

AN ANALYSIS OF THE DETERMINANTS OF THE BANKING CRISES IN THE  
SOUTHERN AFRICAN DEVELOPMENT COMMUNITY (SADC)

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## **Abstract**

This study analysed the determinants of banking crises in the SADC region for the period 1985-2011. The probability of a banking crisis was estimated using a multinomial logit model on real GDP growth level, terms of trade, the ratio of private domestic credit to GDP and the ratio of M2 to foreign exchange reserves. The model was estimated for the pooled, non-systemic and systemic crises economies in order to determine if the impact of the determinants differs between systemic and non-systemic crises. This study found that the impact of the determinants differs between systemic and non-systemic crises as well as between one year prior to a crisis and the year when the crisis starts. Real GDP growth rate was found to be the leading indicator of banking crises one year prior to the start of a crisis for the pooled, non-systemic and systemic crises economies. The ratio of private domestic credit to GDP was found to be significant in explaining the start of a banking crisis in a pooled model. As the ratio of domestic credit to private sector to GDP increases by 1 unit, the likelihood of start of a banking crisis is 0.01 percent higher which is in line with theory and findings by other researchers. This finding remained robust for the systemic banking crises economies. However, none of these macro-economic and financial variables were found significant in explaining the start of a non-systemic crisis.

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**List of acronyms**

BOB	Bank of Botswana
BOP	Balance of Payment
BCT	Binary Classification Tree
DRC	Democratic Republic of the Congo
ERP	Economic Recovery Programme
ESAP	Economic Structural Adjustment Programme
EU	European Union
EWS	Early Warning System
GDP	Gross Domestic Product
IMF	International Monetary Fund
OECD	Organization for Economic Co-operation and Development
SADC	Southern African Development Community
SADCC	Southern African Development Coordination Conference
SAP	Structural Adjustment Programme

## **Dedication**

This work is dedicated to God the Almighty Great, The KING of KINGS, The Good Shepherd who is always faithful (*Psalms 23*). Not forgetting my parents, Eritah Runokunda Mutekwa and Ceiphas Jonas Dembure for their love, care and support.

### **Acknowledgement**

I am indebted to my supervisor, Dr. Ronald Chifamba for his comments, advice and insights during the entire course of this research. In addition, I would like to thank Prof E. Ziramba for his advice and support during my research proposal. Not forgetting my family, close friends and church members for their prayers to make this research a success. May God the Almighty bless you.

### **Declarations**

I, Honest Dembure, declare hereby that this study is a true reflection of my own research and that this work or part thereof has not been submitted for a degree in any other institution of higher education.

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## **CHAPTER 1: INTRODUCTION**

### **1.1. Introduction and background of the study**

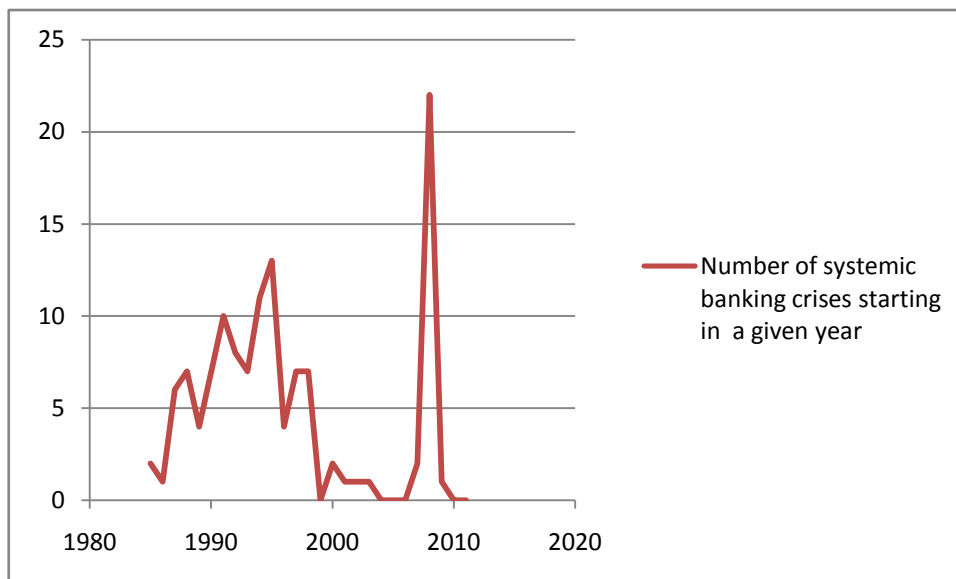
The Southern African Development Community (SADC) comprises 15 countries, with the Secretariat in Gaborone, Botswana. As of 2012, the member states of SADC were: Angola, Botswana, Democratic Republic of the Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, the Seychelles, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. The goal of the SADC regional integration is to promote socio-economic cooperation and integration among member states. According to Mupimpila and Funjika (2010) the organization was established by the SADC Treaty signed by member states in Windhoek, Namibia, on 17<sup>th</sup> August 1992 and enforced on 30<sup>th</sup> September 1993 from the body which was known as the Southern African Development Coordination Conference (SADCC).

