled out of the 30 best African banks, their

DEA results showed that Bank Windhoek Ltd of Namibia was the most productive. Based on the views of Kablan (2010), we expected banking systems in countries with higher GDP *per capita* to have competitive costs since they operate in more mature, wealthier and developed environments. Contrary to our expectations, Mauritius and South Africa emerged the least cost-efficient banking systems, averaging 38% and 59% respectively for the period 2005-'15. This could be ascribed to the hypothesis that Mauritanian and South African banking sectors maybe suffering from significant cost disadvantages of large scaling.

The average cost efficiency (CE) in **Table 5.1** out of 77% reported for the region implies that the SADC banking industry exhibited input wastage or cost inefficiency of 23%. This can be interpreted in two ways. Firstly, it means that banks in the region have the potential to decrease their input costs by 23% without altering the level of their output production. Hence the 63 banks studied for the period analysed were on average operating at 23% above their minimum or best practice cost frontier. Alternatively, it means that with the endowment of resources that were available to them, the banks studied had the potential to expand their outputs by 23%.

The cost efficiency (CE) average score reported in this present study for the SADC region is consistent with that of earlier cost efficiency studies conducted in Africa. Applying the stochastic frontier analysis (SFA), Kablan (2010) obtained an estimated banking CE score of 76% among sub-Saharan African countries, which is almost identical to the 77% obtained in this study. For a study of 10 middle-income sub-Saharan African countries covering the period 2000-'06, Chen (2009) found that the banks sampled operated at a level of cost efficiency ranging between 70% and 80%. In line with our present findings, their study demonstrated that the banking systems of these African countries have the potential to save 20% to 30% of their total costs if they operate efficiently.

The standard deviation statistics presented on the last column of **Table 5.1** suggest that in relation to the rest of the countries studied, the dispersion of efficiency scores is considerably wider for South Africa and Mauritius. We ascribe this empirical observation to the fact that banking systems in South Africa and Mauritius are the largest and most sophisticated in Southern Africa and the whole of Africa at large. We posit that their considerable size of operation and significant representation in various other countries may in some way be exerting a negative influence on their operational cost as a result of possible diseconomies of

scale. This is especially so when the efficiency of these extremely large banks is evaluated in relation to their smaller counterparts. For instance, banking in South Africa is dominated by the big-four banks, which together account for over 80% of retail banking in the country. The rest of the relatively smaller banks represent less than 20% of the market. In 2010, South Africa`s largest four banks represented 49% of the total assets held by Africa`s largest 100 banks at the time (KPMG, 2013). Similar features as described for South Africa apply to Mauritian banks. This evidence of widely dispersed measures of cost efficiency implies that there is more scope for improvement, particularly in South Africa and Mauritius, as well as in other countries like Angola, Botswana, Madagascar, Mozambique and Zambia.

Overall, the Namibian banking sector represent best practice for other countries to follow. Thus in relation to its output production, Namibia exhibit the least resource consumption. This is particularly congruent with the descriptive narrative outlined in chapter two where the Namibian banking sector exhibited high and relatively stable financial deepening. Additionally, its banking sector also portrayed relatively high financial inclusivity in the SADC. Namibia is among the countries that are moving towards the point where every adult has a bank account (over 80% adults by the year 2014). Future studies may then need to further explore the various unique practices and strategies attributable to its high cost efficient behaviour.

5.3.2 Non-parametric Wilcoxon Signed Rank Test Results

In addition to estimating banking cost efficiency levels we sought to ascertain empirically whether the SADC banking system exhibits any significant cost efficiency changes as a result of the global financial crisis of 2008. To do this we used the non-parametric equivalent of the parametric student ***t*** test known as the Wilcoxon matched-pairs signed ranks test. To perform this procedure, a number of sequential steps as outlined in the previous chapter were performed and are summarised in **Table 5.2**

TABLE 5.2: WILCOXON SIGNED RANK TEST RESULTS

ALL BANKS	PRE-CRISIS	POST-CRISIS	CHANGE	RANK	R_-	R_+
AGO	0.676	0.802	-0.1262	9	*9*	
BWA	0.719	0.824	-0.1046	7	*7*	
LES	0.755	0.892	-0.1377	10	*10*	
MAD	0.857	0.887	-0.0297	2	*2*	
MWI	0.867	0.845	0.0219	1		*1*
MAU	0.274	0.513	-0.2390	11	*11*	
MOZ	0.714	0.795	-0.0809	5	*5*	
NAM	0.862	0.932	-0.0696	3	*3*	
ZAR	0.390	0.645	-0.2557	12	*12*	
SWZ	0.941	0.863	0.0779	4		*4*
TAZ	0.767	0.863	-0.0964	6	*6*	
ZAM	0.780	0.658	0.1221	8		*8*
					$R_- = 65$	**$R_+ = 13$**

According to **Table 5.2**, the Wilcoxon statistic, $\boldsymbol{W}_{\text{statistic}} = 13$ (*which is the lower of the two*) turned out to be the sum of the ranks of the positive differences. This statistic value is then compared with $\boldsymbol{W}_{\text{critical}} = 14$, the two-tailed Wilcoxon critical value at 0.05 level of significance for $n = 12$. Against the null hypothesis that there is no difference between pre-crisis and post-crisis, the null is rejected since the Wilcoxon statistic of 13 is actually less than the critical value of 14. So we conclude that there was a significant difference between the cost efficiency performance of SADC banks before the crisis and their cost efficiency levels after the crisis. We found post-crisis efficiency measures to be relatively higher than those recorded during the pre-crisis period by 7.6%. A closer look at the country level changes reveals that South African and Mauritian banking sectors experienced the highest improvement in cost efficiency. This may be ascribed to the hypothesis of catching up or improvement of the least efficient banks in these two countries post the crisis period.

5.4 CONCLUSION

The study sought to evaluate the cost efficiency measures of banking institutions of the SADC economic bloc. The purpose was to measure the level of cost efficiency with which labour, capital, deposits, borrowings and other funding were used to produce loans, interest and non-interest revenues. To execute this task, the non-parametric variable returns to scale (VRS) cost minimisation and input orientation DEA approach was applied to 63 sampled banks from 12 selected SADC countries for the period 2005-'15. Computed DEA results show that the SADC as a region is generally cost-efficient with an average score of 77% observed over the 11-year period of study.

In the second procedure, the Wilcoxon signed ranks test was employed to assess the significance of the changes in the efficiency measures of SADC banks between the pre-crisis and post-crisis periods. The findings of the Wilcoxon test led to the conclusion that there was a significant difference between the cost-efficiency performance of SADC banks before and after the crisis. The pre-crisis efficiency measures were found to be significantly lower than those of the post-crisis period by 7.1%.

CHAPTER SIX

FUNDAMENTAL DRIVERS OF BANKING COST EFFICIENCY IN THE SADC

6.1 INTRODUCTION

The primary objective of this chapter is to investigate the environmental factors driving cost efficiency in the SADC region with a view to proposing policy prescriptions for improvement. A dynamic panel Tobit technique is applied to the first stage DEA-derived efficiency indicators against a variety of internal and external environmental factors. The efficiency with which the bank executes its daily functions is determined by internal (firm-specific) factors specific to a given bank, and by external factors that affect the environment in which banks carry out their business activities. In this study, we follow a basic three-stage process for improving banking efficiency involving: **Stage 1:** pre-selection of those factors as hypothesised by economic theory and practice; **Stage 2:** identification of those factors with a statistically significant influence on efficiency performance; and **Stage 3:** formulation of policy recommendations and guidelines. This chapter is set out as follows: the next section briefly reviews the data variables for analysis summarising their expected effect on bank efficiency. The preliminary descriptive statistics for each regressor are also reported. In the following section, the empirical results of the censored dynamic Tobit are reported, followed by discussion of the results. The last section concludes the chapter.

6.2 SECOND-STAGE ANALYSIS OF ENVIRONMENTAL FACTORS

6.2.1 Data Variables and Descriptive Statistics

This sub-section provides a summary of the data variables used, including the direction of their expected effect and their descriptive statistics. This is reported in **Table 6.1** and **Table 6.2** respectively. Descriptive statistics offer a general insight into the variables characteristics. Using EViews 9.5, common statistical descriptors – namely mean, maximum, minimum and standard deviation – are computed for 63 selected SADC banks observed over 11 years for the period 2005-'15 for the 12 selected SADC countries, aggregating to 693 observations. This unbalanced panel of 693 observations (63 banks × 11 periods) is distributed as follows: Angola (*66 observations*), Botswana (*55 observations*), Lesotho (*33 observations*), Madagascar (*33 observations*), Malawi (*44 observations*), Mauritius (*77 observations*), Mozambique (*33 observations*), Namibia (*44 observations*), South Africa (*132 observations*), Swaziland (*44 observations*), Tanzania (*66 observations*) and Zambia (*66 observations*).

TABLE 6.1 VARIABLES DESCRIPTION

VARIABLE	**SYMBOL**	**DESCRIPTION**	**EXPECTED SIGN**
DETERMINANT VARIABLES			
INTERNAL BANK ENVIRONMENT			
Dynamic term	*CE(-1)*	Lagged dependent variable	+
Intermediation efficiency	*NLCD*	*Net loans to customer deposits*	+
Profitability	*ROAA*	*return on average asset*	+
Liquidity	*LADSF*	*liquid assets to short term funding*	+ / –
Foreign owned/ controlled	*FOR*	*A dummy variable is used to capture banks that are foreign controlled in each of the sampled countries.*	+ / –
Asset quality	*LLP*	*loan loss provision to net interest revenue*	–
Capitalisation	*EQTY*	*equity to total assets*	+ / –
Diversification	*DIV*	*non-interest income to earning assets*	+ / –
Size	*LARG*	*A dummy variable is used to capture relatively large banks based on gross loans and total asset size.*	+ / –
MACROECONOMIC ENVIRONMENT			
Economic growth	*GDPG*	*Growth in gross domestic product*	+
Inflation	*INFL*	*Change in GDP deflator*	–
INSTITUTIONAL ENVIRONMENT			
Political instability	*POLS*	*Measures perceptions of the likelihood of political instability and or politically motivated violence.*	–
Financial crisis	*CRIS*	*Dummy variable to capture the crisis periods: 2008, 2009 & 2010*	–

TABLE 6.2: DESCRIPTIVE STATISTICS FOR SECOND-STAGE VARIABLES

VARIABLE	MEAN	MAXIMUM	MINIMUM	STD. DEV
NLCD	98.19	3025.31	8.26	174.51
ROAA	2.42	13.10	-16.94	2.61
FOR	0.59	1.00	0.00	0.49
LADSF	45.49	521.46	3.15	36.82
CRIS	0.27	1.00	0.00	0.45
LLP	18.90	462.73	-95.57	32.20
EQTY	13.20	98.45	-13.48	8.79
DIV	0.10	2.80	0.00	0.30
LARG	0.56	1.00	0.00	0.50
GDPG	1.51	3.12	-1.34	0.66
INFL	1.84	3.31	-2.19	0.89
POLS	3.88	4.54	2.84	0.38

Source: World Development Indicators (WDI), World Bank (2018).

6.2.2 Panel Unit Root Test Results

A necessary procedure when constructing an econometric model is to perform unit root tests on the data variables to be used for analysis. As previously discussed, the IPS unit root test is preferred over the LLC approach due to its ability to retain its power in small samples (Baltagi, 2008). The attractiveness of most of the tests increases in large samples, but weakens as sample size decreases. To ensure robustness and consistency, both the IPS and LLC test results are reported.

TABLE 6.3: LLC AND IPS UNIT ROOT TESTS

VARIABLE	IPS		LLC		ORDER
	Statistic	*p-value*	*Statistic*	*p-value*	
NLCD	-3.841***	0.000	-7.621***	0.000	I(0)
ROAA	-5.103***	0.000	-11.016***	0.000	I(0)
LADSF	-1.680**	0.047	-8.346***	0.000	I(0)
LLP	-3.799***	0.000	-10.153***	0.000	I(0)
EQTY	-5.557***	0.000	-40.843***	0.000	I(0)
DIV	-1.888**	0.030	-3.608***	0.000	I(0)
GDPG	-20.100***	0.000	-36.159***	0.000	I(1)
INFL	-5.347***	0.000	-10.890***	0.000	I(0)
POLS	-6.073***	0.000	-10.332***	0.000	I(0)
CRIS	-7.628***	0.000	-5.610***	0.000	I(1)

*[***]/ (**) / * indicates significance at 1% (**p < 0.01**), 5% (**p < 0.05**) and 10% (**p < 0.10**) respectively.*

6.3 ESTIMATION, REPORTING AND DISCUSSION OF THE RESULTS

6.3.1 Diagnostic Tests Results

In this sub-section, the Tobit estimation procedure with a left censoring bound of 0 and a right censoring bound of 1 is applied on DEA-derived cost efficiency scores against a set of environmental variables reported in **Table 6.1**. We follow renowned studies – Abel and Le Roux (2016); Gwahula (2013); Sharma *et al* (2012); Kiyota (2009); Avkiran (2009), Casu and Molyneux (2003); Maudos *et al* (2002) – among others that also explored efficiency in the second stage using the Tobit regression. Irsova and Havranek (2010), assert that with constrained dependent variables, censored regression models generate consistent estimates of coefficients relative to ordinary least squares.

Before presenting the Tobit estimation results, critical diagnostic tests have to be performed. Firstly we run the Wald test against the null hypothesis that all regressor variable coefficients are equal to zero, which resulted in the rejection of the null, leading to the conclusion that generally all regressed environmental factors are jointly significant. The Q-statistic for evaluating the presence of auto-correlation and partial auto-correlation produced insignificant test results, leading to the non-rejection of the null hypothesis of no auto-correlation. It is important to recall that the Tobit is constructed under assumptions of normality of residual, as such any extreme data values have detrimental effects on the maximum likelihood (ML) estimates of the standard Tobit model parameters (Barros *et al*, 2016). To overcome this challenge of possible non-normality of residuals, the normal Tobit estimation with Huber-White standard errors and covariance is estimated.

TABLE 6.4: DIAGNOSTIC TESTS

TEST & NULL HYPOTHESIS	TEST STATISTIC	P-VALUE	INFERENCE
Wald test of joint-significance: *All regressor variables are equal to zero.*	*F-statistic =134.94* *Chi-square =1619.30*	*0.000* *0.000*	Reject the null
Auto-correlation and **Partial-autocorrelation** *No autocorrelation*	Q-Stat, *lag = 1* Q-Stat, *lag = 2*	*0.370* *0.660*	Accept the null
Cross sectional dependence *No cross-section dependence in residuals*	Pesaran CD statistic = *1.61*	*0.108*	Accept the null
Heteroscedasticity *Residuals are homoscedastic.*	White diagonal standard errors and co-variances were used.		

To detect the presence of multicollinearity, we perform the correlation matrix on all the regressor variables. The results in Table 6.5 showed no evidence of serious pairwise correlations among explanatory variables.

TABLE 6.5: CORRELATION MATRIX OF REGRESSOR VARIABLES

	NLCD	ROAA	LADSF	LLP	EQTY	DIV	LARG	GDPG	INFL	POLS	CRIS	FOR
NLCD	**1.000**											
ROAA	0.033	**1.000**										
LADSF	0.061	0.175	**1.000**									
LLP	0.210	-0.419	0.041	**1.000**								
EQTY	0.235	0.442	0.231	-0.032	**1.000**							
DIV	0.021	0.139	-0.014	-0.069	0.153	**1.000**						
LARG	-0.081	0.094	-0.155	-0.017	-0.087	0.060	**1.000**					
GDPG	-0.065	0.023	0.044	0.037	-0.025	-0.033	0.001	**1.000**				
INFL	-0.032	0.085	0.075	-0.043	0.049	0.019	0.032	0.134	**1.000**			
POLS	0.083	-0.042	-0.132	0.122	0.000	0.125	0.018	0.044	-0.312	**1.000**		
CRIS	0.021	0.065	0.033	-0.031	-0.052	0.009	0.000	-0.064	0.023	0.048	**1.000**	
FOR	-0.180	-0.126	0.000	-0.102	-0.284	0.054	-0.036	0.074	0.028	-0.082	0.000	**1.000**

6.3.2 Presentation of Tobit & Panel Least Squares Estimation Results

Having performed the diagnostic test successfully, we proceed to report and discuss the results of the maximum likely Tobit estimation in relation to those of the literature. Hoff (2007) maintains that the Tobit estimation procedure generates reasonable estimates and that it can be substituted for by the OLS approach under some conditions. Bogetoft and Otto (2011) argue that OLS suffers from the "theoretical" problem of failing to take into account the condition that efficiencies range between 0 and 1. However, McDonald (2009) as cited by Bogetoft and Otto (2011, p187) conclude that "theoretical niceties are of little concern" and that many two-stage DEA studies have proved most useful in providing insight into real world production processes. For the robustness check, panel least squares estimation results are reported to buttress our primary Tobit model and their results are presented in **Table 6.6**.

TABLE 6.6 COST EFFICIENCY AND ITS FUNDAMENTAL DETERMINANT DRIVERS

Maximum Likelihood Estimation of the Censored Tobit Regression Model
Dependent variable : Bank Cost Efficiency

	TOBIT ESTIMATION		**PANEL LEAST SQUARES**	
Variable	**Coefficients**	***p-value***	**Coefficients**	***p-value***
Constant	0.171***	0.0001	0.223***	0.000
Internal Bank Environment				
CE(-1)	0.808***	0.000	0.743***	0.000
NLCD	0.001***	0.000	0.0002***	0.000
ROAA	0.009**	0.013	0.007**	0.015
FOR	0.042***	0.007	0.027**	0.035
LADSF	-0.001**	0.015	-0.001***	0.007
LLP	-0.0004**	0.023	-0.0002	0.384
EQTY	-0.001	0.306	-0.0003	0.722
DIV	0.009	0.589	0.015	0.460
LARG	0.015	0.259	0.016	0.163
Macroeconomic environment				
GDPG	0.021**	0.019	0.016*	0.080
INFL	-0.005	0.489	-0.003	0.609
Institutional Environment				
POL	-0.034**	0.010	-0.109***	0.001
CRIS	-0.130***	0.001	-0.027**	0.029

*[***]/ (**) / * indicates significance at 1% (**p < 0.01**), 5% (**p < 0.05**) and 10% (**p < 0.10**) respectively.*

6.3.3 Interpretation and Discussion of Tobit Estimation Results

Dynamic Term

We found the lagged dependent variable to be relevant, positive and decimal in line with our earlier expectations. This dynamic term bears a positive and strong significant link to current bank efficiency. Keele and Kelly (2006) argue that sometimes this lagged term is included so as to rid the model of autocorrelation. Tobit results indicated that all regressor variables have significant marginal effects with the exception of bank capitalisation, diversification, bank size and inflation.

6.3.3.1 Internal Banking Environment

Net Loans to Customer Deposits

The empirical findings in this study provide evidence of a positive and strong linkage between efficiency and greater intermediation. A greater ratio implies high efficiency in converting deposits into loans. While it is significant at 1% level, the contribution of intermediation efficiency to cost efficiency seems trivial. The slope coefficient of NLCD means that a 10% acceleration in the loans-to-deposits ratio tends to increase cost efficiency by 0.01%. So banks that focus more on the traditional activities of loan granting are more efficient relative to highly diversified banks. This is in line with the other studies [Nitoi and Spulbar (2015); Ariff and Can (2008)] that have recommended that banks increase lending-focused activities so as to enhance cost efficiency.

Return on Average Assets

The ROAA profitability indicator variable showed that profitable banks tend to be cost-efficient. A 10% higher level of profitability is anticipated to influence a positive effect on cost efficiency by 0.09%. In other words, banks with higher ROAA are associated with increased efficiency. This outcome is consistent with findings from earlier studies [Nitoi and Spulbar (2015); Chronopoulos *et al* (2011); Ariff and Can (2008); Hermes and Nhung (2010); Fries and Taci (2005)] that find cost-efficient banks also to be the most profitable.

Foreign ownership

To account for the effect of foreign control or foreign ownership on cost efficiency, we followed the study by Ariff and Can (2008) by incorporating into the model an ownership structure dummy variable. Our results suggest that more foreign bank participation has beneficial implications for the banking cost efficiencies of SADC countries. The results imply that for the period under study, efficiency tended to be 0.04% higher for foreign-controlled banks. Our results also indicate that this relationship is robust at 1% level of significance. So this finding validates the results of earlier studies [Kiyota (2009); Kirkpatrick *et al* (2008); Figueria (2006); Bonin *et al* (2005); and Cosset *et al* (2005)] that reached similar conclusions. So we concur with Simpasa`s (2003) recommendation to ease regulatory barriers to encourage more foreign bank penetration in the industry to stimulate (a healthy level of) competitive behaviour among SADC banks.

Liquid Assets to Deposits & Short Term Funding

Contrary to expectations, we noticed that banks with higher liquidity ratios are less cost-efficient. A 10% higher level of this liquidity ratio is anticipated to drive bank cost efficiency down by 0.01%. We postulate that while lack of sufficient liquidity may force banks to borrow funds at excessive costs, holding relatively high liquid assets implies greater opportunity costs in terms of forfeited high returns. Our finding compares favourably with those of Brissimis *et al* (2008); Rao (2005); and Koetter and Poghosyan (2009).

Loan Loss Provisions

The ratio of loan loss provisions to net interest revenue is a crucial factor that captures the quality of bank`s major output, loans. This variable was included in the analysis due to a lack of data on non-performing loans for some banks in the sample. However, it is important to recall at this juncture that loan loss provisions are strongly correlated with bad loans. Besides being highly significant at 1% and carrying a negative sign in line with expectations, its contributing effects appear to be infinitesimal. For instance, a 10% increase in the loan loss ratio is anticipated to exert a compromising effect on cost efficiency by 0.004%. Our findings are similar to those of earlier studies [Carvallo & Kasman (2005), Casu and Girardone (2004), Yildrim (2002)]

Equity to Total Assets

The equity to total assets variable was included to represent the influence of capital structure on bank efficiency. In contrast with our earlier hypothesis of a positive effect on bank cost efficiency, no significant link could be established between higher bank capital requirements and banks' cost efficiency. This particular ratio showed a negative and insignificant effect. This empirical finding is consistent with those of earlier studies [Adjei-Frimpong *et al* (2014); Cavallo and Rossi (2002); Chronopuolos *et al* (2011); Ariff and Can (2008); Staikouras *et al* (2008); and Berger and Mester (1997)]. We posit that the increased level of capital may be highly correlated with the bank`s degree of risk exposure and therefore to increased cost. It is also generally argued that raising capital is much costlier than taking deposits. In a study of Ghanaian bank cost efficiency, Adjei-Frimpong *et al* (2014) also found bank capitalisation to be negatively correlated with cost efficiency. Other studies that reported a negative link between high capitalisation and cost efficiency include Ariff and Can (2008); Altunbas et al (2004); and Freixas and Rochet (1997). Among these studies the

argument is that while bank capitalisation provides a buffer against risk, it has the tendency to increase moral hazard, leading to higher costs.

Diversification

With regard to income diversification, no significant link exists between diversification and efficiency. However, this diversification variable, approximated by the proportion of the volume of non-interest income to earning assets, entered the model positive as expected. This finding is similar to those of Mizraei and Mizraei (2011) who found diversification to be insignificant for emerging economies and significant for developed economies. In terms of the direction of impact, our findings are in line with those of Chronopoulos *et al* (2011); Cavallo and Rosi (2002); and Allen and Rai (1996) who found evidence that diversified banks are more cost-efficient in comparison with specialised banking systems.

Bank size

To account for the size of the bank and its possible effects on efficiency, a qualitative variable to represent relatively large banks was generated. In keeping with the cost advantage theory of economies of scale, we found large banks to be positively associated with higher cost efficiency. However, bank size proved not to be a significant driver of cost efficiency in the region. This result is similar to several studies – Repkova (2015); Sharma *et al* (2012); Kasman and Yildirim (2006); Berger and Mester (1997) – that found the relationship to be insignificant. In the light of much banking literature on the subject, we stress the need to interpret this finding with care. Large banks have in recent decades been found to be prone to higher exposure to market risks and greater likelihood of systemic risk contagion.

6.3.3.2 Macroeconomic Environment

Evidence in this study also supports the idea that macroeconomic stability is a necessary precondition for enhancing banking efficiency. The results obtained show that GDP exerts a positive effect on cost efficiency. This is because increased economic growth is connected to several other economic drivers that are related to demand for and supply of deposits and loans. As such, countries with greater GDP *per capita* generally have banking systems that operate in a more mature business environment characterised by competitive interest rates and relatively low operational costs (Kablan, 2010). The empirical evidence reveals that GDP growth has a considerable influence on banking sector efficiency, that is, a 10% rise in GDP has the potential to increase bank cost efficiency by 0.21%.

We included inflation among macroeconomic variables due to its critical role in the economy as a whole. Inflation affects real returns of investment and the cost of doing business directly. Inflation carried the expected negative sign, implying that price instability is counterproductive in attaining bank efficiency. However, it entered the model as insignificant. A study that found an insignificant influence of inflation on efficiency in Africa was that of Gwahula (2013).

6.3.3.3 Political and Business Environment

It is generally acknowledged that a stable political environment plays a crucial role in fostering macroeconomic stability and hence bank performance. Our empirical study found the perception of political instability to exert a negative effect on cost efficiency, in line with our earlier hypothesis. In a related study, Mensah *et al* (2013) found similar results. Their study found that governance variables such as rule of law, government effectiveness and economic freedom had a negative effect on economic growth in 33 African countries. It appears that the relationship between political stability and bank performance is more intricate than is widely presumed. We also found that this result is not unique, as it fits within the work of Goldsmith (1987, p472) who elaborates Mancur Olson`s theory that political stability can be "economically dysfunctional and cause growth to decelerate" in the long term.

The dawn of the global financial crisis of 2008 necessitated an exploration of the magnitude, direction and significance of its effect on cost efficiency in the African context. Financial crises cause several other factors related to the demand and supply of banking services to deteriorate. Economic activity declines, business climate deteriorates, consumer and investor sentiments decrease, resulting in reduced demand for loans. More importantly, financial crises cause demand for loans to decrease, non-performing loans to increase, banking costs to rise and cost efficiency to decrease. Our findings showed that the 2008 US sub-prime global financial crisis affected banking cost efficiency negatively, retarding performance by 0.13% during the period of analysis. We also noticed that the years of the global financial crisis brought upon the SADC banking system a mild decrease in cost efficiency. We posit that the reason is that apart from the banking systems of South Africa and Mauritius, the rest of the banking systems of the countries under study were not sufficiently integrated into the global financial system to suffer significant contagion. We emphasise the need for effective

supervision and regulation of the financial system as a prerequisite for fostering sustainable and greater banking efficiency.

6.4 CONCLUSION AND RECOMMENDATIONS

The primary objective in this chapter was to investigate whether bank cost efficiency is related to a number of hypothesised internal and external bank variables classified as bank-specific, macroeconomic and institutional. Among these factors, we find that bank cost efficiency is influenced significantly by net loans to customer deposits (*intermediation efficiency*), ROAA (*profitability*), liquid assets to deposit and short term funding (*liquidity risk management*), loan loss provisions (*asset quality and credit risk management*), GDP growth (*macroeconomic stability*), and financial crises (*prudent supervision and regulation*).

To improve efficiency, we recommend a number of policy guidelines emanating from our empirical findings. These include the regular and close monitoring of bank credit and risk management processes to reduce bad loans, like loan defaults and late loan payments. Our results further indicate that income diversification – despite carrying the expected positive sign – has no significant bearing on efficiency. Hence cost efficiency can be enhanced by encouraging SADC banking institutions to pursue lending-focused (*loan specialising*) activities of traditional banks. Regarding liquidity, a balance of de-regulation and optimum risk management has the potential to reduce bank cost and improve efficiency. Empirical evidence in this study also showed that macroeconomic stability characterised by high growth and a low inflationary environment contribute strongly towards greater efficiency. So there is a need for government effectiveness, and macroeconomic stabilisation policies that ensure high economic growth and a stable inflation. However, the study revealed that the cost efficiency of SADC banks is not significantly affected by the political stability dimension of governance indicators. We suggest that more researchers explore the relationships around banking cost efficiency further, as well as governance indicators of institutional quality.

CHAPTER SEVEN

BANKING EFFICIENCY, BANKING SECTOR DEVELOPMENT AND ECONOMIC GROWTH

7.1 INTRODUCTION

The relationship between cost efficiency and its fundamental bank-specific drivers in the SADC region, explored in the preceding chapter, is further investigated in this chapter. The main objective in this chapter is to examine the role of banking cost efficiency on real growth in the SADC region by evaluating an unbalanced panel of 132 observations.

7.2 ESTIMATION OF THE GMM MODEL

In the construction of the GMM model, GDP *per capita* (GDPP) was used as a dependent variable in estimating three models to capture various drivers of real economic growth: The factors that influence GDPP were classified into two groups: (**1**) banking sector and (**2**) macroeconomic drivers. **Table 7.1** summarises the variable descriptions for the models.

7.2.1 Data Variables and Descriptive Statistics

TABLE 7.1 VARIABLES DESCRIPTION

BANKING SECTOR-SPECIFIC FACTORS		
CE	Bank cost efficiency	*Generated from DEA analysis*
CRED	Credit expansion	*Domestic credit provided by the banking sector (% of GDP)*
DEEP	Financial deepening	*Broad money (% of GDP)*
BIN	Banking inclusion	*Number of bank accounts per 1 000 adults*
MACROECONOMIC FACTORS		
CAP	Capital growth	*Annual growth rate of gross fixed capital formation*
POP	Labour force growth	*Annual growth rate of population*
GOV	Government spending	*General government final consumption (% of GDP)*
INFL	Inflation	*Percentage change in the consumer price index*
TRAD	Trade	*Volume of exports and imports (% of GDP)*

TABLE 7.2: DESCRIPTIVE STATISTICS FOR SECOND-STAGE VARIABLES

VARIABLE	MEAN	MAX	MIN	STD DEV
GDPP	7.55	9.16	5.83	1.14
CE	0.77	0.98	0.17	0.17
CRED	3.12	5.26	-0.51	1.14
BIN	5.51	7.76	2.72	1.21
DEEP	3.55	4.67	2.45	0.53
POP	0.26	0.55	-0.88	0.31
CAP	3.06	3.76	2.17	0.35
GOV	2.84	3.65	2.19	0.34
INFL	1.98	3.31	0.26	0.54
TRAD	4.42	5.03	3.67	0.37

7.2.2 Panel Unit Root Test Results

The Levin, Lin & Chu (LLC) unit root test method, which assumes common unit root process, and the Im, Pesaran & Shin (IPS), which assumes individual unit root process, were employed and the results are reported in **Table 7.3**. Our preferred choice is IPS, on account of its small sample advantage. Contrary to most stationarity tests, the IPS retains its robustness even in small samples.

TABLE 7.3: LLC AND IPS UNIT ROOT TESTS

VARIABLE	IPS		LLC		ORDER
	Statistic	*p-value*	*Statistic*	*p-value*	
GDPP	-2.500***	0.006	-6.023***	0.000	I(1)
CE	-3.893***	0.000	-10.641***	0.000	I(0)
CRED	-3.560***	0.000	-5.261***	0.000	I(0)
BIN	-2.239**	0.013	-4.258***	0.000	I(1)
DEP	-1.769**	0.039	-3.909***	0.000	I(1)
POP	-89.713***	0.000	-227.528***	0.000	I(0)
CAP	-1.807**	0.035	-5.230***	0.000	I(1)
GOV	-5.614***	0.000	-14.078***	0.000	I(1)
INFL	-2.208**	0.014	-5.140***	0.000	I(0)
TRAD	-2.091**	0.018	-4.817***	0.000	I(0)

*[***]/ (**) / * indicates significance at 1%, 5%, and 10% respectively.*

7.3 ESTIMATION, REPORTING AND DISCUSSION OF RESULTS

7.3.1 The Problem of Multi-collinearity

To detect the presence of multicollinearity, we followed the same procedure as in Chapter 6 and performed the pairwise correlation matrix on all the regressor variables. The initial results in **Table 7.4** showed evidence of serious pairwise correlations among two of the governance indicator variables, rule of law (RUL) and government effectiveness (GEF). These highly collinear variables were removed from the analysis.

TABLE 7.4: CORRELATION MATRIX OF REGRESSOR VARIABLES

	BCE	**BIN**	**DEEP**	**CRED**	**GOV**	**POP**	**CAP**	**INFL**	**TRAD**
BCE	1.000								
BIN	-0.413	1.000							
DEEP	-0.521	0.749	1.000						
CRED	-0.427	0.566	0.688	1.000					
GOV	0.212	0.368	0.338	-0.001	1.000				
POP	0.532	-0.670	-0.674	-0.385	-0.152	1.000			
CAP	-0.027	0.121	0.170	0.077	0.110	-0.081	1.000		
INFL	0.193	-0.496	-0.468	-0.396	-0.334	0.482	-0.276	1.000	
TRAD	-0.065	0.360	0.340	-0.050	0.594	-0.475	-0.012	-0.245	1.000

7.3.2 Testing Exogeneity of Regressors

Bascle (2008) defines endogeneity as the correlation of a regressor variable with the error term, a violation of the exogeneity condition required in estimating econometric models. In this sub-section, the exogeneity condition is tested using the Hausman test of correlated random effects. The table of results below indicates that the exogeneity condition is rejected, implying the presence of endogeneity.

TABLE 7.5: HAUSMAN TEST FOR ENDOGENEITY OF REGRESSORS

DIAGNOSIS & NULL HYPOTHESIS	**TESTS**	**P-VALUE**	**INFERENCE**
Hausman *Errors are uncorrelated with regressors.*	*Chi-Squares* Statistic = 37.43	0.000	Reject the null

This diagnostic check outcome therefore suggests the use of an alternative model that handles the problem of endogeneity. We opt for the dynamic GMM approach for the reasons

discussed in Chapter 4. The dynamic GMM is popularly applied in panel data analysis of economic growth models due to its ability to handle the problem of endogeneity that characterises most economic growth models. GMM deals with endogeneity in a better way than most alternative models (Arellano and Bond, 1991). Baum (2003) maintains that among the class of all estimators that do not require any additional information besides that which is contained in the moment conditions, the GMM estimator is the most consistent, asymptotically normal and efficient.

7.3.3 Sargan and Arrellano Bond Serial Correlation tests

Within the GMM framework, the second order serial correlation test known as m^2 and the Sargan test (also known as J-test) for validity of over-identification instruments proposed by Arellano and Bond (1991) are standard diagnostic tools when constructing the model. To proceed with the reporting and discussion of the results, it is critical that our GMM estimation pass these two essential diagnostic tests. Under the null hypothesis that the errors in the GMM specification exhibit no second-order serial correlation, our empirical results indicate a larger *p*-value, greater than 0.05 implying non-rejection. So it means the residuals of the final model are free from second-order serial correlation. A larger Sargan test *p*-value of 0.55 means that the chosen instrument variables are valid.

TABLE 7.6: ARELLANO-BOND SERIAL CORRELATION & SARGAN TEST

DIAGNOSIS & NULL HYPOTHESIS	TESTS	P-VALUE	INFERENCE
Sargan *Over-identification instruments are valid.*	*J*-Statistic = 51.045	0.551	Accept the null
Arellano-Bond serial correlation AR (2): *No serial correlation in the residuals.*	*m*-Statistic = -0.548	0.584	Accept the null

7.3.4 Presentation of GMM Estimation Results

TABLE 7.7 ECONOMIC GROWTH AND BANKING SECTOR EFFICIENCY USING SYSTEM GMM

Dependent variable : Gross Domestic Product per Person (Capita)

Variable	**Coefficients**	**Std Error**	***t*-statistic**	***p-value***
Banking Sector Development				
CE	0.071***	0.026	2.750	0.007
BIN	0.014*	0.007	1.931	0.056
DEEP	-0.057**	0.028	-2.029	0.045
CRED*CE	0.003	0.004	0.882	0.380
Macroeconomic stability				
GDPP(-1)	0.705***	0.052	13.600	0.000
POP	0.145**	0.072	2.009	0.047
CAP	-0.040**	0.018	-2.200	0.030
INFL	-0.020***	0.007	-2.700	0.008
TRAD	0.066*	0.035	1.887	0.062
GOV	-0.016	0.037	-0.422	0.674
Sargan Test (*J*-statistic*)*			**51.045**	***0.551***
AR (2) (*m*-statistic)			**-0.548**	***0.584***

*[***]/ (**) / * indicates significance at 1% (**p < 0.01**), 5% (**p < 0.05**) and 10% (**p < 0.10**) respectively.*

***Note**: C*ost efficiency (CE), banking inclusion (BIN), financial deepening (DEEP), domestic credit provided by the banking sector credit (CRED), gross domestic product per person (GDPP), population growth (POP), general government gross fixed capital formation (CAP), inflation (INFL), merchandise trade (TRAD), government expenditure (GOV).

TABLE 7.8 ECONOMIC GROWTH AND BANKING SECTOR EFFICIENCY: WALD TEST

DIAGNOSIS & NULL HYPOTHESIS	**TESTS**	**P-VALUE**	**INFERENCE**
Joint-significance: *All banking and financial sector variables are equal to zero.* *C(1) = C(2) = C(3) = C(4) = 0*	Wald test: *F-statistic 3.746*	0.0070	Reject the null
	Wald test: *Chi-square 14.983*	0.0047	

7.3.5 Interpretation and Discussion of GMM Estimation Results

This study primarily investigates the extent to which banking sector efficiency and other financial sector development indicators are associated with real economic growth in the SADC economic region. This section discusses the findings of the dynamic GMM estimation output.

7.3.5.1 Banking & Financial Sector Drivers

Bank cost efficiency

Bank cost efficiency (CE), an important quality component of banking sector development, constitutes the main focus of this entire study. CE was generated earlier in the preceding chapter using DEA analysis. In line with our expectations, cost efficiency exerted a significant and positive influence on real economic growth. This means the efficiency with which banks operate has a significant influence on economic growth. A 10% increase in bank cost efficiency has on average a 0.71% positive effect on economic growth. Using the 77% cost efficiency obtained in Chapter 5 for the region, it means SADC banks need to reduce their costs by 23% to attain full cost efficiency. Based on our current findings it therefore implies that the 23% cost efficiency gains that are needed have the potential, if realised, to trigger a set of events that will eventually increase real economic growth by 1.63% for the region. We hypothesise that the possible channels by which banking cost efficiency is expected to influence or contribute to real economic growth is via its direct effect on reduced costs, improved capital productivity and increased volume of capital, leading to increased investment and hence economic growth. This is also consistent with the celebrated Cobb-Douglas production function, which links the output produced in an economy to technology, capital and labour. We also expect efficiency to have a positive effect on growth via its indirect effect on banking inclusion. Here we envisage that the gains in cost reduction which are passed on to the general public, in particular the previously disadvantaged, make the accessing of banking services affordable.

Banking inclusion

With regard to banking inclusion, evidence in the estimated model suggests that inclusive banking is growth-augmenting. For instance, a 10% increase in banking penetration has a 0.13% positive association with economic growth for countries in the SADC. This finding

is consistent with those of Sharma (2016) who found that for India, the availability of banking services, banking penetration, and the use of baking services had a positive effect on growth. Other studies that found a positive correlation between financial inclusion and growth include studies in East and West Africa [Oruo (2013), Babajide *et al* (2015), and Onaolapo (2015)]. We postulate that our earlier positive influence of banking cost efficiency on growth is via the channel of banking inclusion (inclusive banking). Banking inclusion, which is a subset or dimension of financial inclusion, is the delivery of and affordable and wide range of financial services to the marginalised and low-income segments of society. We emphasise banking inclusion rather than financial inclusion because, as Hawkins (2010) argues, a bank account is crucial since it provides the needed gateway to a multitude of financial services. So we argue that if anyone has any financial product at all, it must be a bank account. In the light of our empirical findings, we recommend to policy-makers that they reform banking policies so that they promote sustainable and inclusive banking. This will lead to an expansion of financial services that are affordable and wider in choice, with product features that cater to the needs of the low-income segment of SADC countries.

Financial deepening

It is important to recall that financial deepening is a multi-dimensional and somewhat of a complex variable which in applied research is measured with different proxy indicators. In this present study we measure it using the ratio of growth of broad money to GDP in keeping with celebrated studies [King and Levine (1993); McKinnon (1973); and Shaw (1973)]. Contrary to our earlier expectations, our estimated model showed evidence of a strong and negative influence of financial deepening on real economic growth. Samolyk (1994) also found similar evidence of a negative link between financial sector deepening and economic growth for Turkey for the period 1986-'98. Similarly, the evidence in the paper by Thornton (1994) failed to support the long-run equilibrium relationship between financial sector deepening and economic growth. Ardic and Damar (2006) used the ratio of bank deposits to GDP to measure the degree of financial deepening and found a positive and significant association. Darat (1994, p32), using different proxy indicators of financial deepening, concluded that financial deepening is a necessary causal factor of economic growth, but that its effect varies across countries and across the proxies used to measure the degree of financial deepening. The author argues that the effect of financial deepening on growth should not be "too surprising as [different] countries exhibit diverse economic environments, and the proxy variables used address different aspects of their financial maturity".

In line with the views of Rousseau and Wachtel (2007), we postulate that excessive rapid growth of credit due to financial deepening may potentially lead to inflation, so weakening the banking system and inhibiting growth in the process. In addition, we add a note of caution, as the World Bank (1989) argues that financial deepening contributes to economic growth by enhancing the productivity of investment, provided financial intermediaries are good at selecting viable projects.

Credit finance provided by the financial sector Bank cost efficiency*

To refrain from merely assessing the effect of credit expansion alone, a qualitative variable was incorporated. We interacted the volume (*quantity*) of domestic credit provided by the financial sector with banking cost efficiency (*quality*) to capture the effect of efficient allocation of credit. The evidence in the estimated model revealed that efficient allocation of credit to the economy exerts a positive influence on growth. However, the variable entered the model as insignificant. Overall, the results of the Wald coefficient restriction procedure in **Table 7.8** suggest that all four indicators of banking and financial sector development that were captured in the GMM model are jointly significant drivers of economic growth.

7.3.5.2 Macroeconomic Drivers

Lagged dependent variable

The literature states that to guarantee convergence to equilibrium, the persistence term must be between 0 and 1. Our findings, as shown in **Table 7.7**, are in keeping with this precondition for convergence. However, some researchers consider this variable to be merely a mathematical strategy for eliminating autocorrelation in the residuals when modelling dynamic data generating processes.

Growth of labour force

In line with classical and endogenous theories of growth, the labour growth variable exerts a significant and positive effect on real growth in SADC region. The estimated positive and significant marginal coefficient obtained for the variable implies that a 1% population growth, as a proxy for labour, induces real economic growth to increase by an average 0.15%.

Growth of gross capital fixed formation

The reported negative effect of public gross fixed capital formation runs contrary to our earlier expectation of a positive relationship between capital formation and real growth. We argue that for the 12 selected SADC countries under study, public gross fixed capital formation seems to be crowding out private capital formation.

Trade

In line with the endogenous growth theory, our GMM results indicated a positive and significant effect of expanding trade on real growth in the region. While these results contrast with the findings of the study by Rodrik *et al* (2004), it is consistent with those of Huchet-Bourdon *et al* (2017); Becks and Levine (2001); and Dollar and Kraay (2001). Huchet-Bourdon *et al* (2017) found that for developing countries, the higher the variety of the export basket, the higher the effect of trade on growth. The authors argue further that trade may have a detrimental effect on growth when countries specialise in low-quality products. Hence, the greater the quality of the export basket, the greater the influence of trade on economic growth.

Government consumption

The available literature regarding government expenditure and economic growth is mixed. While the general expectation is a positive effect on growth, some studies [Hasnul (2015); Ghura (1995); and Barro (1989)] found a negative link. Government expenditure exerts a positive influence on economic growth, especially when the expenditure is targeted towards worthwhile and productive investments. However, the evidence in this study contradicts this particular hypothesis. Mensah *et al* (2013) argue that government expenditure interventions may actually affect the economy negatively through their crowding-out effect on the private sector. Interestingly, one study by Yasin (2000) investigated 26 sub-Saharan countries and found that for the period 1987-'97, the relationship between government spending and economic growth was positive and significant. Butkiewicz and Yanikkaya (2011) suggest that developing countries should limit their government consumption spending and instead invest in infrastructure to stimulate growth.

Inflation

In line with our earlier hypothesis, inflation entered the estimated model negative and significant at 1%. The estimated slope coefficient means that a 10% acceleration in inflation has the potential to decelerate economic growth by an average 0.2%. This is in line with the

study by Kablan (2010), which found inflation to be destabilising to the financial system, so having a negative influence on real growth. The channel of this inflation`s negative influence may be by way of its effect on real returns and on the reduced volume of credit. We therefore conclude that price stability is a necessary pre-condition for economic growth.

7.4 CONCLUSION AND RECOMMENDATIONS

Using the dynamic GMM estimation technique, this study investigated the banking efficiency-growth nexus of the SADC economic bloc for the period 2005-'15 using country-level data from 12 selected countries. The findings of the GMM provide evidence of a strong and positive link between banking cost efficiency and real economic growth within the SADC region. The Wald coefficient restriction diagnostic tests confirmed that all four indicators of banking and financial sector development that were captured in the GMM model are jointly significant drivers of economic growth. So this study submits that economic growth in the SADC region is inextricably intertwined with the efficiency with which banks operate and the nature of banking and financial sector development.

These results have important implications for bank managers, bank regulators, policymakers, and other stakeholders. We highlight considerable scope for improvement at various levels of the economic structure. Within the banking space, bank managers need to monitor their operational costs and control various internal risks when carrying out their day-to-day business activities; bank supervisors and regulators need to balance prudential regulation and over-regulation so as to foster stability in the banking system; and policymakers need to preserve a healthy external macroeconomic and institutional environment in which banking can thrive to influence growth positively. The results highlight the need for banking systems in Southern Africa to aspire to and maintain high levels of cost efficiency so as to augment government efforts to increase economic growth.