### **Overview of the banking crises from late 1980s through 2011**

Over the past three decades the world has witnessed an increase in the number of banking crises. According to Laeven and Valencia (2012) during the 1990s, there were three clusters of crises: in the transition economies in 1990; in the Latin America during the Tequila crisis in 1994 and in the East Asia during the Asian financial crisis in 1998 as shown in Figure 1.1 below. According to Laeven and Valencia (2012), a banking crisis

is defined as systemic if two conditions are met: significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations) as well as significant banking policy intervention measures in response to significant losses in the banking system.

**Figure 1.1: Frequency of the systemic banking crises in the world from 1985-2011**



Source: Laeven and Valencia (2012).

Laeven and Valencia (2012) considered policy interventions in the banking sector to be significant if at least three out of the following 6 measures have been used: extensive liquidity support (5 percent of deposits and liabilities to non-residents); bank restructuring gross costs (at least 3 percent of Gross Domestic Product (GDP)); significant bank

nationalisations; significant guarantees put in place; significant asset purchases (at least 5 percent of GDP); and deposit freezes and/or bank holidays. As shown in Figure 1.1 above, late 1980s and early 1990s witnessed a rapid increase in the number of systemic banking crises. This corresponds with the “Transition Economies Crisis of 1990” and the “Tequila Crisis of 1994”. The early 2000s were a relatively calm period, but ended with the most recent wave, the 2007-2010 Global Financial Crises consisting of the largest number of crises since 1980 which has greatly affected the developed countries.

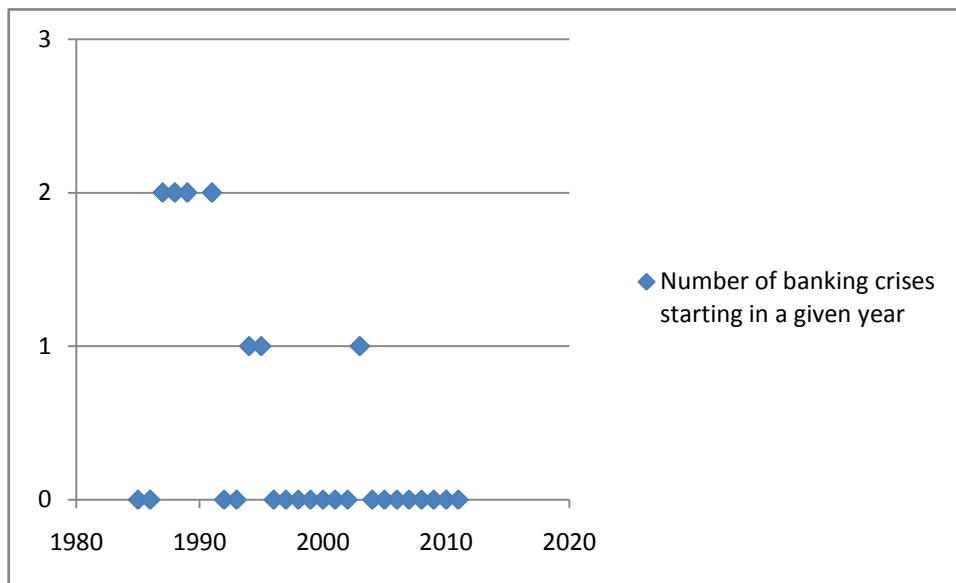
### **Overview of banking crises in the SADC region from late 1980s through 2011**