CHAPTER EIGHT

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

8.1 INTRODUCTION

The primary objective of this study was to undertake an in-depth evaluation of the cost efficiency of banking institutions of the SADC region, study their multi-faceted drivers and investigate their influence together with other banking development indicators on real economic growth. The primary motivation for this study emanated from the existing economic outlook for the Southern Africa, which is summarised in the following problem statement:

The economic outlook for Southern Africa is currently characterised by "weak economic growth and expensive credit", with the growth indicators of all member states below the regional target of 7% (African Economic Outlook, 2018, p9) and banking inclusion stagnant at 70% (The Global Findex database, 2017).

This study addressed four distinct objectives by implementing a three-stage analytical framework for determining banking cost efficiency levels; exploring cost efficiency drivers and investigating the banking efficiency-growth nexus. The four objectives are summarised in chronological order: (***1***) to measure cost efficiency measures of banking institutions in the SADC countries using the revised non-parametric data envelopment analysis (DEA) and attempt to discuss the variations across countries and across the time horizon of the study; (***2***) to determine whether there were any significant variations in cost efficiency behaviour among African banks in the region between the pre-crisis and post-crisis periods; (***3***) to explore the significance and nature of the relationship of environmental factors that drive the cost efficiency of African banks in the region. This exploration was done within the framework of factors that are internal or specific to each bank (which bank managers may influence) and those factors external to a given bank, such as the environment in which the bank carries out its business activities (beyond the influence of bank managers); and (***4***) to establish the nature of the relationship between banking cost efficiency, banking development and economic growth.

8.2 SUMMARY

This particular chapter provides a synopsis of the main highlights of each chapter, summarises the key findings as presented in the three empirical chapters and providing policy recommendations emanating from them. We then present the main contributions in this study. In the last section, we conclude by pointing out the limitations of the study and potential avenues for future studies in the area of banking efficiency, financial sector development and economic growth. This entire thesis, which is explicitly demarcated into eight distinct chapters according to various themes in the study, is summarised as follows.

In *Chapter 1* we motivated the rationale of the study, issuing a call to increase the cost efficiency of banks in the SADC region as a means to enhance financial inclusion at both household and business level. We underlined that cost inefficiency constrains access to cheaper and affordable finance, making worthwhile investment appear unprofitable, so slowing economic growth. We also highlighted the problem statement, main objective, sub-objectives, hypotheses and the main contributions.

Chapter 2 presented a comprehensive discussion of economic developments of the SADC region by reviewing the progress made so far regarding banking development indicators and that of the broader financial sector in general. We followed various key developments in the region that are pertinent to the present study. We studied financial deepening, financial inclusion, financial stability, cost and intermediation efficiency, banking industry profitability, diversification, market concentration and banking ownership structure. This section also captured the macroeconomic environments of the SADC region by reviewing performance indicators of economic growth and inflation outlook.

In *Chapter 3* we reviewed the theoretical literature underpinning efficiency from the cost and production frontier perspective. Different concepts of efficiency were discussed: technical efficiency, allocative efficiency, scale efficiency, economic efficiency, and cost and profit efficiency. Efficiency measurement approaches of parametric and non-parametric natures were also explored. Among parametric approaches we reviewed the distribution frontier approach (DFA), the thick frontier approach (TFA) and the stochastic frontier approach (SFA), while the free disposal hull (FDH) and the development envelopment analysis (DEA) were among the non-parametric techniques studied. Under empirical literature we further

reviewed existing and related empirical studies in Africa and globally on the subject of banking efficiency, their environmental factors and their linkage with economic growth. Research gaps were identified in the process.

In *Chapter 4* we pinpointed the philosophy underpinning this study. We also explained and motivated for the two-stage methodological framework that includes the deterministic DEA technique used in the first stage and the dynamic panel data techniques used in the second stage analysis. Various diagnostic tests performed to establish the validity of the models used were also discussed in this chapter. The variables, data sources and software packages used in this study were also discussed.

In *Chapter 5* the study sought to evaluate the cost efficiency measures of banking institutions of the SADC economic bloc. The purpose was to measure the level of cost efficiency with which labour, capital, deposits, borrowings and other funding were used to produce loans, interest and non-interest revenues. To execute this task, the non-parametric variable returns to scale (VRS) cost *minimisation* and input-orientation DEA approach was applied to 693 data observations of 12 selected SADC countries for the period 2005-'15. After generating cost efficiency measures, we extended our analysis further and applied the non-parametric Wilcoxon matched-pairs signed ranks tests of equality of means to pre- and post-crisis efficiency scores.

In *Chapter 6* we provoke an inquiry into the nature of the influence of various internal and external environmental factors driving cost efficiency in the SADC region. On account of the nature of the dependant variable that characterises efficiency scores, we motivated for the dynamic panel Tobit estimation approach. For robustness check and in line with various celebrated efficiency studies of second-stage enquiry, we reported the panel least squares estimation output results. Before reporting results, we performed various diagnostics checks.

Lastly, in *Chapter 7* we applied the GMM estimation technique to shed light on the nature of the linkage between bank cost efficiency, other banking sector development indicators and real economic growth. The other banking development proxy indicators that were analysed in this study includes; banking inclusion, financial deepening, and an interaction dummy of bank efficiency and volume of credit provided by the banking sector. The reason for choosing the GMM technique over other options was motivated by the need to address possible endogeneity problems (or violations of the exogeneity condition among regressors)

which is common in most growth models. However, to be absolutely certain that endogeneity was present in the model, we performed the Hausman test of correlated random effects. The test confirmed the presence of the endogeneity problem, which confirmed our pre-selection of the GMM model. We also performed the Arellano-Bond serial correlation test and the Sargan validity tests of over-identification instruments. Having confirmed the fitness of the model, we proceeded to report results. The next section summarises the key findings of the three empirical chapters.

8.3 KEY FINDINGS

The results indicate the following. Firstly, an e***valuation of banking cost efficiency in the SADC region*** revealed that regional performance is at 77%, with Namibia representing the best practice with the most efficient banking sector, while Mauritius is the least efficient. The findings of the Wilcoxon signed ranks test led to the conclusion that there was a significant difference between the cost efficiency performance of SADC banks, both before the global financial crisis and since the crisis. The pre-crisis efficiency measures were found to be significantly lower than those of the post-crisis period by 7.6%, implying that SADC banks have become increasingly more efficient over time. However, further examination of results showed wider variability of efficiency scores in Angola, Botswana, Madagascar, Mauritius, Mozambique, South Africa and Zambia, highlighting greater scope for improvement in these countries.

Among the e***nvironmental factors that influence banking cost efficiency***, we found that bank cost efficiency is significantly and positively influenced by increased intermediation efficiency, high profitability, foreign ownership, and a stable macroeconomic environment of high growth, while negative influencers include low liquidity risk, poor asset quality or high credit risk, and increased systemic risk. The study also revealed that banking efficiency in the region is positively and significantly affected by political instability. Besides being statistically insignificant, we found large banks and highly diversified banks to be relatively more cost-efficient. Moreover, our results showed that high capital regulation in the banking industry inhibits cost efficiency, however its effect turned out to be statistically insignificant.

On the c***ausal effect of bank cost efficiency and banking sector development on economic growth,*** the study has found a positive and significant link between banking cost efficiency, banking inclusion and real economic growth in the region, with financial deepening exerting

a negative effect. We therefore submit that economic growth in the SADC region is inextricably intertwined with the efficiency with which banks operate and the nature of banking and financial development in the economy. Although it is insignificant, we found the outcome of interacting the volume of credit provided by the banks and the level of cost efficiency to be positively associated with economic growth.

8.4 MAIN CONTRIBUTIONS

This study has made significant contributions in several ways. First, this study focused on the SADC, a region that has not received much attention with regard to banking efficiency studies. Numerous studies on bank efficiency and banking sector development are relatively limited with regard to Africa, since most such studies concentrated in advanced economies, in particular the US and Europe. Kiyota (2011) cites lack of quality data, small numbers of banking institutions and the low level of financial development among other reasons why there have been so few bank efficiency studies in Africa. We are the first, to our knowledge, to have simultaneously explored the trio of banking cost efficiency, banking sector development and economic growth in the SADC region using recent and uniformly reported Bankscope data. In particular, the study has contributed to African banking literature by exploring the role in the economic growth of banking sector developmental and institutional factors such as financial inclusion, volume of credit to the private sector, good governance and political stability.

Secondly, many studies have looked at the influence of volume (quantity) of credit alone on economic growth. To refrain from merely assessing the effect of credit expansion alone, this study contributed by incorporating a quality component variable into our analysis by interacting credit volume with cost efficiency to capture "efficient credit allocation". In addition, we have extended many basic studies of finance and growth by integrating into our inquiry a banking inclusion variable. So this study has contributed to African literature in that we explored and recommended banking based strategies for economic growth expansion.

Thirdly, we made a methodological contribution to the empirical analysis of efficiency measurement by using the revised DEA technique an upgraded extension of the traditional DEA. We think that our approach has been more insightful, particularly when we make comparative analyses with earlier studies that have used simplistic ratio analysis. Moreover, we systematically and simultaneously examined the issues in this study by using a network

of connected and distinct analytical approaches which formed a logical and integrated unit in an approach that has not previously been attempted.

Fourthly, due to the timing of our study we made contributions to studies of systemic risk in the African context when we exploited the seven-year period since the onset of the 2008 US financial crisis. We evaluated cost efficiency variations of African banking institutions between the pre- and the post-crisis periods. Such an empirical exercise could not have been performed robustly without a reasonably long time period to allow for sufficient degrees of freedom.

8.5 POLICY IMPLICATIONS

The findings of the DEA analysis in the first stage evaluation of cost efficiency for the SADC banking sector provides a number of policy implications: Overall, we found Namibia to be the most efficient banking system, in keeping with one independent DEA study (Desta, 2016) which showed that Bank Windhoek Ltd of Namibia was the most productive out of the 30 best African commercial banks evaluated. So we urge all bank managers, supervisors, and policy-makers in the region to emulate and learn best practices from Namibia.

For bank managers seeking to improve the performance of their banks, it is important that individual banks must re-examine their business models and evaluate the one that optimises their costs. Depending on the size of a bank, a low performing retail bank may consider refocussing and rather specialise in wholesale banking or provide an assortment of both. Generally, small banks operate retail banking targeted at the general public, while relatively large banks focus on wholesale banking for their corporate clients.

In the light of the results obtained regarding environmental factors that influence banking cost efficiency, we recommend a number of policy guidelines emanating from our empirical findings: We recommend regular and close monitoring of bank credit and risk management processes to reduce bad loans – loan defaults and late loan payments. In the light of the empirical evidence of a positive and significant link between greater intermediation efficiency and cost efficiency, bank managers need to focus on pursuing aggressive lending functions and other traditional business ventures, as opposed to off-balance sheet undertakings. This afore-stated recommendation is further supported by the insignificant relationship between income diversification and cost efficiency. Furthermore, the empirical evidence in this study provides support for the role of banking liquidity on cost efficiency. However, the

negative influence of increased liquidity on cost efficiency necessitates urgent policy responses. We hypothesise this to be classic case of the negative effect of over-regulation in the region. A balance of de-regulation and optimum risk management has the potential to reduce bank costs and improve efficiency. So we recommend fine and balanced tuning of policies that help bank managers to optimise the high opportunity cost that escalates from holding *excessive* liquidity and the benefit of low systemic risk that arises from holding *sufficient* liquidity.

Following empirical evidence that cost-efficient banks in the SADC are also the most profitable banks, we call on bank managers to reinforce their profit maximisation goals. When banks pursue their traditional profit maximisation goal, as hypothesised by the theory of a firm, they carefully price (*to ensure that their marginal cost is identical to their perceived marginal revenue*) their product offerings relative to their rivals. This then allows them to penetrate difficult markets and gain a larger market share, thereby maximising profits.

We found that foreign-owned or -controlled banks tend to be cost-efficient relative to their domestic counterparts. This underlines the necessity of promoting a healthy level of foreign competition in host countries of the SADC economic bloc by relaxing barriers to entry which will encourage an influx of foreign-controlled banking corporations. However, we caution policy-makers and bank supervisors to guard against possible external shocks which may simultaneously be introduced into the domestic economy by reason of the entrance of foreign bank participation.

Empirical evidence in this study also showed that macroeconomic stability characterised by high growth contributes strongly towards greater efficiency. Despite being statistically insignificant, we do however caution that high inflationary environments retard cost efficiency. So there is a need for government effectiveness and macroeconomic stabilisation policies that ensure high economic growth and stable inflation.

In view of our findings that the US financial crisis significantly and negatively affected banking efficiency in the SADC region, we caution the need for policy-makers to implement prudential regulations and bank supervision to ensure that systemic risk is low, so as to minimise the likelihood of another financial crisis occurring.

With regard to our findings of a negative and significant influence of political stability on cost efficiency, we recommend caution regarding the policy implications of such an outcome. So we cast doubt on the reliability of the political stability index data obtained from World Governance Indicators. This is particularly concerning, especially when our findings are congruent with those of Mensah *et al* (2013), who also found governance variables such as rule of law, government effectiveness and economic freedom to be related negatively to economic growth in 33 African countries.

Based on the observation and discussion of this study regarding the nexus between efficiency, banking sector development and economic growth, we make the following recommendations: Generally, to promote high economic growth, economic policies should aim at enhancing banking efficiency, minimising financial deepening (in the form of broad money growth) and allowing wider banking inclusion. Government and other policy stakeholders need to enlarge their support for initiatives that are aimed at developing the banking sector in terms of cost efficiency and inclusivity. Reducing banking exclusion and moving towards providing wider access to a larger population expands the customer base, resulting in increased growth in the economy. The other channel of influence is possibly through realising economies of scale on account of increased demand for banking services.

In the light of the negative effect of financial deepening, we caution against excessive rapid growth of credit in the SADC region which, evidence suggests, exerts a downside influence on growth. We implore policy-makers to focus on preventing the apparently downside inflationary pressures of financial deepening that are seemingly reversing the usual positive transmission effect to growth.

8.6 LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

There are limitations and directions in which this study can be extended by future studies. Although the thesis has made several important contributions, we acknowledge a few limitations and drawbacks. As pointed out in the methodology discussion, lack of consistent data in some periods of analysis for Zimbabwe and non-subscription to the Bankscope database by the Seychelles and the DRC made it impossible to carry out a complete SADC study.
This study focuses on only one type of efficiency: cost efficiency. There is a growing interest among researchers to explore profit efficiency as it takes into account the revenue and cost effects of the choices of firm managers. Many studies [Akhavein *et al* (1996), Maudos *et al* (1999), and Harker and Zenios (2000)] have argued that profit efficiency is a superior,

broader and more inclusive concept than cost efficiency. Harker and Zenios (2000) argue that the idea of profit efficiency is founded on the economic goal of most firms: profit maximisation. For that reason it is considered a better approach for assessing the overall performance of a firm than cost efficiency. On that note, further research may attempt to investigate this type of efficiency for developing countries.

Our study uncovered that the cost efficiency of SADC banks is positively and significantly affected by political instability. We suggest that more researchers explore the relationship between banking cost efficiency further, as well as governance indicators of institutional quality using a wider cross-section and time dimension data set.

Lastly, future studies may also be extended to explore bank cost efficiency dynamics for countries with a common monetary union (CMA) such as SACU countries.

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APPENDICES

APPENDIX 1A: DESCRIPTIVE STATISTICS OF THE DATA: *ANGOLA*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	41527	7592	8038	0.183	0.070	2.463	2652	3264	96189	0.813	2.074	0.024
	6234	534	714	0.086	0.021	0.918	345	777	3932	0.443	0.794	0.170
	2455	56	294	0.023	0.005	0.510	248	577	12296	0.430	1.230	0.023
	4388	2160	772	0.492	0.120	1.049	697	736	13578	0.947	0.998	0.018
	2531	648	605	0.256	0.103	2.029	139	298	4262	0.466	2.153	0.099
	24112	3725	2073	0.154	0.046	0.378	1163	5480	80465	0.212	0.582	0.021
2006	69545	8733	9140	0.126	0.054	1.544	2018	5921	146007	0.341	1.148	0.011
	42775	2768	3366	0.065	0.032	1.783	1146	1887	26790	0.607	1.338	0.058
	4514	422	311	0.094	0.032	0.311	377	999	13367	0.378	1.143	0.021
	7654	1499	1015	0.196	0.063	0.967	715	1050	20033	0.680	0.733	0.013
	4476	482	727	0.108	0.066	1.847	181	393	7632	0.460	1.531	0.023
	35272	4346	1627	0.123	0.028	0.282	1508	5773	133907	0.261	0.633	0.019
2007	110799	13121	10423	0.118	0.059	1.200	2654	8687	157562	0.305	1.057	0.023
	92186	6783	5098	0.074	0.047	1.456	2334	3501	120365	0.667	1.294	0.027
	9175	1193	1084	0.130	0.044	0.896	523	1210	22736	0.432	1.284	0.028
	11689	1996	1243	0.171	0.068	0.908	512	1368	25187	0.375	0.698	0.015
	7939	857	997	0.108	0.065	1.494	313	668	9905	0.469	1.305	0.025
	63832	8716	6434	0.137	0.039	0.824	1661	7807	212930	0.213	0.529	0.012
2008	135918	17996	12321	0.132	0.043	1.227	3519	10045	228968	0.350	0.981	0.042
	126167	13936	9271	0.110	0.048	1.756	3711	5279	209298	0.703	1.384	0.039
	14064	3121	1545	0.222	0.045	0.852	758	1814	45274	0.418	1.269	0.054
	14855	2352	1457	0.158	0.061	0.725	627	2010	26932	0.312	0.590	0.026
	13199	1474	1656	0.112	0.059	1.104	503	1500	20835	0.336	0.867	0.021

	133371	14109	10016	0.106	0.030	0.793	2638	12624	375929	0.209	0.541	0.018
2009	164835	18029	19219	0.109	0.045	1.489	4739	12908	455385	0.367	0.780	0.025
	172734	16189	14837	0.094	0.054	2.181	4275	6804	303920	0.628	1.168	0.038
	23235	2845	4429	0.122	0.039	1.679	1207	2637	87504	0.458	1.389	0.048
	16757	2099	5214	0.125	0.042	1.970	813	2647	42859	0.307	0.621	0.014
	19839	1758	2368	0.089	0.067	2.925	795	810	25670	0.982	2.371	0.028
	285427	24072	17362	0.084	0.042	0.760	4090	22859	593635	0.179	0.390	0.019
2010	155565	25123	13879	0.161	0.053	0.970	6079	14313	515686	0.425	0.863	0.032
	190514	15701	10848	0.082	0.044	1.295	5757	8379	347964	0.687	1.195	0.051
	30765	4328	4648	0.141	0.058	2.420	2006	1921	108479	1.044	3.205	0.055
	19695	3801	4838	0.193	0.064	0.851	1284	5682	65901	0.226	0.657	0.030
	20869	1573	1554	0.075	0.054	1.280	1047	1214	34659	0.863	2.222	0.043
	250552	35164	15382	0.140	0.069	0.902	6566	17048	558603	0.385	0.957	0.033
2011	135384	25261	13467	0.187	0.048	0.853	6937	15795	589014	0.439	0.896	0.026
	200463	17813	12953	0.089	0.043	1.338	6586	9683	419608	0.680	1.189	0.045
	34791	5761	4762	0.166	0.062	1.290	3094	3693	118433	0.838	2.188	0.029
	26731	3130	7757	0.117	0.041	1.128	1902	6878	88712	0.277	0.691	0.034
	26677	2319	2136	0.087	0.057	1.173	1209	1822	50894	0.664	1.684	0.035
	310091	28810	22208	0.093	0.032	1.097	7232	20250	996148	0.357	0.924	0.021
2012	145989	21705	14991	0.149	0.036	0.898	7584	16688	668113	0.454	0.901	0.016
	247698	23671	12200	0.096	0.045	1.159	7147	10523	525785	0.679	1.279	0.027
	53196	6700	7293	0.126	0.054	1.422	3236	5130	154469	0.631	1.787	0.018
	52509	4445	8767	0.085	0.043	1.309	2132	6699	112668	0.318	0.652	0.019
	31011	3423	3302	0.110	0.055	0.798	1770	4137	70630	0.428	0.975	0.022
	285350	30848	24990	0.108	0.043	0.770	8704	32439	815204	0.268	0.652	0.022
2013	153354	24497	18097	0.160	0.035	1.057	7996	17128	763025	0.467	0.963	0.014
	223214	26257	19287	0.118	0.043	1.686	8631	11439	615478	0.755	1.956	0.021
	75644	9386	7969	0.124	0.065	0.729	3801	10930	182475	0.348	1.034	0.018
	45369	5940	8871	0.131	0.045	1.292	2840	6865	132395	0.414	0.777	0.014
	40708	4658	3698	0.114	0.063	0.811	1787	4561	83049	0.392	1.003	0.020

	275341	34177	22607	0.124	0.044	0.625	8881	36177	902936	0.245	0.607	0.015
2014	239227	30729	23075	0.128	0.037	1.303	8590	17708	933050	0.485	1.071	0.015
	278800	31982	30746	0.115	0.047	2.775	9836	11081	685388	0.888	3.129	0.022
	92915	8283	16718	0.089	0.040	0.961	4443	17392	236280	0.255	0.823	0.016
	62823	7997	9608	0.127	0.049	1.306	3112	7360	179764	0.423	0.875	0.013
	48020	5290	4127	0.110	0.059	0.831	2312	4968	99052	0.465	1.272	0.015
	392669	37014	21821	0.094	0.045	0.522	9758	41776	950917	0.234	0.616	0.014
2015	235382	41022	28127	0.174	0.049	1.476	11113	19050	1017160	0.583	1.247	0.015
	290755	31982	29076	0.110	0.040	2.430	10438	11963	741627	0.873	2.898	0.021
	100614	8283	7849	0.082	0.036	0.451	5085	17392	277052	0.292	0.823	0.015
	86052	16925	2381	0.197	0.080	0.323	3859	7379	236953	0.523	1.135	0.019
	60497	6510	7376	0.108	0.067	1.440	2958	5122	96998	0.577	1.638	0.013
	390389	43194	29040	0.111	0.053	0.629	11601	46153	938494	0.251	0.592	0.013
MEAN	***105623***	***12384***	***9547***	***0.129***	***0.050***	***1.211***	***3700***	***9228***	***285400***	***0.483***	***1.186***	***0.028***
STDV	***105307***	***12020***	***8409***	***0.060***	***0.017***	***0.586***	***3200***	***9726***	***307324***	***0.214***	***0.616***	***0.023***
MAX	***392669***	***43194***	***30746***	***0.492***	***0.120***	***2.925***	***11601***	***46153***	***1017160***	***1.044***	***3.205***	***0.170***
MIN	***2455***	***56***	***294***	***0.023***	***0.005***	***0.282***	***139***	***298***	***3932***	***0.179***	***0.390***	***0.011***

APPENDIX 1B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *ANGOLA*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	*Banco de Fome*	0.740	***Mean***	**0.563**
	Banco BIC	0.424		
	Banco Sol	0.335		
	BCGT de A	0.467		
	Keve SARL-Banco	1.000		
	Banco Angolano	0.413		
2006	*Banco de Fome*	1.000	***Mean***	**0.654**
	Banco BIC	0.721		
	Banco Sol	0.384		
	BCGT de A	0.436		
	Keve SARL-Banco	0.851		
	Banco Angolano	0.530		
2007	*Banco de Fome*	1.000	***Mean***	**0.811**
	Banco BIC	0.702		
	Banco Sol	0.760		
	BCGT de A	0.727		
	Keve SARL-Banco	0.783		
	Banco Angolano	0.893		
2008	*Banco de Fome*	1.000	***Mean***	**0.815**
	Banco BIC	0.850		
	Banco Sol	0.711		
	BCGT de A	0.670		
	Keve SARL-Banco	0.757		
	Banco Angolano	0.902		
2009	*Banco de Fome*	0.851	***Mean***	**0.853**
	Banco BIC	0.878		
	Banco Sol	0.861		
	BCGT de A	1.000		
	Keve SARL-Banco	0.700		
	Banco Angolano	0.826		
2010	*Banco de Fome*	0.872	***Mean***	**0.784**
	Banco BIC	0.730		
	Banco Sol	0.771		
	BCGT de A	0.824		
	Keve SARL-Banco	0.509		
	Banco Angolano	1.000		

2011	*Banco de Fome*	0.782	***Mean***	**0.760**
	Banco BIC	0.761		
	Banco Sol	0.568		
	BCGT de A	0.835		
	Keve SARL-Banco	0.613		
	Banco Angolano	1.000		
2012	*Banco de Fome*	0.816	***Mean***	**0.821**
	Banco BIC	0.841		
	Banco Sol	0.767		
	BCGT de A	1.000		
	Keve SARL-Banco	0.615		
	Banco Angolano	0.890		
2013	*Banco de Fome*	0.955	***Mean***	**0.888**
	Banco BIC	1.000		
	Banco Sol	0.742		
	BCGT de A	0.943		
	Keve SARL-Banco	0.782		
	Banco Angolano	0.904		
2014	*Banco de Fome*	0.856	***Mean***	**0.762**
	Banco BIC	1.000		
	Banco Sol	0.716		
	BCGT de A	0.788		
	Keve SARL-Banco	0.557		
	Banco Angolano	0.656		
2015	*Banco de Fome*	0.951	***Mean***	**0.780**
	Banco BIC	1.000		
	Banco Sol	0.549		
	BCGT de A	0.642		
	Keve SARL-Banco	0.768		
	Banco Angolano	0.769		

APPENDIX 2A: DESCRIPTIVE STATISTICS OF THE DATA: *BOTSWANA*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	2562.7	244.6	160.3	0.095	0.080	4.263	79.2	37.6	2430.2	2.106	4.037	0.092
	729.1	170	164.5	0.233	0.094	5.157	109.3	31.9	1288.5	3.426	8.194	0.209
	2173.9	291.2	162.3	0.134	0.065	4.109	90.1	39.5	4031.7	2.281	4.661	0.060
	12	0.3	1.9	0.025	0.010	0.633	0.55	3	2	0.183	0.333	0.050
	620.3	56.9	13.4	0.092	0.071	0.453	18.8	29.6	177.4	0.635	1.287	0.263
2006	2795	288.3	196.2	0.103	0.042	4.980	86.7	39.4	5881.8	2.201	4.246	0.050
	1019.7	155.5	209.2	0.152	0.066	3.867	95.8	54.1	1317.1	1.771	4.307	0.242
	2811.2	373.6	183.9	0.133	0.054	4.970	105.9	37	6655.4	2.862	5.770	0.083
	22.5	4.9	0.3	0.218	0.081	0.094	3.1	3.2	12.5	0.969	1.938	0.008
	804.7	69.1	15.1	0.086	0.062	0.455	32	33.2	193.1	0.964	1.828	0.341
2007	3142.9	347.8	243.6	0.111	0.045	3.854	109.7	63.2	6744.6	1.736	3.245	0.097
	1363	92.3	135	0.068	0.033	2.184	100.1	61.8	1784.9	1.620	1.545	0.166
	3164.7	449.9	183.6	0.142	0.062	5.615	121.6	32.7	6760.8	3.719	7.813	0.105
	204.3	19.1	1.7	0.093	0.079	0.425	8.2	4	189	2.050	4.800	0.062
	975.3	95.8	14.4	0.098	0.077	0.451	21.2	31.9	217.9	0.665	1.502	0.374
2008	4033.8	400.3	347.6	0.099	0.042	4.307	136.9	80.7	9763.6	1.696	3.458	0.079
	2369	187.7	212.9	0.079	0.060	0.982	126.9	216.9	2343.1	0.585	1.092	0.116
	3198.6	545.5	195.9	0.171	0.064	5.813	156.3	33.7	7977.7	4.638	9.588	0.082
	447.4	49.6	6.5	0.111	0.087	0.670	16.5	9.7	527.4	1.701	4.856	0.077
	1102.5	105.5	15.5	0.096	0.074	0.356	25.8	43.5	242.5	0.593	1.310	0.366
2009	4721.5	523	370.2	0.111	0.049	3.202	161	115.6	10552.7	1.393	2.740	0.073
	2129.6	178.9	199.3	0.084	0.059	0.714	178	279	2932.2	0.638	1.311	0.110
	3588.6	496.9	243.6	0.138	0.064	7.987	152.2	30.5	7262	4.990	12.449	0.059
	720.8	61.6	11.1	0.085	0.064	0.910	30.4	12.2	899.6	2.492	4.566	0.096
	1299.6	116.3	18.5	0.089	0.068	0.320	30.6	57.9	279.6	0.528	1.111	0.384

2010	5803	543.6	408.3	0.094	0.051	2.180	180.5	187.3	10304.6	0.964	1.990	0.050
	3216.6	298	263.5	0.093	0.068	0.798	225.4	330.2	4288.7	0.683	1.318	0.082
	3546.8	483.8	234.7	0.136	0.049	9.658	151.6	24.3	9211.5	6.239	16.897	0.036
	964.8	69.4	15.6	0.072	0.051	0.975	35	16	1286.2	2.188	4.469	0.062
	1467.9	122.8	19.2	0.084	0.069	0.325	34.4	59	290.9	0.583	1.164	0.351
2011	7286.2	661.8	504.5	0.091	0.060	2.495	226.1	202.2	10597.4	1.118	2.294	0.041
	6295	412.5	325.9	0.066	0.058	0.633	276.8	514.9	6817.5	0.538	1.060	0.060
	4182.4	511.4	355.1	0.122	0.061	12.592	164.5	28.2	8074.1	5.833	16.262	0.041
	1551.2	91.8	20.6	0.059	0.045	1.280	45.5	16.1	1899.8	2.826	5.466	0.053
	1695.5	123.5	16.5	0.073	0.063	0.212	40.2	77.8	290.4	0.517	1.008	0.337
2012	8602.8	769.1	626.7	0.089	0.069	1.973	265.4	317.6	11443.3	0.836	1.653	0.030
	9460.3	679.6	545.1	0.072	0.065	0.827	397.8	658.8	9607.4	0.604	1.319	0.074
	5092.5	577.3	326.5	0.113	0.069	8.022	202.6	40.7	7299.1	4.978	13.074	0.024
	1988.4	112.9	23.9	0.057	0.048	1.207	53.4	19.8	2246.7	2.697	5.162	0.055
	2005.8	125.4	28.2	0.063	0.054	0.294	45.5	95.9	438.9	0.474	0.855	0.255
2013	10565.7	897.4	743.6	0.085	0.071	1.481	305.7	502.1	12932.8	0.609	1.205	0.024
	11166.1	1015.6	686.8	0.091	0.083	0.908	460.8	756.8	10787.3	0.609	1.474	0.085
	6370.2	613.3	394	0.096	0.070	8.208	234.5	48	7892.2	4.885	12.040	0.022
	2216.1	135.7	23.2	0.061	0.046	1.282	60.9	18.1	2885.9	3.365	6.420	0.054
	2375	150.9	26.4	0.064	0.055	0.251	58.2	105	591.7	0.554	0.998	0.216
2014	12365.3	954.6	768.1	0.077	0.067	1.475	356.2	520.7	14328.1	0.684	1.332	0.020
	12150.6	928.5	612.9	0.076	0.072	0.804	568.7	762	12176	0.746	1.749	0.097
	8194.5	595.4	478	0.073	0.052	11.980	249.6	39.9	10041.7	6.256	16.679	0.025
	2630.1	137.3	28.8	0.052	0.041	1.591	63.1	18.1	3244.9	3.486	6.751	0.048
	2627.3	158.3	30.3	0.060	0.054	0.296	58.9	102.2	646.7	0.576	1.112	0.195
2015	13108.3	873.1	861.5	0.067	0.055	1.594	375.9	540.4	17233.7	0.696	1.416	0.024
	13205.4	970.6	775.8	0.074	0.061	1.113	622.65	697.2	15569.1	0.893	2.198	0.080
	7334.3	471.3	408.7	0.064	0.040	12.128	220.5	33.7	9866	6.543	20.950	0.039
	2816.2	102.9	34.5	0.037	0.028	2.184	64.2	15.8	3404.5	4.063	7.956	0.063
	3034.4	164.4	30.3	0.054	0.049	0.316	56.6	96	1026.5	0.590	1.295	0.136

MEAN	**3987.8**	**346.9**	**235.0**	**0.094**	**0.060**	**2.834**	**147.2**	**149.6**	**5221.7**	**2.038**	**4.646**	**0.115**
STDV	**3630.7**	**290.8**	**242.6**	**0.039**	**0.015**	**3.277**	**140.0**	**212.7**	**4768.1**	**1.773**	**4.832**	**0.105**
MAX	**13205.4**	**1015.6**	**861.5**	**0.233**	**0.094**	**12.592**	**622.65**	**762**	**17233.7**	**6.543**	**20.950**	**0.384**
MIN	**12.00**	**0.30**	**0.30**	**0.025**	**0.010**	**0.094**	**0.55**	**3.00**	**2.00**	**0.183**	**0.333**	**0.008**

APPENDIX 2B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *BOTSWANA*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	FNB	1.000	***Mean***	**0.733**
	ABC holding	0.554		
	Standard Chart	0.903		
	Bank Gaborone	0.268		
	Botswana Building	0.940		
2006	FNB	0.965	***Mean***	**0.801**
	ABC holding	0.670		
	Standard Chart	1.000		
	Bank Gaborone	0.535		
	Botswana Building	0.835		
2007	FNB	0.604	***Mean***	**0.623**
	ABC holding	0.272		
	Standard Chart	0.700		
	Bank Gaborone	0.539		
	Botswana Building	1.000		
2008	FNB	0.613	***Mean***	**0.692**
	ABC holding	0.398		
	Standard Chart	0.742		
	Bank Gaborone	0.707		
	Botswana Building	1.000		
2009	FNB	0.726	***Mean***	**0.679**
	ABC holding	0.298		
	Standard Chart	0.803		
	Bank Gaborone	0.567		
	Botswana Building	1.000		
2010	FNB	0.721	***Mean***	**0.683**
	ABC holding	0.383		
	Standard Chart	0.749		
	Bank Gaborone	0.562		
	Botswana Building	1.000		
2011	FNB	0.873	***Mean***	**0.795**
	ABC holding	0.487		
	Standard Chart	0.938		
	Bank Gaborone	0.678		
	Botswana Building	1.000		
2012	FNB	0.932	***Mean***	**0.859**

	ABC holding	0.608		
	Standard Chart	1.000		
	Bank Gaborone	0.772		
	Botswana Building	0.981		
2013	FNB	0.948	***Mean***	**0.899**
	ABC holding	0.769		
	Standard Chart	1.000		
	Bank Gaborone	0.802		
	Botswana Building	0.978		
2014	FNB	0.877	***Mean***	**0.833**
	ABC holding	0.596		
	Standard Chart	0.915		
	Bank Gaborone	0.778		
	Botswana Building	1.000		
2015	FNB	0.729	***Mean***	**0.732**
	ABC holding	0.549		
	Standard Chart	0.773		
	Bank Gaborone	0.607		
	Botswana Building	1.000		

APPENDIX 3A: DESCRIPTIVE STATISTICS OF THE DATA: *LESOTHO*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	97.4	43.6	38	0.448	0.054	2.147	19.4	17.7	448.8	1.096	2.113	0.041
	181.2	40.8	26.8	0.225	0.046	1.121	21.6	23.9	846.9	0.904	1.900	0.028
	8.65	1.2	3.8	0.139	0.018	0.644	5.3	5.9	32.4	0.898	1.593	0.015
2006	124.1	37	44	0.298	0.040	2.573	22.7	17.1	438.7	1.327	2.462	0.058
	180.6	50.6	30.6	0.280	0.036	1.249	22.8	24.5	1319.1	0.931	1.886	0.023
	19.7	3.2	5.9	0.162	0.032	0.952	5.9	6.2	75.8	0.952	1.806	0.020
2007	278.6	37.3	49	0.134	0.036	2.426	21.2	20.2	564.8	1.050	2.218	0.062
	290.1	67.6	33.7	0.233	0.044	1.101	26.3	30.6	1408.9	0.859	1.850	0.047
	41.8	7.2	10.1	0.172	0.031	1.772	7.1	5.7	162.6	1.246	2.596	0.055
2008	963.4	250.9	147.5	0.260	0.073	3.606	94.1	40.9	2970.7	2.301	4.631	0.042
	372.5	96	38.8	0.258	0.053	1.183	34.3	32.8	1331.9	1.046	2.229	0.068
	78.4	13.6	17.1	0.173	0.034	1.727	10.4	9.9	270.8	1.051	2.202	0.080
2009	1179.9	265.1	174.1	0.225	0.072	3.266	110.1	53.3	3200.3	2.066	3.923	0.040
	466.9	99.2	49.6	0.212	0.183	1.097	38.2	45.2	1451.4	0.845	1.752	0.064
	76.8	19	23.1	0.247	0.041	1.060	13.7	21.8	28.6	0.628	1.624	1.350
2010	1472.9	265.5	206.4	0.180	0.061	3.540	117.7	58.3	3501.6	2.019	3.961	0.029
	584.2	101	55.4	0.173	0.147	1.099	38	50.4	1782.5	0.754	1.766	0.044
	91.2	20.3	33.8	0.223	0.037	1.470	16.9	23	309.6	0.735	1.891	0.103
2011	1818.9	292.2	226.6	0.161	0.062	4.212	130.5	53.8	3628.1	2.426	4.474	0.025
	658.4	92.4	62.7	0.140	0.120	1.387	40.6	45.2	1633.6	0.898	2.055	0.041
	125.6	22	47.4	0.175	0.040	1.830	21.9	25.9	280.4	0.846	2.444	0.072
2012	2579.6	366.1	261.9	0.142	0.077	5.145	125.7	50.9	3900.6	2.470	5.811	0.024
	856.7	106.5	75.2	0.124	0.107	1.443	44.8	52.1	1556.2	0.860	2.019	0.039
	229.2	28.9	64.6	0.126	0.052	2.324	25.2	27.8	380.9	0.906	2.993	0.040
2013	3195.1	478.2	283.5	0.150	0.077	4.103	149.3	69.1	4932.1	2.161	4.475	0.021

	871	105	82.3	0.121	0.105	1.351	52.7	60.9	1875.9	0.865	2.026	0.035
	452.7	65.4	144.7	0.144	0.080	4.522	57	32	742.2	1.781	5.297	0.046
2014	3484.8	532.5	302.5	0.153	0.086	2.989	173.6	101.2	4912.6	1.715	3.374	0.035
	919.9	120.6	99.3	0.131	0.120	1.594	63.2	62.3	2013	1.014	2.204	0.061
	569.1	65.7	128.5	0.115	0.064	3.918	48.6	32.8	1002.1	1.482	4.759	0.032
2015	3583.9	571	333.7	0.159	0.077	2.689	189.2	124.1	5801.8	1.525	2.940	0.031
	1042.5	136.8	104.7	0.131	0.112	1.351	77.6	77.5	2193.5	1.001	2.006	0.058
	694.8	79.3	142.6	0.114	0.070	3.047	58.2	46.8	1059.3	1.244	4.051	0.035
MEAN	**836.1**	**135.8**	**101.5**	**0.186**	**0.069**	**2.241**	**57.1**	**40.9**	**1698.7**	**1.270**	**2.828**	**0.084**
STDV	**1007.7**	**155.8**	**93.1**	**0.070**	**0.037**	**1.218**	**50.8**	**26.6**	**1575.1**	**0.539**	**1.206**	**0.228**
MAX	**3583.9**	**571.0**	**333.7**	**0.448**	**0.183**	**5.145**	**189.2**	**124.1**	**5801.8**	**2.470**	**5.811**	**1.350**
MIN	**8.65**	**1.2**	**3.8**	**0.114**	**0.018**	**0.644**	**5.3**	**5.7**	**28.6**	**0.628**	**1.593**	**0.015**

APPENDIX 3B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *LESOTHO*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	Standard	1.000	***Mean***	**0.658**
	Nedbank	0.719		
	FNB	0.257		
2006	Standard	1.000	***Mean***	**0.791**
	Nedbank	0.920		
	FNB	0.454		
2007	Standard	1.000	***Mean***	**0.815**
	Nedbank	0.843		
	FNB	0.603		
2008	Standard	1.000	***Mean***	**0.884**
	Nedbank	0.889		
	FNB	0.764		
2009	Standard	1.000	***Mean***	**0.925**
	Nedbank	0.945		
	FNB	0.830		
2010	Standard	1.000	***Mean***	**0.952**
	Nedbank	0.984		
	FNB	0.873		
2011	Standard	1.000	***Mean***	**0.947**
	Nedbank	0.946		
	FNB	0.894		
2012	Standard	1.000	***Mean***	**0.885**
	Nedbank	0.811		
	FNB	0.844		
2013	Standard	1.000	***Mean***	**0.853**
	Nedbank	0.721		
	FNB	0.839		
2014	Standard	1.000	***Mean***	**0.905**
	Nedbank	0.757		
	FNB	0.959		
2015	Standard	1.000	***Mean***	**0.872**
	Nedbank	0.705		
	FNB	0.909		

APPENDIX 4A: DESCRIPTIVE STATISTICS OF THE DATA: *MADAGASCAR*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	221708.1	35429.5	1963.4	0.160	0.086	0.071	8602.2	27723.3	411518	0.310	0.389	0.022
	147531.4	24561.8	12885.4	0.166	0.080	3.100	6099.2	4157.2	365654.7	1.467	3.905	0.008
	70	8.1	1.7	0.116	0.102	1.700	4.6	1	74.6	4.600	4.600	0.046
2006	287884.7	49178.6	3480.6	0.171	0.116	0.123	9683.1	28265.5	578599	0.343	0.488	0.019
	169542.8	33193.7	14234.6	0.196	0.081	2.759	12630.7	5159.3	349409.8	2.448	3.364	0.010
	73.7	9.5	2.2	0.129	0.108	1.222	5.7	1.8	95.3	3.167	3.167	0.045
2007	341088	59191.9	689.2	0.174	0.100	0.023	11544.9	29926.8	764879	0.386	1.127	0.018
	191700	33600	16017.3	0.175	0.082	2.542	17354.6	6300	376100	2.755	2.933	0.010
	88.4	10	2.5	0.113	0.095	1.250	6.8	2	106	3.400	3.400	0.042
2008	472160.5	53403.8	2348.8	0.113	0.067	0.070	13841.2	33319.5	1016395.1	0.415	1.062	0.033
	198400	35300	17800	0.178	0.095	2.738	18477.5	6500	494600	2.843	3.015	0.008
	125.9	11.7	5.3	0.093	0.084	2.208	7.3	2.4	114	3.042	3.042	0.040
2009	516813.3	57767.3	31687.2	0.112	0.053	0.830	17194.6	38190.5	1023318.9	0.450	1.020	0.035
	236500	37000	14700	0.156	0.085	1.598	19600	9200	543500	2.130	2.554	0.010
	124.3	10.7	4.5	0.086	0.062	1.607	8.7	2.8	144.2	3.107	3.107	0.044
2010	528942.9	57625	32936.5	0.109	0.053	0.686	18323.8	48014.8	1002347.3	0.382	0.760	0.039
	233600	32100	21300	0.137	0.070	2.173	23500	9800	719800	2.398	2.714	0.008
	153.9	11.8	5	0.077	0.065	1.282	8.8	3.9	164.7	2.256	2.256	0.043
2011	558457.3	65614	32406.6	0.117	0.061	0.673	20313.3	48156.9	1098147.9	0.422	0.771	0.033
	206542.7	39378.9	22638.8	0.191	0.067	2.739	26600	8264.3	845881.5	3.219	4.019	0.007
	152.3	11.9	6.2	0.078	0.064	1.442	10.3	4.3	173.1	2.395	2.395	0.048
2012	609409.5	71198.3	35869.7	0.117	0.060	0.657	23203.8	54597.1	1191929.7	0.425	0.642	0.031
	258211.4	39574.3	21702.8	0.153	0.060	2.634	33214.6	8238.4	850131.5	4.032	4.531	0.008
	138.1	11.2	5.1	0.081	0.055	1.457	10.4	3.5	185.2	2.971	2.971	0.043
2013	748818.4	71179.7	41610.7	0.095	0.071	0.723	27804.4	57537.9	1188076.1	0.483	0.642	0.029

	349000	43400	31500	0.124	0.063	2.763	37325.2	11400	814800	3.274	2.860	0.011
	131.4	9.8	6.6	0.075	0.048	2.357	11.4	2.8	196.7	4.071	4.071	0.040
2014	848632	92963.1	55613.3	0.110	0.083	0.975	31925	57022.8	1270593.8	0.560	0.552	0.029
	508600	53000	27500	0.104	0.078	2.350	32600	11700	845600	2.786	2.949	0.011
	150.9	12.1	9.6	0.080	0.055	2.526	11.8	3.8	227.1	3.105	3.105	0.037
2015	848632	92963.1	62390.1	0.110	0.079	1.094	36448.5	57022.8	1270593.8	0.639	0.552	0.025
	508600	53000	27500	0.104	0.065	2.350	34500	11700	845600	2.949	2.949	0.013
	152	14.8	12.4	0.097	0.066	4.000	13.4	3.1	224.3	4.323	4.323	0.037
MEAN	**272489.0**	**34265.0**	**16025.3**	**0.124**	**0.075**	**1.658**	**14572.3**	**17340.3**	**541490.3**	**2.168**	**2.431**	**0.027**
STDV	**264449.2**	**28920.9**	**17490.9**	**0.036**	**0.017**	**1.012**	**13015.6**	**20444.2**	**459370.3**	**1.383**	**1.346**	**0.014**
MAX	**848632.0**	**92963.1**	**62390.1**	**0.196**	**0.116**	**4.000**	**37325.2**	**57537.9**	**1270593.8**	**4.600**	**4.600**	**0.048**
MIN	**70.000**	**8.100**	**1.700**	**0.075**	**0.048**	**0.023**	**4.600**	**1.000**	**74.600**	**0.310**	**0.389**	**0.007**