Between 1985 and 2011, the SADC has experienced a number of banking crises. However, most of these banking crises occurred in the late 1980s and early 1990s. The recent banking crisis episode in the SADC region is the Zimbabwe banking crises which occurred between 2003-2006 when more than 9 financial institutions were either liquidated or placed under curatorship. The list of the episodes of banking crises which has occurred in the SADC region is shown in Table 1.1 in Appendix A. The database by Domac and Martinez (2003), Enowbi and Mlambo (2012), Gono (2012) and Laeven and Valencia (2012) have been used to come up with these numbers of episodes.

The frequency of the banking crises derived from these data bases is shown in Figure 1.2 below. Enowbi and Mlambo (2012) defined systemic banking crisis episode as a situation when much or all of the banking capital is exhausted, while a non-systemic or

smaller banking crises episode is identified when there is evidence of a significant banking problem such as a government intervention in banking problem and financial institutions. From Figure 1.2 below, it can be seen that most of the banking crises in the SADC region occurred in the late 1980s when it was still SADCC and early 1990s. It is also during this time that most Southern African countries under the framework of the International Monetary Fund (IMF) and the World Bank implemented the Structural Adjustment Programmes (SAPs).

**Figure 1.2: Frequency of banking crises in the SADC region**



Source: Domac and Martinez (2003); Enowbi and Mlambo (2012); Gono (2012); Laeven and Valencia (2012); and researcher's own elaborations.

The main objectives of the economic reforms programmes spearheaded by the IMF and the World Bank were to stabilise the Balance of Payments (BOP), fight poverty and improve economic growth. Most countries desperately seeking to close their BOP deficits were supposed to meet strict conditions set by IMF before they could get external loans. Conditionalities linked to IMF aid packages included trade liberalisation, financial liberalisation such as currency devaluation, interest rate reduction among others. As argued by McKinnon (1973) financial liberalisation of the formal financial sector would attract savings which ultimately lead to economic growth. However, some observers are of the view that financial sector openness would make economies more susceptible to financial instability and may cause banking crises (Enowbi & Mlambo, 2012).

Although countries initially benefited from the SAPs, it is imperative to note that most of the Southern African countries which adopted these programs later on suffered economic disruption of various kinds and in particular banking crises. For instance, Democratic Republic of the Congo (DRC) adopted the SAP 1 in 1985 and experienced banking crises between 1991-1994 whilst Madagascar adopted its SAP 1 in 1988 and experienced banking crises between 1988-1992. Mozambique implemented an Economic Recovery Programme (ERP) in 1987 and experienced banking crises between 1987-1991. Zambia adopted the SAP in late 1991 and experienced banking crises between 1989-1996. Last but not least, Zimbabwe adopted its Economic

Structural Adjustment Programme (ESAP) in 1990 and experienced banking crises between 1991-2003 (Enowbi & Mlambo, 2012). One interesting observation is that the occurrence of most of these banking crises coincided with most of the currency crises which occurred in the SADC region like the: 1989, 1994 and 1999 DRC currency crises; the 1994 Madagascar currency crises; the 1987 Mozambiquean currency crisis; the 1989 and 1996 Zambian currency crises; and the 1991, 1998 and 2003 Zimbabwean currency crises according to the database on banking and currency crises by Laeven and Valencia (2008).

From Figure 1.2 above, during the turn of the new millennium, that is, since the year 2000, there were few cases of banking crises that have been reported in the SADC region. Although the African continent has initially been believed to be insulated from the 2007-2010 Global Financial Crises, the continual alliance and integration of the African continent with other countries in other continents due to globalisation keeps the topic on banking crises high on agenda since banking crises are believed to be contagious.

To date, several studies have empirically tackled the determinants of the banking crises. These studies range from those which utilised the panel logit (as in Dermiguc-Kunt & Detragiache, 1998) to the binary recursive trees (as in Duttagupta & Cashin, 2011). The

panel logit and the binary trees have been found to outperform the signal approach in terms of Type I error (misclassification of problem banks as non-problem banks) and Type II error (misclassifying non-problem bank as problem banks). However, a common feature so far in the empirical work on the determinants of the banking crises has been their reliance on using grouped data from both developing and developed countries (mixed country approach).

Although reliance on the mixed country approach arguably increases the number of observations, it undoubtedly brings problems due to differences in the structures and system of developing countries and those of developed countries which could lead to biased results. This research departs from previous work in two ways. Firstly, this research addresses deficiency on previous work by specifically focusing on banking crises in the SADC region since countries from the same regional economic integration tends to share the same features, in this instance, the SADC region has less developed financial markets and less levels of banking intermediation compared to developed countries.

Secondly, another shared feature among most of the previous researchers has been their reliance on the banking crisis dependent variables constructed by some pioneer researchers such as Dermiguc-Kunt and Detragiache (1998) and Laeven and Valencia

(2008, 2010). Although depending solely on such databases sets the basis for research on banking crises, it excludes some important banking crises which have occurred in some developing countries especially those characterised by poor statistical records. This can be the reason for some mixed results for studies in this area. Besides, Dermiguc-Kunt and Detragiache (1998) also admit to have relied on value judgment if there was insufficient evidence to support their crisis criteria. However, to the researcher's knowledge, there are some banking crises which have occurred in the SADC region like the Zimbabwe banking crises which occurred between 2003-2006 when more than 9 financial institutions were either placed under curatorship or liquidated as reported by Gono (2012) which is not documented in the banking crises episodes databases.

This researcher feels the 2003-2006 Zimbabwean banking crisis episode should be considered, given its magnitude which is another contribution of this research. Following the definition of a systemic banking crisis episode by Enowbi and Mlambo (2012), the 2003-2006 Zimbabwean banking crisis can be classified as systemic banking crisis since much of the capital were exhausted. During this period, more than 9 financial institutions were either liquidated or placed under curatorship as reported by Gono (2012). Therefore, in addition to utilising the banking crises episodes from pioneer researchers, this study also relies on the information from different reserve

banks reports from different SADC countries in order to have a true picture of the banking crises which has occurred in the region for the period under review.

It is against the background discussed above that this study revisits some of the well-rehearsed but nevertheless pressing questions on banking crises in the SADC region which are: what are the main determinants of banking crises in the SADC region?; and has most recent empirical research given relevant policy implications regarding banking crises? These questions are discussed in this research with special focus on the SADC region. Theory and empirical evidence are used as the main guidelines for the structure of this discussion and act as back up for the conclusions.

## **1.2.Statement of the problem**

Over the past three decades there has been an upsurge in the number of systemic and non-systemic banking crises in the developed and developing countries (Laeven & Valencia, 2008). Banking crises generally create a serious funding and confidence crises that could negatively affect the whole economy (Erdogan, 2008). They in most instances impose tremendous economic burden including huge bailout costs which Caprio and Klingebiel (2005) estimated to be 10% of Gross Domestic Product (GDP) on average in the developing economies. Besides this, banking crises are perceived to cause sharp output losses notably through reduced investment and consumption which

Hoggarth and Saporta (2001) estimated to cost an average of 5.6% of GDP in developing market economies.

Several solutions have been proposed to mitigate the negative effects of banking crises. Perhaps the most popular of these are the formulation of different bank regulations and policies that foster competition and contestability in order to promote bank stability. Despite these efforts, banking crises are still a menace for both developed and developing economies. The ability to correctly identify the major causes of banking crises will provide information on which governments, investors and shareholders can base their financial decisions in order to cushion themselves against the negative effects of banking crises. Therefore, the purpose of this study is to analyse the determinants of banking crises in the SADC region in order to come up with practical solutions which may be utilised to minimise banking crises.