APPENDIX 4B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *MADAGASCAR*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	Bank of Africa	0.6081	***Mean***	**0.789**
	Banque Malgache	0.759		
	MCB	1		
2006	Bank of Africa	0.8138	***Mean***	**0.909**
	Banque Malgache	0.9131		
	MCB	1		
2007	Bank of Africa	0.7992	***Mean***	**0.874**
	Banque Malgache	0.8216		
	MCB	1		
2008	Bank of Africa	0.6273	***Mean***	**0.737**
	Banque Malgache	0.5823		
	MCB	1		
2009	Bank of Africa	0.7945	***Mean***	**0.846**
	Banque Malgache	0.7437		
	MCB	1		
2010	Bank of Africa	0.6896	***Mean***	**0.737**
	Banque Malgache	0.5212		
	MCB	1		
2011	Bank of Africa	0.7792	***Mean***	**0.764**
	Banque Malgache	0.5131		
	MCB	1		
2012	Bank of Africa	0.8388	***Mean***	**0.813**
	Banque Malgache	0.6005		
	MCB	1		
2013	Bank of Africa	1	***Mean***	**0.912**
	Banque Malgache	0.7741		
	MCB	0.9632		
2014	Bank of Africa	1	***Mean***	**0.968**
	Banque Malgache	1		
	MCB	0.9039		
2015	Bank of Africa	0.9915	***Mean***	**0.978**
	Banque Malgache	1		
	MCB	0.9417		

APPENDIX 5A: DESCRIPTIVE STATISTICS OF THE DATA: *MALAWI*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	11062	3335	1896	0.301	0.126	0.715	1589	2651	23257	0.599	0.891	0.036
	4820	1658	1193	0.344	0.124	0.598	925	1994	13435	0.464	1.173	0.034
	2773	787	784	0.284	0.110	0.927	320	845	6822	0.379	0.784	0.053
	770	153	132	0.199	0.075	1.150	145.8	115	1440	1.271	2.641	0.113
2006	16966	4049	2586	0.239	0.141	0.762	2105	3392	25433	0.621	0.892	0.042
	7551	905	1193	0.120	0.053	0.651	599	1832	15605	0.327	1.276	0.019
	4637	1112	1330	0.240	0.101	1.521	518.5	874	9186	0.593	1.019	0.055
	1283	200	215	0.156	0.078	1.595	196.4	135	1398	1.460	2.804	0.068
2007	18719	4505	3131	0.241	0.126	0.673	2497	4653	34938	0.537	0.769	0.022
	11868	1505	3563	0.127	0.056	1.672	446	2131	23734	0.209	1.594	0.005
	6118	1478	2315	0.242	0.093	1.904	748.3	1216	13889	0.615	1.020	0.036
	772	224	285	0.290	0.081	2.100	208.7	136	2378	1.539	3.282	0.036
2008	25775	5179	4067	0.201	0.105	0.564	2671	7217	45439	0.370	0.687	0.018
	16527	2978	3563	0.180	0.088	1.006	1477	3541	28916	0.417	0.959	0.013
	11239	2090	1715	0.186	0.115	1.156	959.7	1484	17114	0.647	1.251	0.029
	2413	298	587	0.124	0.045	2.989	265.7	196	4173	1.354	3.335	0.024
2009	37870	6820	4381	0.180	0.127	0.466	2633	9411	55072	0.280	0.616	0.020
	21603	4076	4211	0.189	0.104	1.158	2112	3636	36738	0.581	1.218	0.012
	17670	2854	1542	0.162	0.092	0.744	1217.4	2072	27895	0.588	1.152	0.034
	1311	460	780	0.351	0.085	3.098	359.1	252	5176	1.427	3.248	0.032
2010	42880	6903	4212	0.161	0.119	0.341	3012	12359	59023	0.244	0.512	0.020
	25225	4639	5123	0.184	0.111	1.277	1518	4012	42631	0.378	1.412	0.015
	26237	3661	1983	0.140	0.089	0.691	1372.8	2869	37127	0.479	1.028	0.039
	3478	539	753	0.155	0.057	1.678	387.2	449	6581	0.863	2.186	0.030
2011	46943	8200	5506	0.175	0.127	0.434	2243	12685	66751	0.177	0.660	0.014

	39434	4980	6539	0.126	0.085	1.072	2067	6097	57702	0.339	0.817	0.015
	30141	4367	2337	0.145	0.104	0.709	1700.4	3297	47028	0.516	1.094	0.038
	2473	526	797	0.213	0.064	1.494	362.2	533	8288	0.679	1.971	0.023
2012	63951	9914	12439	0.155	0.102	0.810	5691	15366	91501	0.370	0.737	0.026
	53299	9130	13056	0.171	0.099	1.848	4419	7066	84717	0.625	1.217	0.032
	27528	4460	4538	0.162	0.135	1.052	2198	4312	36390	0.510	0.967	0.041
	2498	891	1082	0.357	0.089	1.639	591.8	661	9811	0.896	2.337	0.030
2013	64346	19761	14130	0.307	0.151	0.801	7922	17650	123855	0.449	0.871	0.043
	56856	15759	16941	0.277	0.127	2.047	6126	8276	130139	0.740	1.507	0.043
	33964	7762	9253	0.229	0.170	1.603	3495.2	5773	53598	0.605	1.199	0.065
	3969	943	1100	0.238	0.113	1.613	963.7	682	8410	1.413	3.132	0.044
2014	81153	21804	17321	0.269	0.148	0.865	8331	20031	144967	0.416	0.896	0.026
	58818	16923	18009	0.288	0.118	1.570	7445	11473	140599	0.649	1.350	0.042
	45187	8954	8891	0.198	0.141	1.087	5671.5	8178	64493	0.694	1.216	0.059
	5058	1129	1459	0.223	0.106	1.900	1339	768	12839	1.744	3.297	0.032
2015	115686	28219	15593	0.244	0.132	0.611	11451	25519	214989	0.449	0.881	0.022
	95114	22908	14740	0.241	0.124	1.263	9093	11675	167657	0.779	1.641	0.022
	59017	12089	6398	0.205	0.118	0.845	6724.1	7573	103159	0.888	1.609	0.049
	4513	1036	1279	0.230	0.088	1.765	1151	725	10624	1.588	3.220	0.037
MEAN	***27489***	***5913***	***5067***	***0.215***	***0.106***	***1.238***	***2665***	***5359***	***48066***	***0.699***	***1.508***	***0.034***
STDV	***27794***	***6887***	***5376***	***0.063***	***0.028***	***0.626***	***2819***	***5936***	***50495***	***0.410***	***0.864***	***0.019***
MAX	***115686***	***28219***	***18009***	***0.357***	***0.170***	***3.098***	***11451***	***25519***	***214989***	***1.744***	***3.335***	***0.113***
MIN	***770***	***153***	***132***	***0.120***	***0.045***	***0.341***	***145.8***	***115***	***1398***	***0.177***	***0.512***	***0.005***

APPENDIX 5B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *MALAWI*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	Nat Bank of Malawi	1.000	***Mean***	**0.879**
	Standard Bank	0.831		
	First Merchant	0.885		
	Nedbank	0.800		
2006	Nat Bank of Malawi	1.000	***Mean***	**0.853**
	Standard Bank	0.615		
	First Merchant	0.868		
	Nedbank	0.931		
2007	Nat Bank of Malawi	1.000	***Mean***	**0.870**
	Standard Bank	0.872		
	First Merchant	0.921		
	Nedbank	0.687		
2008	Nat Bank of Malawi	0.832	***Mean***	**0.851**
	Standard Bank	0.843		
	First Merchant	1.000		
	Nedbank	0.729		
2009	Nat Bank of Malawi	1.000	***Mean***	**0.863**
	Standard Bank	0.905		
	First Merchant	0.977		
	Nedbank	0.571		
2010	Nat Bank of Malawi	0.912	***Mean***	**0.896**
	Standard Bank	0.949		
	First Merchant	1.000		
	Nedbank	0.723		
2011	Nat Bank of Malawi	1.000	***Mean***	**0.836**
	Standard Bank	0.899		
	First Merchant	0.931		
	Nedbank	0.516		
2012	Nat Bank of Malawi	0.858	***Mean***	**0.835**
	Standard Bank	0.915		
	First Merchant	1.000		
	Nedbank	0.567		
2013	Nat Bank of Malawi	0.958	***Mean***	**0.871**
	Standard Bank	0.873		
	First Merchant	1.000		
	Nedbank	0.655		

2014	Nat Bank of Malawi	1.000	***Mean***	**0.839**
	Standard Bank	0.840		
	First Merchant	0.946		
	Nedbank	0.569		
2015	Nat Bank of Malawi	0.914	***Mean***	**0.846**
	Standard Bank	1.000		
	First Merchant	0.875		
	Nedbank	0.595		

APPENDIX 6A: DESCRIPTIVE STATISTICS OF THE DATA: *MAURITIUS*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	54944	2517	1633	0.046	0.037	0.777	989.1	2102.9	61327.2	0.470	0.931	0.042
	23934	1481	1000	0.062	0.036	0.338	355.3	2959.2	32930.9	0.120	0.301	0.042
	2882.20	96.70	43.20	0.034	0.023	0.135	61.10	320.9	4308.6	0.190	0.434	0.075
	672.00	34.00	1.50	0.051	0.034	7.500	1.900	0.200	174.8	9.500	12.000	0.195
	124.60	6.70	0.50	0.054	0.045	2.500	0.500	0.200	77.3	2.500	3.000	0.147
	161.30	2.10	0.60	0.013	0.010	3.000	0.200	0.200	137.6	1.000	4.000	0.031
	668.60	9.20	1.50	0.014	0.007	15.000	0.500	0.100	203.0	5.000	10.000	0.070
2006	58139	2658	1532	0.046	0.033	0.698	1103.3	2193.8	68211.0	0.503	0.910	0.053
	27270	1606	1059	0.059	0.036	0.375	390.1	2826.1	37970.2	0.138	0.350	0.048
	2475.5	40.20	18.70	0.016	0.012	0.056	59.2	336.6	3693.8	0.176	0.422	0.073
	564.40	35.60	16.20	0.063	0.040	81.000	2.300	0.200	295.5	11.500	11.500	0.125
	142.20	4.70	5.30	0.033	0.011	3.533	1.400	1.500	359.7	0.933	2.733	0.031
	56.30	2.50	0.50	0.044	0.014	5.000	0.200	0.100	106.2	2.000	9.000	0.060
	617.40	13.00	2.30	0.021	0.008	23.000	0.500	0.100	496.9	5.000	10.000	0.074
2007	64097	3027	1929	0.047	0.035	0.787	1229.3	2449.8	73901.0	0.502	0.928	0.068
	29138	1685	1361	0.058	0.035	0.496	411.0	2742.4	46103.2	0.150	0.386	0.058
	2047.6	46.2	27.0	0.023	0.012	0.084	61.8	321.8	4110.4	0.192	0.431	0.072
	829.7	44.0	2.8	0.053	0.052	14.000	2.200	0.200	396.4	11.000	19.000	0.103
	126.9	4.80	5.40	0.038	0.007	1.929	3.500	2.800	612.8	1.250	2.536	0.046
	114.0	3.30	0.80	0.029	0.015	4.000	0.300	0.200	120.0	1.500	5.000	0.065
	1173.4	21.70	0.90	0.018	0.010	9.000	0.900	0.100	387.3	9.000	21.000	0.167
2008	74995	3667	2704	0.049	0.038	1.100	1454.5	2458.3	95173.0	0.592	1.085	0.061
	34672	2686	1126	0.077	0.050	0.488	592.3	2309.7	52124.5	0.256	0.569	0.061
	4364	29.40	73.90	0.007	0.006	0.232	125.6	318.9	6133.7	0.394	0.778	0.092
	466	45.60	2.00	0.098	0.041	10.000	3.700	0.200	439.8	18.500	32.500	0.092

	199	8.30	12.80	0.042	0.010	5.120	6.300	2.500	731.8	2.520	4.520	0.054
	286	12.20	3.30	0.043	0.023	0.485	2.200	6.800	484.0	0.324	0.750	0.064
	1028	22.20	4.80	0.022	0.016	12.000	1.100	0.400	416.9	2.750	8.000	0.125
2009	92403	4736	2385	0.051	0.043	0.793	1662.7	3008.6	110937.0	0.553	0.941	0.044
	38771	2441	1176	0.063	0.036	0.523	641.9	2248.9	62060.4	0.285	0.598	0.045
	6005	133	143	0.022	0.019	0.435	144.6	327.8	9479.5	0.441	0.743	0.050
	516	37.20	55.80	0.072	0.047	79.714	3.900	0.700	488.2	5.571	11.000	0.060
	177	7.10	11.10	0.040	0.004	5.045	6.200	2.200	1488.9	2.818	5.909	0.011
	490	16.20	6.80	0.033	0.026	1.097	2.000	6.200	438.4	0.323	0.839	0.055
	755	16.90	6.30	0.022	0.009	21.000	1.000	0.300	657.7	3.333	11.000	0.100
2010	104662	4835	2150	0.046	0.039	0.547	1742.1	3927.4	121878.4	0.444	0.786	0.031
	44007	2613	1049	0.059	0.040	0.368	720.7	2846.9	60914.9	0.253	0.460	0.038
	8282	292.20	162.30	0.035	0.031	0.504	173.2	322.1	12598.7	0.538	0.905	0.035
	564	34.70	10.30	0.062	0.034	20.600	4.000	0.500	372.7	8.000	18.400	0.039
	255	8.50	13.40	0.033	0.017	5.826	7.600	2.300	2165.1	3.304	6.696	0.006
	594	18.70	4.50	0.032	0.026	0.804	2.400	5.600	722.9	0.429	1.054	0.033
	1056	86.30	2.00	0.082	0.028	1.818	2.400	1.100	863.7	2.182	8.636	0.121
2011	115494	5510	2857	0.048	0.042	0.555	1906.8	5147.6	124849.8	0.370	0.666	0.029
	57131	2632	1264	0.046	0.033	0.455	884.7	2779.7	70396.1	0.318	0.515	0.033
	9440.7	356.2	213.9	0.038	0.032	0.668	203.1	320.1	14118.1	0.634	1.037	0.033
	732.1	34.10	11.60	0.047	0.043	23.200	4.600	0.500	397.8	9.200	20.200	0.031
	414.3	13.70	15.90	0.033	0.019	8.368	7.900	1.900	788.3	4.158	7.579	0.014
	809.2	18.30	9.70	0.023	0.019	1.032	3.000	9.400	938.1	0.319	0.713	0.031
	1218.9	61.40	17.80	0.050	0.017	14.833	4.400	1.200	939.5	3.667	13.917	0.119
2012	130528.9	6663	2851.2	0.051	0.045	0.514	2079.2	5543.9	138032.7	0.375	0.699	0.031
	63205.4	4793.9	1549.7	0.076	0.058	0.582	964.0	2664.4	75533.2	0.362	0.598	0.034
	12248.2	396.60	240.80	0.032	0.029	0.732	232.9	328.9	17198.2	0.708	1.146	0.029
	779.9	41.00	3.30	0.053	0.036	8.250	4.800	0.400	666.8	12.000	24.250	0.015
	408.5	19.00	17.00	0.047	0.024	3.617	8.400	4.700	1539.4	1.787	3.319	0.008
	750.3	24.90	5.70	0.033	0.029	0.582	3.600	9.800	649.8	0.367	0.755	0.045

	1084.5	53.00	2.00	0.049	0.019	1.818	6.200	1.100	624.9	5.636	19.727	0.221
2013	143030.3	6340.6	3246.8	0.044	0.039	0.597	2271.3	5442.0	150918.6	0.417	0.748	0.027
	70768.3	6665.3	2400.5	0.094	0.075	0.928	1666.6	2585.4	81276.2	0.645	1.117	0.041
	11969.7	486.00	50.60	0.041	0.037	0.163	224.5	310.5	15162.7	0.723	1.183	0.032
	899.1	51.30	8.10	0.057	0.038	27.000	4.100	0.300	832.2	13.667	34.000	0.018
	340.2	17.10	12.00	0.050	0.018	2.857	7.900	4.200	1776.8	1.881	3.524	0.007
	715.6	18.50	4.60	0.026	0.019	0.500	3.600	9.200	910.7	0.391	0.793	0.031
	1185.5	46.00	6.20	0.039	0.016	7.750	6.200	0.800	1108.8	7.750	20.500	0.102
2014	146233.9	6560.1	3888.4	0.045	0.037	0.747	2405.6	5202.5	171021.9	0.462	0.844	0.025
	68589	4022.7	1846.7	0.059	0.043	0.680	1065.3	2714.9	90542.4	0.392	1.121	0.026
	11124.9	564.7	156.6	0.051	0.046	0.477	254.3	328.1	15470.0	0.775	1.318	0.023
	932.6	56.4	9.70	0.060	0.034	24.250	4.700	0.400	777.2	11.750	28.500	0.019
	280.2	15.7	16.50	0.056	0.022	5.000	7.300	3.300	3025.7	2.212	4.485	0.003
	685.1	20.9	4.70	0.031	0.023	0.540	3.900	8.700	660.6	0.448	0.851	0.034
	1328.7	42.5	169.4	0.032	0.014	282.333	6.700	0.600	974.6	11.167	41.333	0.089
2015	157308.4	7379.2	3782	0.047	0.036	0.752	2582.1	5030.4	202713.6	0.513	0.887	0.021
	71788.7	4067	1673	0.057	0.040	0.602	1184.9	2779.8	103577.8	0.426	0.760	0.019
	13069.6	608.3	248.7	0.047	0.040	0.771	311.000	322.700	17321.9	0.964	1.490	0.017
	897.8	49.40	2.50	0.055	0.031	8.333	5.800	0.300	1077.9	19.333	37.000	0.012
	106.3	14.20	18.00	0.134	0.026	6.207	6.500	2.900	1164.8	2.241	4.828	0.006
	658.3	18.80	6.10	0.029	0.020	0.744	4.000	8.200	741.4	0.488	0.927	0.025
	1018.4	40.60	69.40	0.040	0.017	138.800	6.600	0.500	1217.6	13.200	60.400	0.070
MEAN	**23141.6**	**1205.0**	**602.9**	**0.046**	**0.029**	**11.908**	**393.8**	**982.2**	**28382.3**	**3.197**	**7.438**	**0.054**
STDV	**39922.1**	**2047.1**	**1017.0**	**0.020**	**0.014**	**37.307**	**672.8**	**1586.2**	**47098.4**	**4.535**	**11.405**	**0.043**
MAX	**157308.4**	**7379.2**	**3888.4**	**0.134**	**0.075**	**282.333**	**2582.1**	**5543.9**	**202713.6**	**19.333**	**60.400**	**0.221**
MIN	**56.300**	**2.100**	**0.500**	**0.007**	**0.004**	**0.056**	**0.200**	**0.100**	**77.300**	**0.120**	**0.301**	**0.003**

APPENDIX 6B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *MAURITIUS*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	MCB Ltd	0.041	***Mean***	**0.305**
	SBM	0.034		
	Bank One	0.042		
	Investec	0.301		
	Standard	0.202		
	SBI	0.517		
	Standard Chart	1.000		
2006	MCB Ltd	0.052	***Mean***	**0.264**
	SBM	0.048		
	Bank One	0.045		
	Investec	0.277		
	Standard	0.168		
	SBI	0.260		
	Standard Chart	1.000		
2007	MCB Ltd	0.040	***Mean***	**0.253**
	SBM	0.040		
	Bank One	0.058		
	Investec	0.319		
	Standard	0.030		
	SBI	0.283		
	Standard Chart	1.000		
2008	MCB Ltd	0.057	***Mean***	**0.213**
	SBM	0.054		
	Bank One	0.046		
	Investec	0.153		
	Standard	0.039		
	SBI	0.139		
	Standard Chart	1.000		
2009	MCB Ltd	0.081	***Mean***	**0.271**
	SBM	0.077		
	Bank One	0.080		
	Investec	0.234		
	Standard	0.120		
	SBI	0.306		
	Standard Chart	1.000		
2010	MCB Ltd	0.133	***Mean***	**0.333**
	SBM	0.119		

	Bank One	0.123		
	Investec	0.371		
	Standard	0.083		
	SBI	0.499		
	Standard Chart	1.000		
2011	MCB Ltd	0.191	***Mean***	**0.447**
	SBM	0.196		
	Bank One	0.160		
	Investec	0.614		
	Standard	0.213		
	SBI	0.753		
	Standard Chart	1.000		
2012	MCB Ltd	0.300	***Mean***	**0.575**
	SBM	0.311		
	Bank One	0.277		
	Investec	0.925		
	Standard	0.269		
	SBI	0.944		
	Standard Chart	1.000		
2013	MCB Ltd	0.252	***Mean***	**0.494**
	SBM	0.185		
	Bank One	0.228		
	Investec	1.000		
	Standard	0.192		
	SBI	0.728		
	Standard Chart	0.873		
2014	MCB Ltd	0.243	***Mean***	**0.499**
	SBM	0.248		
	Bank One	0.186		
	Investec	0.899		
	Standard	0.252		
	SBI	0.663		
	Standard Chart	1.000		
2015	MCB Ltd	0.337	***Mean***	**0.550**
	SBM	0.324		
	Bank One	0.252		
	Investec	0.949		
	Standard	0.128		
	SBI	0.859		
	Standard Chart	1.000		

APPENDIX 7A: DESCRIPTIVE STATISTICS OF THE DATA: *MOZAMBIQUE*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	445.8	53.1	61.7	0.119	0.061	1.244	32.4	49.6	881.3	0.653	1.631	0.029
	1048.3	317.7	224.9	0.303	0.070	0.039	250.3	5731.5	2892.8	0.044	0.095	0.056
	2005	1763.6	364.8	0.880	0.209	0.808	239.6	451.3	402.4	0.531	19.364	0.334
2006	525.9	92.4	89.6	0.176	0.066	1.733	44.3	51.7	1048	0.857	2.190	0.065
	1262.5	495.9	293.2	0.393	0.101	0.046	273.1	6353.7	3238	0.043	0.107	0.060
	3119.6	686.7	562	0.220	0.063	1.150	331.3	488.6	11329.9	0.678	1.417	0.021
2007	838	98.5	78.8	0.118	0.066	1.361	45.6	57.9	1051.3	0.788	1.883	0.099
	1572.5	520.6	324.1	0.331	0.089	0.045	307.1	7213	3918.3	0.043	0.097	0.061
	3759.8	903.1	628.3	0.240	0.065	1.147	417.2	547.9	14362.1	0.761	1.515	0.026
2008	1123.6	122.5	99.5	0.109	0.057	0.793	66.8	125.5	1852.8	0.532	1.173	0.054
	2481.1	593.6	451.1	0.239	0.092	0.057	419.8	7947.4	5347.5	0.053	0.110	0.050
	5399.6	1066	813.9	0.197	0.059	1.321	493.3	616.1	17815.6	0.801	1.534	0.025
2009	1473	150.6	239.7	0.102	0.042	1.398	110.4	171.5	3197.6	0.644	1.218	0.049
	4514.8	670.7	631	0.149	0.088	0.068	483.4	9306.1	6561.3	0.052	0.115	0.044
	7072	1276.9	1162.5	0.181	0.058	1.689	637.9	688.1	21643.1	0.927	1.815	0.022
2010	2113.7	145.1	286.3	0.069	0.033	1.034	154.4	276.9	3990.7	0.558	1.021	0.067
	5749.9	889.8	658.9	0.155	0.091	0.051	553.9	12877.2	8030	0.043	0.110	0.039
	11372.4	1524.4	1332.9	0.134	0.055	1.490	786.7	894.6	26924	0.879	1.887	0.019
2011	2887.7	254.6	274.1	0.088	0.060	0.897	159.9	305.6	4170.7	0.523	1.109	0.095
	6481.7	1023	415.1	0.158	0.096	0.031	587.6	13485	8866.7	0.044	0.112	0.056
	12862	2355	1459.2	0.183	0.078	1.697	1041.3	859.8	27509.7	1.211	2.281	0.024
2012	3510.4	347.2	252.6	0.099	0.082	0.730	159.9	346.2	4319.7	0.462	1.252	0.092
	7264.7	811.9	482.7	0.112	0.063	0.030	658	16234.2	11024.8	0.041	0.096	0.042
	15249.1	2345.7	1980.3	0.154	0.063	1.596	1236.4	1241.1	35118.6	0.996	1.807	0.013
2013	5406.7	436.4	315.5	0.081	0.058	0.907	229.7	347.7	6659.9	0.661	1.496	0.058