### **1.3.Objectives of the study**

The main objective of this study is to analyse the determinants of the banking crises in the SADC region. The specific objectives of this study are to: explore how real GDP growth rate influence banking crises; ascertain if terms of trade contributes to banking crises; examine the influence of ratio of domestic credit to GDP on banking crises; find the effect of the ratio of M2 to foreign exchange reserve on banking crises and make recommendations on how banking crises can be minimised.

#### **1.4. Significance of the study**

Although the study in this area has been done in other countries, to the researcher's knowledge so far no study has been done specifically for the SADC region. Therefore, academically, the study contributes to the existing literature and knowledge gap on banking crisis. Furthermore, future researchers may gain additional information on banking crises.

#### **1.5. Limitation(s) of the study**

Due to the small/unique sample for the study, results may not be generalisable beyond the SADC region from which the sample has been drawn. This study also assumed homogeneity across individuals (pooled regression) for which results may differ if one considers heterogeneity across individuals.

#### **1.6. Chapter summary**

Chapter 1 has presented the introduction of the study. Chapter 2 presents the theoretical and empirical literature related to the determinants of banking crises. The methodology is presented in Chapter 3 while the empirical results of this study are presented in Chapter 4. Chapter 5 presents the summary of the study findings, conclusions and recommendations for further study.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.0. Introduction**

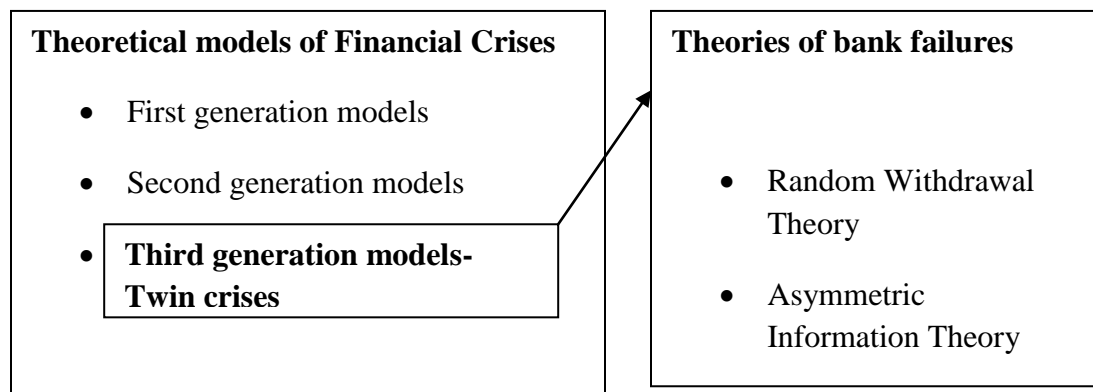
This chapter provides extensive exposition of the theoretical and empirical literature on banking crises which enables to identify the gap in literature in this study. Two major theories of banking crises, that is, the Random Withdrawal Theory and the Asymmetric Information Approach served as the theoretical foundation for this study.

### **2.1. Theoretical literature**

The views expressed in the literature on banking crises fall broadly into two theory approaches. One approach descends directly from the seminal work of Diamond and Dybvig (1983) and has been labelled the Random Withdrawal Hypothesis Approach. The other approach has a varied origin associated with, among others, Gorton (1987) and Jacklin and Bhattacharya (1988) and is referred to as the Asymmetric Information Approach. The Random Withdrawal Hypothesis attributes bank suspensions to bank illiquidity induced by a contagion of fear. The Asymmetric Information Approach assigns a key role to bank insolvency induced by asset shocks due to weak management, fraud and malfeasance, or persistent adverse economic conditions in a particular sector.

It is imperative to note that banking crises are linked to financial crises which makes these two forms of crises intertwined as argued by Gungel (2008). Therefore, theory on banking crises can be explained by analysing the financial crises. This linkage is illustrated in Figure 2.1 below. Theoretical models of financial crises can be examined under crisis models (currency or banking crises) and bank failure models. The macro origin of financial crises mainly relies on three generation models, namely: the first-generation models; the second-generation models and the third-generation models. According to the first-generation models, weak economic fundamentals are more vulnerable to speculative attacks. Even though the second-generation models do not reject the role of weak fundamentals, this suggests that self-fulfilling expectations appear to be the main cause of crises.

**Figure 2.1: Theoretical models of financial crises and bank failures**



Source: Gungel (2008)

The first and the second generation models are also known as currency crisis models. The third generation model combine weaknesses in the economic fundamentals of early generation models with weaknesses in the banking sectors, to the analysis of financial crises. For this reason, the third generation models are also known as the twin crises, that is, banking and currency crisis models. However, the thrust of this research is on theory of bank failures rather than models of financial crises as this research is on banking crises and therefore much emphasis is placed on the Random Withdrawal and the Asymmetric Information Theories.

### **2.1.1. Random Withdrawal Theory**

The theory of random withdrawal regards banks as intermediaries between savers who prefer to deposit in liquid accounts and borrowers who prefer to take out long-maturity loans. Under ordinary circumstances, banks can provide a valuable service by channelling funds from many individual deposits into loans for borrowers. Individual depositors might not be able to make these loans themselves, since they know they may suddenly need immediate access to their funds, whereas the businesses' investments will only pay off in the future (moreover, by aggregating funds from many different depositors, banks help depositors save on the transactions costs they would have to pay in order to lend directly to businesses). Since banks provide a valuable service to both sides, that is, providing the long-maturity loans businesses want and the liquid accounts

depositors want, they can charge a higher interest rate on loans than they pay on deposits and thus profit from the difference.

The Random Withdrawal theory states that banking crises are random events, unrelated to changes in the real economy. Banking crises can arise from self-fulfilling expectations, as modelled by Diamond and Dybvig (1983) among others. In their model, two possible equilibria can emerge. In the first equilibrium, a depositor may believe that a banking crisis is about to occur and that all other depositors will try to obtain liquid funds. As a result, his/her optimal strategy is to withdraw his/her own liquid assets immediately. A speculative attack follows and banks run out of liquid funds. An alternative equilibrium is one in which no one believes that a bank run will occur and banks have sufficient funds to meet true liquidity demands, such that no crisis develops.

The model of Diamond and Dybvig (1983) was the first coherent explanation of how bank debt contracts could be optimal and yet lead to banking panics. According to Calomiris and Gorton (1991) a banking panic occurs when bank debt holders at all or many banks in the banking system suddenly demand that banks convert their debt claims into cash (at par) to such an extent that the banks suspend convertibility of their debt into cash. An essential feature of the Diamond and Dybvig model is the view of banks as mechanisms for insuring against risk. In their model, agents have uncertain

needs for consumption and face an environment in which long-term investments are costly to liquidate. Agents would prefer the higher returns associated with long-term investments, but their realised preferences may turn out to be for consumption at an earlier date. Banks exist to insure that consumption occurs in concert with the realisation of agents' consumption preferences.

In the Diamond and Dybvig model, for a panic to occur, a bank cannot honour all its liabilities at par if all agents present them for redemption. The problem is that liquidation of the bank's long-term assets is assumed to be costly. But, the essential mechanism causing the possibility of panic is the sequential-service constraint. With this rule, a panic can occur as a self fulfilling set of beliefs. If agents think that other agents think there will be many withdrawals, then agents at the end of the sequential-service line will suffer losses. Thus, all agents, seeking to avoid losses associated with being at the end of the line, may suddenly decide to redeem their claims, causing the very event they imagined. The first-come-first-served rule prevents allocation of the bank's resources on a pro rata basis, which would have prevented the panic.

In a nutshell, for banking panics to occur, two related ingredients are needed. First, as Cone (1983) and Jacklin (1987) made it clear, markets had to be incomplete in an important way, namely, agents were not allowed to trade claims on physical assets after their preferences for consumption had been realised. Thus, stock markets or markets in

bank liabilities are assumed to be closed. Secondly, deposit withdrawals are assumed to be made according to a first come- first-served rule, or sequential-service constraint. These two assumptions, particularly the latter, are able to account for panics which are caused by random withdrawal risk.