	8538.8	734.6	459.5	0.086	0.054	0.027	856.5	17172.5	11973.9	0.050	0.093	0.035
	19355.1	2364.6	2220.6	0.122	0.062	1.205	1455	1843.1	35716.6	0.789	1.353	0.006
2014	6490.3	443.9	424	0.068	0.054	1.277	308.8	331.9	7070.3	0.930	2.076	0.093
	10600.5	952.8	769.7	0.090	0.049	0.034	691	22750.6	14041.5	0.030	0.066	0.029
	23332.1	2571.7	2777.6	0.110	0.062	0.983	1610.2	2824.5	38423.6	0.570	1.034	0.007
2015	6882.6	654.2	512.9	0.095	0.071	1.545	347.7	332	9294.2	1.047	3.028	0.062
	12088.2	1522.1	1070	0.126	0.079	0.046	1228.8	23500.8	16953	0.052	0.089	0.029
	27435.4	2880.8	4418	0.105	0.051	1.257	1996.6	3514.4	49871.2	0.568	1.023	0.009
MEAN	**6795.8**	**941.5**	**792.0**	**0.175**	**0.071**	**0.840**	**552.0**	**4816.3**	**12590.9**	**0.511**	**1.642**	**0.054**
STDV	**6664.8**	**801.4**	**912.3**	**0.148**	**0.029**	**0.625**	**489.9**	**6879.8**	**12613.3**	**0.371**	**3.285**	**0.057**
MAX	**27435.4**	**2880.8**	**4418.0**	**0.880**	**0.209**	**1.733**	**1996.6**	**23500.8**	**49871.2**	**1.211**	**19.364**	**0.334**
MIN	**445.8**	**53.1**	**61.7**	**0.068**	**0.033**	**0.027**	**32.4**	**49.6**	**402.4**	**0.030**	**0.066**	**0.006**

APPENDIX 7B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *MOZAMBIQUE*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	ABC	0.582	***Mean***	**0.693**
	Barclays	0.498		
	Standard bank	1.000		
2006	ABC	1.000	***Mean***	**0.782**
	Barclays	0.596		
	Standard bank	0.749		
2007	ABC	1.000	***Mean***	**0.668**
	Barclays	0.457		
	Standard bank	0.546		
2008	ABC	1.000	***Mean***	**0.757**
	Barclays	0.554		
	Standard bank	0.718		
2009	ABC	1.000	***Mean***	**0.911**
	Barclays	0.868		
	Standard bank	0.866		
2010	ABC	0.978	***Mean***	**0.968**
	Barclays	0.926		
	Standard bank	1.000		
2011	ABC	1.000	***Mean***	**0.841**
	Barclays	0.735		
	Standard bank	0.789		
2012	ABC	1.000	***Mean***	**0.739**
	Barclays	0.575		
	Standard bank	0.643		
2013	ABC	1.000	***Mean***	**0.730**
	Barclays	0.509		
	Standard bank	0.683		
2014	ABC	1.000	***Mean***	**0.856**
	Barclays	0.786		
	Standard bank	0.781		
2015	ABC	1.000	***Mean***	**0.810**
	Barclays	0.620		
	Standard bank	0.809		

APPENDIX 8A: DESCRIPTIVE STATISTICS OF THE DATA: *NAMIBIA*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	6831.3	422.8	294	0.062	2.785	1.937	206.5	151.8	5300.1	1.360	2.540	0.074
	5187.3	277.7	227.8	0.054	0.048	2.768	149.6	82.3	4614.9	1.818	3.300	0.067
	5904.1	337.6	249.9	0.057	0.043	2.636	171.7	94.8	6475.4	1.811	3.526	0.068
	3690.3	196	196	0.053	0.049	3.920	73.6	50	2646.1	1.472	3.102	0.078
2006	8028.6	483.9	372.6	0.060	3.065	2.360	233.7	157.9	6793.8	1.480	2.878	0.065
	6670.9	354.5	240.7	0.053	0.049	2.636	157.2	91.3	5481.6	1.722	3.424	0.068
	7713.3	385	258.9	0.050	0.040	3.769	184	68.7	8336.5	2.678	5.534	0.061
	3796.5	248.1	248.1	0.065	0.056	4.015	118.6	61.8	3383.1	1.919	3.979	0.074
2007	8928.6	611	385.6	0.068	3.714	2.344	256.4	164.5	6909.5	1.559	2.979	0.087
	7436.5	378.5	288.3	0.051	0.045	2.725	184.3	105.8	5945.9	1.742	3.575	0.090
	7371.8	497.2	264.2	0.067	0.050	3.218	236.1	82.1	8608	2.876	5.280	0.083
	4177.4	272.6	272.6	0.065	0.055	2.740	153.5	99.5	4007.2	1.543	2.405	0.084
2008	9386.6	706.8	527.7	0.075	3.750	2.799	298.2	188.5	8030	1.582	3.164	0.096
	8493.8	470.6	373.9	0.055	0.047	2.912	212.5	128.4	7742.1	1.655	3.579	0.099
	8215.6	487	353.3	0.059	0.045	3.956	266.8	89.3	9184	2.988	5.671	0.095
	4350.6	307.7	307.7	0.071	0.060	2.278	175.2	135.1	3711.7	1.297	2.080	0.109
2009	10739.7	760.1	520.8	0.071	3.215	2.203	327.4	236.4	9134.8	1.385	2.848	0.092
	9933.8	496.8	323.8	0.050	0.042	2.393	252.2	135.3	8578.9	1.864	3.675	0.107
	8240.1	470.9	494.4	0.057	0.038	5.288	308.5	93.5	10796.9	3.299	6.280	0.064
	4922.2	318.7	318.7	0.065	0.053	2.500	179.8	127.5	4189	1.410	2.325	0.075
2010	11473.4	808.2	643.4	0.070	3.027	2.410	347.6	267	9908.6	1.302	2.909	0.064
	11423.6	565.5	363.8	0.050	0.043	2.760	309.6	131.8	8419.8	2.349	4.294	0.088
	8756	502.7	492.5	0.057	0.038	4.027	326.8	122.3	12092.4	2.672	5.536	0.050
	5240.2	355.4	355.4	0.068	0.053	2.606	198.4	136.4	4550.6	1.455	2.444	0.057
2011	12676	841.9	663.5	0.066	3.014	2.376	407.7	279.3	10616	1.460	2.865	0.054

	13115.4	680.8	392.3	0.052	0.045	2.983	350	131.5	9852.6	2.662	4.883	0.069
	10222.2	516.9	537	0.051	0.036	2.757	326.1	194.8	13739.5	1.674	3.098	0.040
	5535.2	343.1	343.1	0.062	0.049	2.445	197	140.3	4843.8	1.404	2.388	0.049
2012	14234.3	893.5	779.4	0.063	3.115	2.718	467.3	286.8	12748.1	1.629	3.082	0.050
	15604.6	791.7	453.9	0.051	0.045	3.560	405.4	127.5	12126.6	3.180	5.535	0.061
	12325	603.3	575.3	0.049	0.037	2.380	416.5	241.7	14029.2	1.723	3.144	0.044
	6124.6	381.9	381.9	0.062	0.047	2.705	216.5	141.2	5090.8	1.533	2.693	0.052
2013	17112.2	987.9	903.8	0.058	2.623	2.399	501.4	376.7	18835.7	1.331	2.484	0.035
	17787	920.1	511.6	0.052	0.047	3.951	422.7	129.5	16915.7	3.264	5.846	0.047
	13140.7	696.4	636.6	0.053	0.037	2.143	472.3	297	15781.9	1.590	3.019	0.043
	7008.4	413.7	413.7	0.059	0.044	2.754	247.9	150.2	5240.8	1.650	2.741	0.054
2014	20137.7	1145	1118.3	0.057	2.076	2.027	558	551.6	21522.4	1.012	1.923	0.036
	20393.1	1055.3	634.4	0.052	0.046	4.869	473.8	130.3	18782.4	3.636	6.731	0.048
	15432.8	892.7	716.2	0.058	0.046	2.203	512.1	325.1	17484.5	1.575	3.190	0.041
	8374.5	477.8	477.8	0.057	0.043	2.235	283.8	213.8	5981.7	1.327	2.095	0.065
2015	23006.1	1467.5	1308.9	0.064	1.728	1.541	657.4	849.2	23951.8	0.774	1.429	0.040
	23817.8	1268.9	791	0.053	0.046	5.136	576.3	154	21994	3.742	6.653	0.053
	17216.3	1154.4	773.7	0.067	0.052	1.986	570.1	389.6	18057.7	1.463	2.973	0.049
	9907.4	591.3	591.3	0.060	0.045	2.564	339.6	230.6	6678.6	1.473	2.284	0.081
MEAN	**10456.4**	**610.0**	**485.9**	**0.059**	**0.764**	**2.885**	**312.0**	**189.6**	**9979.9**	**1.894**	**3.554**	**0.066**
STDV	**5227.8**	**299.8**	**239.0**	**0.007**	**1.293**	**0.852**	**140.9**	**142.9**	**5610.4**	**0.725**	**1.366**	**0.020**
MAX	**23817.8**	**1467.5**	**1308.9**	**0.075**	**3.750**	**5.288**	**657.4**	**849.2**	**23951.8**	**3.742**	**6.731**	**0.109**
MIN	**3690.3**	**196**	**196**	**0.049**	**0.036**	**1.541**	**73.6**	**50**	**2646.1**	**0.774**	**1.429**	**0.035**

APPENDIX 8B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *NAMIBIA*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	FNB	0.710	***Mean***	**0.755**
	Windhoek	0.691		
	Standard	0.620		
	NedNamibia	1.000		
2006	FNB	0.929	***Mean***	**0.932**
	Windhoek	0.972		
	Standard	0.825		
	NedNamibia	1.000		
2007	FNB	0.974	***Mean***	**0.899**
	Windhoek	1.000		
	Standard	0.722		
	NedNamibia	0.901		
2008	FNB	0.993	***Mean***	**0.930**
	Windhoek	1.000		
	Standard	0.787		
	NedNamibia	0.940		
2009	FNB	1.000	***Mean***	**0.939**
	Windhoek	0.960		
	Standard	0.796		
	NedNamibia	0.999		
2010	FNB	1.000	***Mean***	**0.898**
	Windhoek	0.933		
	Standard	0.719		
	NedNamibia	0.940		
2011	FNB	1.000	***Mean***	**0.941**
	Windhoek	0.970		
	Standard	0.807		
	NedNamibia	0.986		
2012	FNB	0.965	***Mean***	**0.950**
	Windhoek	0.952		
	Standard	0.881		
	NedNamibia	1.000		
2013	FNB	0.914	***Mean***	**0.933**
	Windhoek	0.898		
	Standard	0.922		
	NedNamibia	1.000		

2014	FNB	0.944	***Mean***	**0.937**
	Windhoek	0.915		
	Standard	0.888		
	NedNamibia	1.000		
2015	FNB	0.924	***Mean***	**0.897**
	Windhoek	0.884		
	Standard	0.780		
	NedNamibia	1.000		

APPENDIX 9A: DESCRIPTIVE STATISTICS OF THE DATA: *SOUTH AFRICA*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	312829	13015	27503	0.042	0.018	8.398	9370	3275	386039	2.861	7.602	0.066
	221851	13184	28345	0.059	0.032	6.149	10021	4610	245793	2.174	3.635	0.058
	312779	9474	10226	0.030	0.025	2.963	5807	3451	303945	1.683	3.538	0.045
	236442	8669	8469	0.037	0.027	1.918	5312	4415	229993	1.203	2.542	0.064
	71765	1625	5100	0.023	0.014	49.038	1462	104	56162	14.058	30.750	0.080
	547.3	744.9	16.9	1.361	1.528	0.126	178.95	134	537.9	1.335	3.720	0.031
	1115.3	112.6	210.1	0.101	0.096	4.863	7.3	43.2	402.1	0.169	4.565	0.211
	197.9	11.6	213.5	0.059	0.110	12.708	54.9	16.8	94.3	3.268	10.042	0.046
	7499	2463	447	0.328	0.436	6.672	527	67	1293	7.866	16.687	0.313
	1727.4	141.5	108.3	0.082	0.073	4.198	102.5	25.8	2549.1	3.973	8.853	0.044
	327.8	13.7	2.1	0.042	0.032	2.333	7.6	0.9	390.2	8.444	11.889	0.075
	95.3	16.5	12	0.173	0.130	2.353	9.7	5.1	371.1	1.902	4.059	0.030
2006	417776	16654	30613	0.040	0.018	8.103	11001	3778	494071	2.912	6.987	0.061
	317016	15846	37665	0.050	0.029	7.516	10653	5011	321235	2.126	4.071	0.048
	378564	14907	14728	0.039	0.032	3.927	8577	3750	367512	2.287	4.541	0.062
	296282	11136	9295	0.038	0.029	2.002	6082	4643	292292	1.310	2.634	0.060
	88573	2453	5681	0.028	0.015	45.815	2081	124	69061	16.782	33.008	0.081
	914.2	899.2	111.8	0.984	1.046	0.719	205.6	155.6	842.1	1.321	3.888	0.048
	1222.7	113.8	363.6	0.093	0.085	7.360	8.4	49.4	626.9	0.170	4.970	0.148
	197.9	11.6	213.5	0.059	0.051	12.708	67.7	16.8	94.3	4.030	10.042	0.068
	7499	2463	447	0.328	0.367	6.672	548	67	1293	8.179	16.687	0.377
	2130.8	173.1	143.6	0.081	0.065	6.679	116.7	21.5	3542	5.428	10.633	0.053
	394.9	15.9	2.3	0.040	0.034	2.556	7.1	0.9	465.3	7.889	12.778	0.069
	134.4	19.4	12.1	0.144	0.118	2.241	11.6	5.4	429.3	2.148	4.130	0.032
2007	549423	24732	34786	0.045	0.022	6.417	14488	5421	578057	2.673	6.145	0.071

	391570	19503	20568	0.050	0.030	3.208	11917	6411	372310	1.859	3.461	0.069
	461624	18890	16344	0.041	0.032	3.545	9944	4610	310512	2.157	4.167	0.117
	361668	14277	10239	0.039	0.032	2.606	7079	3929	339562	1.802	3.511	0.082
	116721	3652	5936	0.031	0.018	35.976	2730	165	92690	16.545	28.697	0.080
	2192.1	654	663.1	0.298	0.388	3.380	258.9	196.2	1475.7	1.320	3.882	0.047
	1552.4	148.5	376.5	0.096	0.082	6.213	121.6	60.6	745.8	2.007	4.818	0.170
	390.4	27.3	244.4	0.070	0.064	14.046	73.3	17.4	184.9	4.213	10.040	0.057
	10644	2873	715	0.270	0.325	3.686	506	194	808	2.608	5.763	0.807
	2871.9	226	194.4	0.079	0.069	11.641	117.1	16.7	3770.8	7.012	14.976	0.066
	465.2	19.5	3	0.042	0.035	3.333	8.4	0.9	557.2	9.333	15.444	0.071
	150.1	26.1	14.5	0.174	0.147	2.636	11.2	5.5	474.2	2.036	4.309	0.035
2008	672062	33674	38931	0.050	0.023	5.178	18888	7518	714760	2.512	5.347	0.097
	453669	23645	21147	0.052	0.032	2.387	12594	8859	418750	1.422	2.957	0.076
	541002	22108	19951	0.041	0.030	3.256	11525	6127	382281	1.881	3.564	0.142
	428189	16404	10288	0.038	0.031	2.378	7353	4327	429426	1.699	3.334	0.097
	131662	4537	5177	0.034	0.019	27.247	3240	190	98070	17.053	25.532	0.118
	3238.1	944.4	1038.2	0.292	0.401	4.324	354.6	240.1	3298.9	1.477	4.474	0.031
	1850.5	193.9	393.5	0.105	0.090	4.160	144.7	94.6	1108.1	1.530	3.812	0.163
	544.1	47.2	291.5	0.087	0.078	11.042	85	26.4	456.1	3.220	7.913	0.058
	15762	2386	1251	0.151	0.180	5.416	619	231	3000	2.680	5.424	0.392
	3462.6	333.9	191.1	0.096	0.080	5.308	133.4	36	4391.5	3.706	7.200	0.077
	497.8	23.2	4.6	0.047	0.038	3.538	10.2	1.3	593.9	7.846	12.462	0.092
	178.8	34.5	14.8	0.193	0.167	2.792	13.7	5.3	552.4	2.585	4.925	0.051
2009	628987	32569	39731	0.052	0.026	4.084	19871	9729	662530	2.042	4.480	0.077
	426079	17388	19789	0.041	0.024	1.936	11216	10220	318202	1.097	2.236	0.109
	519321	21899	20049	0.042	0.033	3.035	10816	6606	356365	1.637	3.305	0.122
	448155	16356	11850	0.036	0.031	2.386	7898	4967	427774	1.590	3.128	0.080
	129297	3998	5349	0.031	0.017	28.452	3097	188	107921	16.473	25.580	0.164
	5607.4	1273.9	1282.7	0.227	0.407	4.555	508.4	281.6	7107.4	1.805	4.918	0.038
	1867.2	185.7	445.5	0.099	0.084	2.375	168.2	187.6	881.4	0.897	2.128	0.240

	604.7	61.5	399.9	0.102	0.083	9.659	121.5	41.4	816.3	2.935	6.560	0.061
	20994	2708	1608	0.129	0.154	5.089	625	316	1700	1.978	4.206	1.087
	3694.4	278.5	200.2	0.075	0.068	6.256	125	32	4248.7	3.906	7.931	0.062
	542.5	24.5	2.9	0.045	0.038	2.636	13.2	1.1	660.6	12.000	14.818	0.103
	196.8	32	17.6	0.163	0.143	3.826	13.6	4.6	662.4	2.957	5.978	0.038
2010	620738	28987	40501	0.047	0.023	3.256	20770	12437	704906	1.670	3.569	0.047
	443765	16587	26525	0.037	0.028	2.648	13097	10018	351394	1.307	2.527	0.064
	522682	23385	19312	0.045	0.034	2.577	12537	7493	387598	1.673	3.317	0.080
	469021	16862	13174	0.036	0.030	2.347	8794	5612	454135	1.567	3.037	0.061
	123109	4191	5242	0.034	0.016	11.225	3098	467	118704	6.634	11.244	0.103
	10916.2	2057.8	1683.6	0.189	0.315	4.487	715	375.2	10449.9	1.906	4.831	0.047
	1982.8	209.9	415.9	0.106	0.085	2.255	185.9	184.4	911.6	1.008	2.367	0.189
	570.8	54.1	430.7	0.095	0.081	6.496	134.4	66.3	1167.9	2.027	4.922	0.039
	30487	3317	1957	0.109	0.127	5.544	699	353	825	1.980	4.516	2.759
	3788.5	265	168.1	0.070	0.064	6.113	130	27.5	4567	4.727	10.404	0.043
	613	16.8	2.2	0.027	0.026	2.750	11.4	0.8	702.4	14.250	18.875	0.084
	245.2	31.3	17.9	0.128	0.104	5.114	15.4	3.5	719.3	4.400	9.429	0.028
2011	686236	29749	43839	0.043	0.021	3.528	21736	12425	759227	1.749	3.744	0.041
	472615	17619	28202	0.037	0.028	2.675	14425	10542	338709	1.368	2.610	0.061
	515443	24429	21300	0.047	0.033	2.664	13642	7996	432226	1.706	3.318	0.062
	490539	18462	15033	0.038	0.031	2.382	10243	6312	472740	1.623	3.077	0.053
	130736	4482	5092	0.034	0.016	9.395	3477	542	176094	6.415	10.022	0.065
	18408.2	3326	2319.6	0.181	0.301	4.271	992.8	543.1	11660.1	1.828	4.578	0.064
	2429.1	199.7	411.2	0.082	0.068	2.344	199.3	175.4	1215.4	1.136	2.574	0.139
	709.4	20.7	827.4	0.029	0.025	10.140	210.8	81.6	1350.2	2.583	5.463	0.055
	41690	4651	2700	0.112	0.126	4.945	893	546	1396	1.636	3.963	2.044
	4435.1	324.8	222.9	0.073	0.067	11.145	130.7	20	4273	6.535	15.720	0.042
	651.2	17.6	3.4	0.027	0.023	1.889	12.9	1.8	720	7.167	9.444	0.070
	254.2	32.1	19.9	0.126	0.100	6.219	17.3	3.2	932.9	5.406	10.938	0.018
2012	709117	33966	51012	0.048	0.024	3.242	23578	15733	784811	1.499	2.871	0.044

	533347	22002	28578	0.041	0.031	2.376	16228	12026	472283	1.349	2.348	0.041
	577341	29302	25551	0.051	0.036	2.655	15787	9624	541598	1.640	3.227	0.052
	483768	19853	17167	0.041	0.032	2.683	11425	6398	495195	1.786	3.302	0.051
	143901	4754	6076	0.033	0.015	9.435	3583	644	185311	5.564	9.500	0.064
	31116.3	5422.2	2501.5	0.174	0.300	3.586	1346.9	697.5	18870.6	1.931	4.292	0.054
	2931	214.3	425.4	0.073	0.063	7.411	245.8	57.4	1787.3	4.282	8.270	0.130
	1032.7	42	888.2	0.041	0.017	12.545	258.1	70.8	1780.3	3.645	6.826	0.034
	54625	6338	3206	0.116	0.131	6.083	1184	527	4295	2.247	4.854	0.882
	5244.1	305.7	245.8	0.058	0.048	12.869	165.5	19.1	4738.2	8.665	17.524	0.043
	716.8	19.9	4.4	0.028	0.024	2.933	13.7	1.5	781.8	9.133	12.000	0.063
	300.2	37.2	22.6	0.124	0.088	7.063	20.2	3.2	997.6	6.313	11.938	0.022
2013	758986	39095	56114	0.052	0.025	3.324	26762	16882	852656	1.585	3.083	0.038
	610498	28195	26877	0.046	0.035	1.998	17267	13453	543396	1.284	2.236	0.035
	618379	32351	26997	0.052	0.037	2.528	17593	10679	587689	1.647	3.223	0.047
	532160	21419	19174	0.040	0.031	2.812	12629	6818	545387	1.852	3.376	0.046
	158718	5416	6915	0.034	0.015	9.195	3995	752	204903	5.313	8.934	0.056
	34058.3	7300.1	2748.8	0.214	0.240	3.214	1536.1	855.3	24964.6	1.796	3.790	0.067
	3416	226.3	527.4	0.066	0.046	9.803	299.2	53.8	2161.1	5.561	10.428	0.117
	1214.6	84.2	812.5	0.069	0.033	12.462	257.8	65.2	2124	3.954	7.847	0.034
	60281	7677	3566	0.127	0.145	7.307	1527	488	7634	3.129	5.875	0.593
	5123.9	332.4	210.1	0.065	0.049	7.696	180.2	27.3	5048.3	6.601	12.363	0.047
	771	22.3	6.1	0.029	0.025	4.357	16.1	1.4	824	11.500	14.571	0.061
	336.9	38.9	21.3	0.115	0.084	4.532	20	4.7	953.3	4.255	8.447	0.020
2014	819780	45152	60100	0.055	0.025	3.591	28789	16737	946261	1.720	3.380	0.040
	696311	30938	34130	0.044	0.035	2.355	20697	14495	601315	1.428	2.421	0.034
	646637	35601	27419	0.055	0.039	2.453	19334	11177	622721	1.730	3.295	0.048
	583884	23137	20180	0.040	0.031	2.596	13838	7773	591635	1.780	3.252	0.050
	183692	5922	8614	0.032	0.015	12.201	4520	706	221377	6.402	10.789	0.057
	36671.6	8356.5	3248.6	0.228	0.236	3.827	1551.1	848.8	31330.5	1.827	4.748	0.068
	3980.5	260.8	627.6	0.066	0.040	11.268	350.7	55.7	2706.6	6.296	11.627	0.135

	1164.6	110.5	752.1	0.095	0.049	11.995	287.3	62.7	2141.3	4.582	7.872	0.037
	59201	7462	2971	0.126	0.169	6.530	1326	455	6764	2.914	6.288	0.693
	5942.6	340.5	226.5	0.057	0.046	8.420	186.4	26.9	5797.1	6.929	13.323	0.046
	802.4	24	7.8	0.030	0.024	5.200	17.4	1.5	923.8	11.600	14.733	0.059
	427.2	45.1	21.5	0.106	0.073	3.525	22.7	6.1	1068.5	3.721	7.426	0.020
2015	917858	49310	65800	0.054	0.027	3.724	31918	17670	1049312	1.806	3.557	0.040
	762596	38410	33484	0.050	0.039	2.056	23245	16288	665743	1.427	2.364	0.035
	700149	38407	28740	0.055	0.036	2.169	20902	13252	683799	1.577	2.944	0.051
	643141	24312	21231	0.038	0.028	2.417	14296	8784	656591	1.628	3.078	0.055
	219272	6753	9956	0.031	0.015	13.657	5256	729	279820	7.210	12.058	0.052
	41472.6	9589.4	3874.4	0.231	0.232	3.488	2166.8	1110.8	39198.4	1.951	4.144	0.062
	5372.9	307	649.6	0.057	0.035	11.278	382.1	57.6	3275.9	6.634	11.981	0.128
	1235.1	132.6	764.9	0.107	0.038	10.267	307.6	74.5	2830.8	4.129	7.129	0.032
	15767	4603	2088	0.292	0.104	17.256	1120	121	21326	9.256	22.471	0.216
	6967.3	397.7	237.5	0.057	0.047	5.982	211.4	39.7	6726.6	5.325	10.259	0.050
	872.8	26.4	8.9	0.030	0.025	3.870	17.9	2.3	980.8	7.783	10.000	0.063
	458.6	51.4	22.3	0.112	0.079	3.141	25.6	7.1	1169.1	3.606	7.197	0.022
MEAN	**191573.6**	**9042.7**	**9875.9**	**0.100**	**0.097**	**6.574**	**5316.4**	**3012.2**	**184828.5**	**4.061**	**7.664**	**0.139**
STDV	**257294.1**	**12046.3**	**14451.9**	**0.151**	**0.176**	**7.219**	**7535.4**	**4692.5**	**259397.0**	**3.636**	**5.986**	**0.325**
MAX	**917858.0**	**49310.0**	**65800.0**	**1.361**	**1.528**	**49.038**	**31918.0**	**17670.0**	**1049312.0**	**17.05**	**33.01**	**2.759**
MIN	**95.300**	**11.600**	**2.100**	**0.023**	**0.014**	**0.126**	**7.100**	**0.800**	**94.300**	**0.169**	**2.128**	**0.018**

APPENDIX 9B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *SOUTH AFRICA*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	Standard	0.141	***Mean***	**0.187**
	FRB	0.120		
	ABSA	0.152		
	Nedbank	0.133		
	Investec	0.185		
	Capitec	0.031		
	Sasfin	1.000		
	Bidvest	0.108		
	ABC	0.077		
	Mercantile	0.143		
	GBS	0.099		
	Habib	0.056		
2006	Standard	0.118	***Mean***	**0.168**
	FRB	0.123		
	ABSA	0.110		
	Nedbank	0.112		
	Investec	0.127		
	Capitec	0.039		
	Sasfin	1.000		
	Bidvest	0.071		
	ABC	0.060		
	Mercantile	0.111		
	GBS	0.099		
	Habib	0.045		
2007	Standard	0.965	***Mean***	**0.814**
	FRB	0.816		
	ABSA	0.992		
	Nedbank	0.988		
	Investec	1.000		
	Capitec	0.663		
	Sasfin	0.774		
	Bidvest	0.678		
	ABC	0.778		
	Mercantile	0.801		
	GBS	0.849		
	Habib	0.465		
2008	Standard	0.837	***Mean***	**0.775**

	FRB	0.798		
	ABSA	0.954		
	Nedbank	1.000		
	Investec	0.839		
	Capitec	0.694		
	Sasfin	0.723		
	Bidvest	0.673		
	ABC	0.831		
	Mercantile	0.787		
	GBS	0.747		
	Habib	0.411		
2009	Standard	0.735	***Mean***	**0.737**
	FRB	0.789		
	ABSA	0.934		
	Nedbank	0.943		
	Investec	0.811		
	Capitec	0.628		
	Sasfin	0.610		
	Bidvest	0.590		
	ABC	1.000		
	Mercantile	0.801		
	GBS	0.581		
	Habib	0.421		
2010	Standard	0.586	***Mean***	**0.618**
	FRB	0.646		
	ABSA	0.678		
	Nedbank	0.758		
	Investec	0.651		
	Capitec	0.649		
	Sasfin	0.532		
	Bidvest	0.470		
	ABC	1.000		
	Mercantile	0.513		
	GBS	0.588		
	Habib	0.347		
2011	Standard	0.566	***Mean***	**0.593**
	FRB	0.585		
	ABSA	0.591		
	Nedbank	0.656		

	Investec	0.540		
	Capitec	0.686		
	Sasfin	0.571		
	Bidvest	0.509		
	ABC	1.000		
	Mercantile	0.584		
	GBS	0.529		
	Habib	0.300		
2012	Standard	0.599	***Mean***	**0.603**
	FRB	0.585		
	ABSA	0.611		
	Nedbank	0.640		
	Investec	0.617		
	Capitec	0.774		
	Sasfin	0.481		
	Bidvest	0.481		
	ABC	1.000		
	Mercantile	0.553		
	GBS	0.579		
	Habib	0.316		
2013	Standard	0.665	***Mean***	**0.644**
	FRB	0.681		
	ABSA	0.678		
	Nedbank	0.737		
	Investec	0.713		
	Capitec	0.707		
	Sasfin	0.452		
	Bidvest	0.525		
	ABC	1.000		
	Mercantile	0.556		
	GBS	0.633		
	Habib	0.385		
2014	Standard	0.623	***Mean***	**0.604**
	FRB	0.629		
	ABSA	0.602		
	Nedbank	0.682		
	Investec	0.700		
	Capitec	0.692		
	Sasfin	0.398		

	Bidvest	0.413		
	ABC	1.000		
	Mercantile	0.560		
	GBS	0.578		
	Habib	0.368		
2015	Standard	0.875	***Mean***	**0.783**
	FRB	0.842		
	ABSA	0.839		
	Nedbank	1.000		
	Investec	0.988		
	Capitec	0.812		
	Sasfin	0.590		
	Bidvest	0.555		
	ABC	0.729		
	Mercantile	0.789		
	GBS	0.860		
	Habib	0.512		

APPENDIX 10A: DESCRIPTIVE STATISTICS OF THE DATA: *SWAZILAND*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	1349	116	80	0.086	0.072	1.810	60	44	1454	1.364	2.932	0.028
	603	51	41	0.084	0.063	3.509	30.7	12	705	2.647	5.440	0.040
	598	42	53	0.071	0.056	3.889	32	14	322	2.356	4.430	0.079
	921	54	21	0.059	0.067	0.433	47.2	48	326	0.987	1.529	0.037
2006	1218	126	90	0.104	0.059	2.161	66.9	42	1648	1.612	3.337	0.039
	688	59	52	0.085	0.060	3.497	36.5	15	841	2.450	4.557	0.031
	876	56	60	0.064	0.057	5.103	35.8	12	821	3.060	6.009	0.040
	945	50	31	0.053	0.060	0.528	53.2	58	344	0.913	1.449	0.042
2007	1667	163	97	0.098	0.070	1.861	76.1	52	2189	1.466	2.938	0.058
	758	70	61	0.092	0.064	4.522	34.4	13	962	2.567	4.896	0.044
	970	67	62	0.069	0.060	5.469	39.2	11	1005	3.469	6.726	0.054
	1058	61	50	0.058	0.066	0.815	61.4	62	465	0.997	1.664	0.041
2008	1703	198	156	0.116	0.088	2.340	95.3	67	2170	1.429	2.685	0.068
	814	87	74	0.107	0.081	4.205	40.8	18	988	2.318	4.761	0.058
	826	85	72	0.103	0.085	4.993	44.2	15	1298	3.048	5.903	0.071
	1102	98	44	0.089	0.103	0.753	61.7	59	680	1.049	1.881	0.044
2009	1347	160	159	0.119	0.054	2.431	100.8	65	3008	1.546	3.124	0.039
	855	101	88	0.118	0.064	3.682	45.2	24	1442	1.891	3.808	0.046
	1366	95	84	0.069	0.060	5.728	54.7	15	1686	3.721	6.891	0.038
	1203	66	59	0.055	0.060	1.105	70	53	719	1.316	2.075	0.095
2010	1458	154	168	0.106	0.054	2.314	113.4	73	2779	1.562	3.018	0.042
	1188	111	106	0.093	0.053	4.297	62.7	25	1766	2.549	4.549	0.027
	1248	110	94	0.088	0.067	4.875	57	19	1803	2.969	5.990	0.030
	1326	77	72	0.058	0.056	1.405	71.8	51	812	1.411	2.271	0.062
2011	2162	167	164	0.077	0.046	2.378	126.6	69	3196	1.840	3.203	0.031

	1343	123	120	0.092	0.059	5.046	59.3	24	1737	2.492	4.857	0.030
	1961	118	100	0.060	0.055	5.175	57	19	1684	2.938	5.887	0.038
	1250	72	94	0.057	0.052	1.222	73.2	77	934	0.949	1.519	0.059
2012	2049	186	185	0.091	0.051	2.095	113.6	88	3196	1.289	2.598	0.040
	1474	129	151	0.087	0.060	7.215	63.8	21	1650	3.053	6.579	0.017
	1813	120	112	0.066	0.056	7.121	38.4	16	2011	2.446	6.752	0.032
	1297	78	101	0.060	0.052	1.234	81	82	941	0.993	1.635	0.053
2013	2791	207	220	0.074	0.047	2.433	129.9	90	4044	1.439	2.868	0.034
	1567	139	188	0.088	0.054	8.450	76.6	22	2065	3.450	7.347	0.016
	2249	129	131	0.057	0.051	6.708	65.4	20	1972	3.354	7.154	0.029
	1316	72	113	0.054	0.046	1.423	83.6	80	904	1.049	1.821	0.054
2014	2554	242	263	0.095	0.066	2.897	142.5	91	3728	1.573	3.243	0.032
	2054	173	237	0.084	0.051	9.131	82.8	26	2987	3.185	7.827	0.014
	2745	163	139	0.059	0.052	6.526	69.8	21	2506	3.277	7.235	0.027
	1414	79	140	0.056	0.051	1.158	91	121	940	0.752	1.285	0.051
2015	2731	288	266	0.106	0.063	3.196	168.9	83	4456	2.032	3.826	0.023
	2345	211	278	0.090	0.065	10.179	109.4	27	2704	4.007	8.425	0.020
	2824	195	155	0.069	0.060	6.668	78	23	3107	3.362	7.379	0.028
	1366	84	134	0.061	0.052	1.060	96.6	127	1054	0.762	1.252	0.047
MEAN	**1486.2**	**118.8**	**117.3**	**0.080**	**0.061**	**3.705**	**72.7**	**45.2**	**1728.4**	**2.112**	**4.217**	**0.041**
STDV	**624.0**	**57.5**	**65.0**	**0.020**	**0.011**	**2.476**	**31.5**	**31.4**	**1052.8**	**0.942**	**2.139**	**0.017**
MAX	**2824.4**	**288.4**	**277.9**	**0.119**	**0.103**	**10.179**	**168.9**	**126.8**	**4456.1**	**4.007**	**8.425**	**0.095**
MIN	**598**	**42**	**21**	**0.053**	**0.046**	**0.433**	**31**	**11**	**322**	**0.752**	**1.252**	**0.014**

APPENDIX 10B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *SWAZILAND*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	Standard	0.849	***Mean***	**0.877**
	FNB	0.767		
	Nedbank	1.000		
	Swaz Dev & Sav	0.894		
2006	Standard	0.961	***Mean***	**0.966**
	FNB	0.920		
	Nedbank	1.000		
	Swaz Dev & Sav	0.982		
2007	Standard	0.975	***Mean***	**0.981**
	FNB	1.000		
	Nedbank	0.967		
	Swaz Dev & Sav	0.982		
2008	Standard	0.943	***Mean***	**0.922**
	FNB	0.963		
	Nedbank	0.783		
	Swaz Dev & Sav	1.000		
2009	Standard	0.756	***Mean***	**0.889**
	FNB	1.000		
	Nedbank	0.904		
	Swaz Dev & Sav	0.898		
2010	Standard	0.777	***Mean***	**0.915**
	FNB	0.935		
	Nedbank	0.946		
	Swaz Dev & Sav	1.000		
2011	Standard	0.663	***Mean***	**0.841**
	FNB	0.916		
	Nedbank	1.000		
	Swaz Dev & Sav	0.785		
2012	Standard	0.733	***Mean***	**0.874**
	FNB	0.989		
	Nedbank	1.000		
	Swaz Dev & Sav	0.774		
2013	Standard	0.738	***Mean***	**0.860**
	FNB	0.916		
	Nedbank	1.000		
	Swaz Dev & Sav	0.785		

2014	Standard	0.807	***Mean***	**0.873**
	FNB	0.878		
	Nedbank	1.000		
	Swaz Dev & Sav	0.807		
2015	Standard	0.770	***Mean***	**0.869**
	FNB	1.000		
	Nedbank	0.951		
	Swaz Dev & Sav	0.755		

APPENDIX 11A: DESCRIPTIVE STATISTICS OF THE DATA: *TANZANIA*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	241941	26497.7	19043.9	0.110	0.076	5.815	5576	3274.8	369338.7	1.703	6.201	0.016
	134862.5	14179.4	11030.4	0.105	0.065	2.537	4884.3	4347	197722.4	1.124	4.651	0.025
	31958.9	3442.1	1979.9	0.108	0.069	1.138	1348.7	1740.5	48368.5	0.775	1.623	0.020
	44568	12049.4	8062.9	0.270	0.038	5.005	3775.6	1611	269769.8	2.344	6.109	0.010
	150733	12521.2	6718.5	0.083	0.059	3.700	3037.8	1815.8	172167.7	1.673	6.327	0.034
	7470.1	607.6	561.2	0.081	0.059	0.075	642.5	7470.1	10557	0.086	0.160	0.047
2006	272081.5	31907.3	20401	0.117	0.082	7.964	7546	2561.7	463684.7	2.946	11.216	0.016
	166409.4	17029	14592.7	0.102	0.061	2.987	6577.7	4884.6	248138.1	1.347	4.103	0.032
	42904.8	4622.7	2755.3	0.108	0.071	1.317	1852.6	2092.6	64054	0.885	2.020	0.028
	66972.7	22309.2	12974.3	0.333	0.049	7.282	3837.9	1781.6	356048.7	2.154	3.937	0.025
	206986.1	16852.3	11188.9	0.081	0.058	7.350	3435.2	1522.3	198919.2	2.257	9.137	0.065
	9055	795.8	504.9	0.088	0.038	0.056	1030.9	9055	13886.4	0.114	0.202	0.060
2007	344057.8	40926.4	30078.2	0.119	0.085	11.324	10139.7	2656.1	485588	3.818	11.426	0.034
	144881.6	19681.5	22034.9	0.136	0.046	4.178	8599.7	5274.4	314570	1.630	4.497	0.021
	62744.7	6044	3586	0.096	0.064	1.422	2478.6	2522.4	85327.9	0.983	2.004	0.036
	95514	28469.7	7745	0.298	0.074	4.575	4312.6	1692.8	272313.3	2.548	4.645	0.064
	234029.9	22911.2	16174.6	0.098	0.056	1.028	8917.3	15731.4	249893.2	0.567	1.441	0.056
	21627.9	1667.9	1513	0.077	0.038	0.070	1346.4	21627.9	27460.3	0.062	0.133	0.065
2008	446826	34505.2	29829.1	0.077	0.061	12.776	13745.6	2334.7	597468.5	5.888	16.850	0.044
	205991.4	25034	14376.5	0.122	0.064	2.693	9089.4	5338.1	283602.5	1.703	4.287	0.016
	93640.5	7562.9	4285.5	0.081	0.055	1.058	3510.8	4048.8	127409.9	0.867	1.816	0.030
	146810.9	19299.6	16605.5	0.131	0.067	13.219	4102.9	1256.2	217657.8	3.266	9.326	0.057
	312868.1	36702.9	17057.7	0.117	0.083	0.789	20724.2	21615.6	402433.4	0.959	2.206	0.035
	39877.3	3283.8	2726.5	0.082	0.037	0.068	2089.7	39877.3	52328.5	0.052	0.109	0.066
2009	359988.3	39658.3	31640.6	0.110	0.055	13.128	16814	2410.1	652437.8	6.976	17.695	0.024

	219474	25896.1	21326.3	0.118	0.054	4.681	13361.8	4555.5	443291.6	2.933	6.684	0.014
	120513.6	9902.8	4606.2	0.082	0.057	0.879	3997.5	5240	164562.6	0.763	1.710	0.032
	125777.1	14012.1	30207.5	0.111	0.043	20.537	4735.4	1470.9	286287.3	3.219	7.819	0.018
	258072.8	29342.2	14929	0.114	0.089	0.766	18635.1	19496.1	328717	0.956	1.819	0.043
	62234.3	4991.1	4232.9	0.080	0.038	0.068	2988.4	62234.3	87447	0.048	0.102	0.065
2010	403407.2	37081.75	30734.85	0.092	0.051	12.955	18704.2	2372.4	624953.2	7.884	17.279	0.029
	334270.8	25827.2	28916.3	0.077	0.047	4.469	17000.3	6469.8	454272.6	2.628	6.254	0.015
	149603.1	13256.5	6864.4	0.089	0.058	1.262	5481.3	5440.2	220951.8	1.008	2.184	0.023
	98761	17276.7	29364.4	0.175	0.038	16.760	6739.2	1752.1	367536.9	3.846	8.361	0.005
	256927.6	28390.1	24371.6	0.110	0.069	1.397	22212.8	17447.4	398797.3	1.273	2.618	0.023
	82456.7	7884.2	6744	0.096	0.039	0.082	4392.6	82456.7	131885.6	0.053	0.125	0.060
2011	630475.2	45591.7	54054.7	0.072	0.051	24.234	19424.3	2230.5	985688.9	8.708	22.591	0.014
	475098	39103.4	37225.3	0.082	0.063	5.126	24005.6	7262.5	592446	3.305	6.644	0.017
	194596.9	17502.4	8577.8	0.090	0.066	1.091	7172.2	7859.6	269381.4	0.913	1.964	0.022
	140939.3	14977.4	31760	0.106	0.023	15.244	8535.6	2083.5	592628.2	4.097	8.646	0.008
	281966	28249.5	22127.4	0.100	0.057	1.602	25259	13815.4	439811.1	1.828	3.543	0.017
	113433.8	9577.8	5867.9	0.084	0.049	0.052	6118.4	113433.8	173113.8	0.054	0.135	0.060
2012	446722.3	57899.6	50192.6	0.130	0.061	15.452	19336.6	3248.2	894366.3	5.953	17.025	0.033
	508840.9	54711.1	41778.8	0.108	0.075	4.251	30993.1	9828.9	689847.1	3.153	5.924	0.063
	258966.4	21334.8	9702.3	0.082	0.062	1.194	7963.2	8127.4	306308.3	0.980	2.161	0.033
	184167.8	20165.9	24689.4	0.109	0.031	15.049	9291.6	1640.6	546911.3	5.664	11.997	0.010
	322408.7	29303.4	25875.6	0.091	0.061	2.934	25179.2	8818.8	445969.3	2.855	5.564	0.033
	169794.9	12406.9	8629.6	0.073	0.042	0.051	7490	169794.9	221459.6	0.044	0.101	0.092
2013	595785.4	74727.7	42331.5	0.125	0.069	8.703	22792.1	4864.1	974725.1	4.686	12.432	0.021
	459690	51297.5	52529.2	0.112	0.067	5.535	32827.4	9489.8	700991.4	3.459	7.401	0.033
	334120	29407.2	11945.4	0.088	0.066	1.133	9945.7	10544.5	399672.8	0.943	2.097	0.038
	214367.7	29244.1	22314.5	0.136	0.046	13.285	7815.1	1679.7	581042.8	4.653	11.892	0.007
	342213.7	37225.2	22985.4	0.109	0.087	3.113	23793	7384.7	431688.1	3.222	6.627	0.037
	216950.4	15475.8	11964.3	0.071	0.047	0.055	10139.9	216950.4	252183.6	0.047	0.098	0.112
2014	729372.6	90641.3	39493.6	0.124	0.077	8.132	25039.9	4856.8	991641	5.156	13.399	0.023

	396809.5	60847.1	40600.1	0.153	0.075	4.354	33440.3	9325.2	764082.6	3.586	7.819	0.018
	416110.1	36078.6	16265.5	0.087	0.060	1.357	11273.4	11990.5	577529.7	0.940	2.260	0.037
	178260.1	34312.6	21751.3	0.192	0.050	15.206	8813.1	1430.4	614300.9	6.161	15.006	0.011
	355325.5	36722.7	23592.4	0.103	0.083	2.727	26384.8	8651	470158.9	3.050	5.913	0.036
	221592.8	13981	13952.7	0.063	0.034	0.063	9916.3	221592.8	311486.1	0.045	0.118	0.094
2015	765762.3	70792.1	58329.5	0.092	0.063	11.291	27387.9	5165.8	1221126	5.302	14.772	0.028
	529965.8	67646	51590.7	0.128	0.065	3.623	41190.9	14240.6	969870	2.892	5.967	0.015
	550969.4	47069.7	21573	0.085	0.062	1.664	13238.7	12962	734114.6	1.021	2.684	0.038
	220470.4	35987.6	22928.3	0.163	0.050	16.007	9560.6	1432.4	662704	6.675	15.884	0.016
	421782.4	39971.3	27552.4	0.095	0.074	1.751	29695.1	15732.4	615059.9	1.888	3.856	0.032
	220505	24260	7872	0.110	0.075	0.036	10190	220505	305148	0.046	0.123	0.102
MEAN	**255966.1**	**27408.1**	**20300.3**	**0.113**	**0.059**	**5.450**	**12301.2**	**22794.2**	**415534.9**	**2.465**	**6.087**	**0.036**
STDV	**176986.6**	**19068.6**	**14554.7**	**0.048**	**0.015**	**5.913**	**9705.2**	**50930.7**	**272688.4**	**2.142**	**5.469**	**0.023**
MAX	**765762.3**	**90641.3**	**58329.5**	**0.333**	**0.089**	**24.234**	**41190.9**	**221592.8**	**1221125.6**	**8.708**	**22.591**	**0.112**
MIN	**7470.1**	**607.6**	**504.9**	**0.063**	**0.023**	**0.036**	**642.5**	**1256.2**	**10557**	**0.044**	**0.098**	**0.005**

APPENDIX 11B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *TANZANIA*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	Standard Chart	0.925	***Mean***	0.828
	Stanbic	0.946		
	Diamond Trust Bank	0.848		
	CitiBank	0.407		
	Barclays	1.000		
	CBA	0.842		
2006	Standard Chart	0.671	***Mean***	0.687
	Stanbic	0.761		
	Diamond Trust Bank	0.700		
	CitiBank	0.418		
	Barclays	1.000		
	CBA	0.574		
2007	Standard Chart	0.876	***Mean***	0.786
	Stanbic	0.711		
	Diamond Trust Bank	0.755		
	CitiBank	0.594		
	Barclays	1.000		
	CBA	0.781		
2008	Standard Chart	0.825	***Mean***	0.854
	Stanbic	0.884		
	Diamond Trust Bank	0.739		
	CitiBank	1.000		
	Barclays	0.850		
	CBA	0.828		
2009	Standard Chart	0.794	***Mean***	0.866
	Stanbic	0.776		
	Diamond Trust Bank	0.804		
	CitiBank	1.000		
	Barclays	0.955		
	CBA	0.869		
2010	Standard Chart	0.885	***Mean***	0.883
	Stanbic	1.000		
	Diamond Trust Bank	0.819		
	CitiBank	0.779		
	Barclays	0.937		
	CBA	0.878		

2011	Standard Chart	0.837	***Mean***	0.789
	Stanbic	1.000		
	Diamond Trust Bank	0.817		
	CitiBank	0.514		
	Barclays	0.825		
	CBA	0.742		
2012	Standard Chart	0.824	***Mean***	0.851
	Stanbic	1.000		
	Diamond Trust Bank	0.928		
	CitiBank	0.578		
	Barclays	0.917		
	CBA	0.859		
2013	Standard Chart	0.865	***Mean***	0.895
	Stanbic	1.000		
	Diamond Trust Bank	0.927		
	CitiBank	0.611		
	Barclays	0.999		
	CBA	0.966		
2014	Standard Chart	1.000	***Mean***	0.849
	Stanbic	0.857		
	Diamond Trust Bank	0.844		
	CitiBank	0.578		
	Barclays	0.965		
	CBA	0.850		
2015	Standard Chart	0.988	***Mean***	0.933
	Stanbic	0.963		
	Diamond Trust Bank	1.000		
	CitiBank	0.679		
	Barclays	0.987		
	CBA	0.982		

APPENDIX 12A: DESCRIPTIVE STATISTICS OF THE DATA: *ZAMBIA*

	OUTPUTS			PRICE OF OUTPUTS			INPUTS			PRICE OF INPUTS		
Year	***Loans***	***Interest Revenue***	***Non-Interest Revenue***	***Price of Loan***	***Price of Interest Revenue***	***Price of Non-interest Revenue***	***Labour Costs***	***Fixed Assets***	***Deposits***	***Price of Labour***	***Price of Capital***	***Price of Deposits***
2005	794.4	146.3	127.5	0.184	0.123	7.544	55.5	16.9	992.2	3.284	10.976	0.020
	366.516	113.541	70.653	0.310	0.116	2.658	60.302	26.577	967.324	2.269	4.468	0.016
	316639	134714	69028	0.425	0.097	1.041	78836	66303	1357664	1.189	2.575	0.008
	63059.3	16	9562.6	0.000	0.000	8.087	5932.8	1182.4	42273.5	5.018	13.585	0.205
	101446	35039.5	18028.5	0.345	0.080	2.892	9649.9	6233.9	338161.2	1.548	3.430	0.012
	7865.6	4516.4	8266.1	0.574	0.057	2.856	11101.5	2894.4	42886	3.836	4.249	0.025
2006	1092.7	116.9	116.9	0.107	0.084	3.302	97	35.4	1337.9	2.740	4.102	0.023
	698.536	123.593	102.216	0.177	0.080	3.994	71.844	25.591	1447.211	2.807	4.981	0.018
	532898	127628	101963	0.239	0.083	1.542	95639	66104	1523361	1.447	2.770	0.008
	95986	1023	10652	0.011	0.007	9.089	6076	1172	86947	5.184	12.782	0.090
	120188.3	33811	59637.4	0.281	0.072	9.537	11808.8	6253.4	544175.8	1.888	3.628	0.019
	8993.2	4858.6	11171.3	0.540	0.064	3.471	5993.9	3218.4	74835.9	1.862	4.529	0.020
2007	1781.8	185.6	151.1	0.104	0.112	1.181	67.2	127.9	1713.2	0.525	1.587	0.022
	779.87	173.736	115.122	0.223	0.136	4.013	86.882	28.685	1597.08	3.029	5.355	0.020
	863282	161612	120160	0.187	0.084	1.133	120564	106074	1798545	1.137	2.177	0.007
	134629	550	9201	0.004	0.003	1.541	9117	5969	114447	1.527	3.260	0.087
	144347.4	75271.3	23326	0.521	0.099	3.707	14049.9	6293	859715.2	2.233	4.670	0.025
	18296	7451	13327	0.407	0.086	2.231	7855.4	5974	106827	1.315	3.091	0.013
2008	2928.7	300.4	205.1	0.103	0.136	1.124	112.9	182.5	2253	0.619	1.966	0.027
	1062.666	193.48	125.688	0.182	0.126	4.325	135.039	29.063	2115.768	4.646	8.115	0.021
	1096317	260746	138511	0.238	0.133	1.081	128952	128148	2325203	1.006	2.193	0.008
	244397	12637	7673	0.052	0.047	1.472	10898	5213	125476	2.091	4.172	0.122
	268408.5	71738.6	72842.7	0.267	0.076	11.343	15374.4	6421.6	657286.8	2.394	5.049	0.050
	22553	13118	19916	0.582	0.147	2.295	9163	8679	134278	1.056	3.104	0.013
2009	2370.2	404.8	239	0.171	0.124	1.247	207.5	191.7	2247.4	1.082	2.131	0.064

	1006.235	209.6	182.011	0.208	0.107	7.191	122.443	25.311	2347.127	4.838	9.950	0.025
	1264913	325500	171166	0.257	0.147	1.226	149347	139581	2292358	1.070	2.185	0.017
	292192	22883	7775	0.078	0.063	1.148	14756	6770	150990	2.180	6.105	0.247
	246735.7	106977.6	37977.8	0.434	0.103	4.893	15838.9	7762.3	639934.9	2.040	4.353	0.043
	36593	13871	14938	0.379	0.121	1.809	13498	8259	127117	1.634	3.622	0.031
2010	2076.5	322	286.5	0.155	0.119	1.647	203.2	173.9	3177.2	1.168	2.673	0.048
	1198.587	195.492	255.646	0.163	0.072	9.796	134.343	26.097	3164.587	5.148	8.790	0.010
	1862217	324195	244088	0.174	0.116	1.436	169814	169938	2591242	0.999	2.128	0.017
	224001	48127	14688	0.215	0.182	1.492	19978	9847	174983	2.029	5.085	0.182
	257572.1	89358.1	55410.25	0.347	0.088	7.813	19356.6	7091.95	648610.9	2.729	4.668	0.044
	68334	15078	15061	0.221	0.143	0.841	14864	17906	187418	0.830	2.048	0.032
2011	2036.2	301	221.7	0.148	0.092	1.468	289.7	151	3638.7	1.919	2.374	0.021
	1820.825	257.413	221.904	0.141	0.082	8.577	143.389	25.872	3573.822	5.542	9.505	0.016
	1979389	393394	232648	0.199	0.102	1.015	207550	229140	3412319	0.906	1.838	0.018
	409102	49023	23246	0.120	0.093	0.980	22763	23731	234558	0.959	2.384	0.201
	451382	90444.1	40700.6	0.200	0.072	5.542	25407.8	7344.6	896559.1	3.459	5.185	0.014
	138189	16122	19316	0.117	0.110	0.971	21598	19883	290527	1.086	2.601	0.017
2012	3089.7	342.6	252.5	0.111	0.092	1.855	208.6	136.1	3731.6	1.533	3.005	0.025
	2264.492	321.696	298.721	0.142	0.090	10.500	169.155	28.449	3681.026	5.946	9.755	0.023
	2685699	461950	257836	0.172	0.093	1.065	237364	242129	4314918	0.980	1.966	0.021
	673722	48854	74122	0.073	0.063	2.675	35914	27704	394532	1.296	3.074	0.157
	422186	111067	82609	0.263	0.080	1.630	28408	50670	1058249	0.561	0.900	0.017
	192864	21271	23935	0.110	0.093	1.181	27256	20275	341399	1.344	3.115	0.030
2013	3180.4	348.8	242	0.110	0.086	2.030	222.5	119.2	4269.2	1.867	3.714	0.019
	2816.426	405.019	298.325	0.144	0.091	13.147	191.931	22.692	4267.129	8.458	14.436	0.018
	3060087	553383	284192	0.181	0.099	0.937	266152	303411	5514878	0.877	1.787	0.022
	906190	51769	107036	0.057	0.045	3.293	37561	32509	504821	1.155	2.918	0.161
	271324	135372	63244	0.499	0.069	2.107	34639	30011	1483650	1.154	1.602	0.013
	165526.5	18696.5	21625.5	0.113	0.068	1.077	31137	20079	315963	1.551	2.860	0.053
2014	3597.4	415.4	238.1	0.115	0.093	1.780	252.7	133.8	5125	1.889	3.380	0.024

	3169.325	465.049	346.501	0.147	0.108	13.926	248.01	24.881	5325.97	9.968	16.809	0.027
	3259456	645473	222149	0.198	0.130	0.809	307405	274635	5053720	1.119	2.205	0.027
	973034	23344	167558	0.024	0.015	4.431	46194	37815	807169	1.222	3.398	0.222
	397697	202127	86197	0.508	0.104	2.776	29272	31054	1239780	0.943	1.585	0.025
	301548	34259	31589	0.114	0.079	1.246	33455	25361	487749	1.319	2.977	0.050
2015	3388.9	382.1	240.05	0.113	0.080	1.898	259.9	126.5	4697.1	2.055	3.538	0.045
	3586.347	532.872	298.304	0.149	0.111	7.471	278.075	39.926	7457.805	6.965	12.726	0.029
	3638280	638000	429700	0.175	0.111	1.591	362785	270055	6033084	1.343	2.906	0.038
	1169698	48843	220092	0.042	0.027	2.043	55683	107706	1340536	0.517	1.818	0.180
	511181	221308	62274	0.433	0.130	2.332	27142	26706	1223018	1.016	2.085	0.025
	471789	45334	37718	0.096	0.076	1.609	37107	23437	607581	1.583	3.536	0.071
MEAN	**460838**	**86470**	**56770**	**0.210**	**0.091**	**3.545**	**42983**	**39373**	**796498**	**2.287**	**4.554**	**0.049**
STDV	**815685**	**153114**	**87533**	**0.145**	**0.035**	**3.301**	**77694**	**74218**	**1353569**	**1.912**	**3.506**	**0.059**
MAX	**3638280**	**645473**	**429700**	**0.582**	**0.182**	**13.926**	**362785**	**303411**	**6033084**	**9.968**	**16.809**	**0.247**
MIN	**366.52**	**16.00**	**70.65**	**0.000**	**0.000**	**0.809**	**56**	**17**	**967**	**0.517**	**0.900**	**0.007**

APPENDIX 12B: INDIVIDUAL BANK AND BANKING SECTOR COST EFFICIENCY: *ZAMBIA*

YEAR	DMU	COST EFFICIENCY FOR DMU_i	MEAN EFFICIENCY FOR THE SECTOR	
2005	Barclays	1.000	***Mean***	**0.754**
	Standard Chart	0.713		
	Zam Nat Com	0.572		
	Afri Bank Corp	0.643		
	CitiBank	0.598		
	Cavmont	1.000		
2006	Barclays	0.888	***Mean***	**0.812**
	Standard Chart	0.809		
	Zam Nat Com	0.784		
	Afri Bank Corp	0.566		
	CitiBank	0.823		
	Cavmont	1.000		
2007	Barclays	1.000	***Mean***	**0.773**
	Standard Chart	0.939		
	Zam Nat Com	0.804		
	Afri Bank Corp	0.347		
	CitiBank	0.634		
	Cavmont	0.913		
2008	Barclays	0.990	***Mean***	**0.848**
	Standard Chart	0.669		
	Zam Nat Com	0.775		
	Afri Bank Corp	0.722		
	CitiBank	0.932		
	Cavmont	1.000		
2009	Barclays	1.000	***Mean***	**0.773**
	Standard Chart	0.561		
	Zam Nat Com	0.764		
	Afri Bank Corp	0.742		
	CitiBank	0.825		
	Cavmont	0.745		
2010	Barclays	0.486	***Mean***	**0.577**
	Standard Chart	0.348		
	Zam Nat Com	0.566		
	Afri Bank Corp	1.000		
	CitiBank	0.587		
	Cavmont	0.473		
2011	Barclays	0.448	***Mean***	**0.560**

	Standard Chart	0.412		
	Zam Nat Com	0.584		
	Afri Bank Corp	1.000		
	CitiBank	0.477		
	Cavmont	0.437		
2012	Barclays	0.551	***Mean***	**0.692**
	Standard Chart	0.569		
	Zam Nat Com	0.592		
	Afri Bank Corp	1.000		
	CitiBank	0.632		
	Cavmont	0.808		
2013	Barclays	0.492	***Mean***	**0.645**
	Standard Chart	0.582		
	Zam Nat Com	0.555		
	Afri Bank Corp	1.000		
	CitiBank	0.493		
	Cavmont	0.745		
2014	Barclays	0.535	***Mean***	**0.738**
	Standard Chart	0.623		
	Zam Nat Com	0.750		
	Afri Bank Corp	0.792		
	CitiBank	1.000		
	Cavmont	0.727		
2015	Barclays	0.536	***Mean***	**0.653**
	Standard Chart	0.456		
	Zam Nat Com	0.712		
	Afri Bank Corp	0.673		
	CitiBank	1.000		
	Cavmont	0.538		

APPENDIX 13: TOBIT REGRESSION MODEL

Dependent Variable: CE
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 04/10/18 Time: 21:59
Sample (adjusted): 2006 2015
Included observations: 630 after adjustments
Left censoring (value) series: 0
Right censoring (value) series: 1
Convergence achieved after 5 iterations
Coefficient covariance computed using the Huber-White method

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.171073	0.044116	3.877843	0.0001
CE(-1)	0.808278	0.034216	23.62302	0.0000
NLCD	0.000700	0.000107	6.547002	0.0000
ROAA	0.008905	0.003573	2.492339	0.0127
FOR	0.041535	0.015365	2.703204	0.0069
LADSF	-0.000636	0.000262	-2.424775	0.0153
LLP	-0.000418	0.000183	-2.280311	0.0226
EQTY	-0.001271	0.001241	-1.024136	0.3058
DIV	0.008574	0.015868	0.540350	0.5890
LARG	0.015373	0.013621	1.128593	0.2591
GDPG	0.020896	0.008941	2.337085	0.0194
INFL	-0.004655	0.006722	-0.692445	0.4887
CRIS	-0.034192	0.013304	-2.570019	0.0102
POLS	-0.130061	0.038032	-3.419723	0.0006
Error Distribution				
SCALE:C(15)	0.155615	0.007723	20.14925	0.0000

Mean dependent var	0.738384	S.D. dependent var	0.255349
S.E. of regression	0.137053	Akaike info criterion	-0.381693
Sum squared resid	11.55180	Schwarz criterion	-0.275843
Log likelihood	135.2333	Hannan-Quinn criter.	-0.340578
Avg. log likelihood	0.214656		

Left censored obs	0	Right censored obs	121
Uncensored obs	509	Total obs	630

APPENDIX 14: PANEL LEAST SQUARES

Dependent Variable: CE
Method: Panel Least Squares
Date: 05/10/18 Time: 19:48
Sample (adjusted): 2006 2015
Periods included: 10
Cross-sections included: 63
Total panel (balanced) observations: 630

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.223004	0.034474	6.468778	0.0000
CE(-1)	0.742519	0.022206	33.43792	0.0000
NLCD	0.000194	4.50E-05	4.317200	0.0000
ROAA	0.007493	0.003078	2.434362	0.0152
FOR	0.026822	0.012724	2.107978	0.0354
LADSF	-0.000587	0.000218	-2.689423	0.0074
LLP	-0.000183	0.000211	-0.870834	0.3842
EQTY	-0.000304	0.000853	-0.356604	0.7215
DIV	0.014532	0.019639	0.739940	0.4596
LARG	0.016219	0.011608	1.397189	0.1629
GDPG	0.015532	0.008853	1.754435	0.0799
INFL	-0.003410	0.006669	-0.511352	0.6093
POLS	-0.109191	0.033852	-3.225520	0.0013
CRIS	-0.027116	0.012384	-2.189490	0.0289

R-squared	0.706796	Mean dependent var	0.738384
Adjusted R-squared	0.700608	S.D. dependent var	0.255349
S.E. of regression	0.139719	Akaike info criterion	-1.076400
Sum squared resid	12.02513	Schwarz criterion	-0.977606
Log likelihood	353.0659	Hannan-Quinn criter.	-1.038026
F-statistic	114.2250	Durbin-Watson stat	2.127158
Prob(F-statistic)	0.000000		

APPENDIX 15: AUTO-CORRELATION TEST

Date: 05/17/18 Time: 08:55
Sample: 2005 2015
Included observations: 630

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	0.036	0.036	0.8031	0.370
.|. |	.|. |	2	-0.007	-0.008	0.8324	0.660
.|. |	.|. |	3	0.040	0.041	1.8609	0.602
.|. |	.|. |	4	0.017	0.014	2.0385	0.729
.|. |	.|. |	5	-0.019	-0.020	2.2796	0.809
.|. |	.|. |	6	-0.020	-0.020	2.5247	0.866
.|. |	.|. |	7	-0.017	-0.017	2.7116	0.910
.|. |	.|. |	8	0.044	0.047	3.9674	0.860
.|. |	.|. |	9	-0.001	-0.002	3.9677	0.914

APPENDIX 16: CROSS-SECTIONAL DEPENDENCE TEST

Cross-Section Dependence Test
Series: TOBIT_RESID
Null hypothesis: No cross-section dependence (correlation)
Sample: 2005 2015
Periods included: 10
Cross-sections included: 63
Total panel observations: 630
Note: non-zero cross-section means detected in data
Cross-section means were removed during computation of correlations

Test	Statistic	Prob.
Pesaran CD	1.609087	0.1076

APPENDIX 17: WALD TESTS

Wald Test:
Equation: TOBIT_NORMAL_MODEL

Test Statistic	Value	df	Probability
F-statistic	134.9414	(12, 615)	0.0000
Chi-square	1619.296	12	0.0000

Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=C(7)=C(8)=C(9)=C(10)=C(11)=C(12)=C(13)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	0.808278	0.034216
C(3)	0.000700	0.000107
C(4)	0.008905	0.003573
C(5)	-0.000636	0.000262
C(6)	-0.000418	0.000183
C(7)	-0.001271	0.001241
C(8)	0.008574	0.015868
C(9)	0.015373	0.013621
C(10)	0.020896	0.008941
C(11)	-0.004655	0.006722
C(12)	-0.034192	0.013304
C(13)	-0.130061	0.038032

APPENDIX 18: PANEL GMM ESTIMATION

Dependent Variable: GDPP
Method: Panel Generalized Method of Moments
Transformation: First Differences
Date: 05/17/18 Time: 05:38
Sample (adjusted): 2007 2015
Periods included: 9
Cross-sections included: 12
Total panel (balanced) observations: 108
Difference specification instrument weighting matrix
Instrument specification: @DYN(GDPP, -1) CE(-1) CREB(-1) BIN POP(-1) DEP FDI GOV(-1) INFL(-1) TRAD(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CE	0.071295	0.025927	2.749836	0.0071
BIN	0.013958	0.007230	1.930583	0.0564
DEP	-0.057434	0.028304	-2.029170	0.0452
CREF*CE(-1)	0.003121	0.003537	0.882444	0.3797
GDPP(-1)	0.705022	0.051840	13.59994	0.0000
POP	0.145268	0.072310	2.008964	0.0473
CAP	-0.040429	0.018373	-2.200485	0.0301
INFL	-0.020030	0.007419	-2.699811	0.0082
TRAD	0.065798	0.034864	1.887261	0.0621
GOV	-0.015825	0.037485	-0.422171	0.6738

Effects Specification

Cross-section fixed (first differences)

Mean dependent var	0.025622	S.D. dependent var	0.030994
S.E. of regression	0.032609	Sum squared resid	0.104210
J-statistic	51.04549	Instrument rank	63
Prob(J-statistic)	0.550614		

APPENDIX 19: HAUSMAN ENDOGENEITY TEST

Correlated Random Effects - Hausman Test
Equation: WALD_TEST
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	37.426706	10	0.0000

APPENDIX 20: WALD TESTS

Wald Test:
Equation: WALD_TEST

Test Statistic	Value	df	Probability
F-statistic	3.745958	(4, 98)	0.0070
Chi-square	14.98383	4	0.0047

Null Hypothesis: C(1)=C(2)=C(3)=C(4)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	0.071295	0.025927
C(2)	0.013958	0.007230
C(3)	-0.057434	0.028304
C(4)	0.003121	0.003537