The Diamond and Dybvig (1983) model, provides a mathematical statement of the idea that an institution with long-maturity assets and short-maturity liabilities may be unstable. Diamond and Dybvig's model points out that business investment often requires expenditures in the present to obtain returns in the future for example, spending on machines and buildings now for production in future years. Therefore, when businesses need to borrow to finance their investments, they wish to do so on the understanding that the lender will not demand repayment(s) until some agreed upon time in the future. In other words, businesses prefer loans with a long maturity, that is, low liquidity. The same principle applies to individuals seeking financing to purchase large-ticket items such as housing or automobiles. Conversely, individual savers (both households and firms) may have sudden, unpredictable needs for cash, due to unforeseen expenditures. So they demand liquid accounts which permit them immediate access to their deposits, that is, they value short maturity deposit accounts.

Diamond and Dybvig model's crucial point about how banking works is that under ordinary circumstances, savers' unpredictable needs for cash are unlikely to occur at the

same time. Therefore, since depositors' needs reflect their individual circumstances, by accepting deposits from many different sources, the bank expects only a small fraction of withdrawals in the short term, even though all depositors have the right to take their deposits back at any time. Thus a bank can make loans over a long horizon, while keeping only relatively small amounts of cash on hand to pay any depositors that wish to make withdrawals. This is so because individual expenditure needs are largely uncorrelated, by the law of large numbers banks expect few withdrawals on any one day.

Since banks have no way of knowing whether their depositors really need the money they withdraw, a different outcome is also possible. Due to the fact that banks lend out at long maturity, they cannot quickly call in their loans. And even if they tried to call in their loans, borrowers would be unable to pay back quickly, since their loans were, by assumption, used to finance long-term investments. Therefore, if all depositors attempt to withdraw their funds simultaneously, a bank will run out of money long before it is able to pay all the depositors. The bank will be able to pay the first depositors who demand their money back, but if all others attempt to withdraw too, the bank will go bankrupt and the last depositors will be left with nothing. This means that even healthy banks are potentially vulnerable to panics, usually called bank runs.

If a depositor expects all other depositors to withdraw their funds, then it is irrelevant whether the banks' long term loans are likely to be profitable; the only rational response for the depositor is to rush to take his or her deposits out before the other depositors remove theirs. In other words, the Diamond–Dybvig model views bank runs as a type of self-fulfilling prophecy: each depositor's incentive to withdraw funds depends on what they expect other depositors to do. If enough depositors expect other depositors to withdraw their funds, then they all have an incentive to rush to be the first in line to withdraw their funds.

#### **2.1.1.1. Criticism of the Random Withdrawal Theory**

Although, the Random Withdrawal theory forms platform for the explanation on how banking failures erupts, it has often been criticised of being vague for the fact that it does not clearly bring out the triggers of self-fulfilling prophecies. Furthermore, Gorton (1988) asserts that “panic-based” view or random withdrawal hypothesis does not generate any testable implications because the existing theory proposes that panic happens as a result of shift in depositors’ expectation that is caused by random event that is unrelated to changes in real economy. Because of these shortcomings, this induced further research on what exactly causes bank failures. This led to view of the asymmetric information model as the best explanation on banking failures as postulated by Jacklin and Bhattacharya (1988).

### **2.1.2. Asymmetric Information Theory**

Jacklin and Bhattacharya (1988) postulated that asymmetric information is a crucial factor in banking failures. These sentiments were also echoed by Calomiris and Gorton (1991) who argued that panics are not caused by random events but rather they are caused by rising risk of business failures and uncertainty in economic outlook based on the research. Along this same line of argument, Carlson (2005) believes that panics are motivated by real economic events and are triggered by sudden changes in aggregate risk. As an economic downturn is likely to reduce the value of a bank's assets, signals about an impending downturn may induce depositors to consider withdrawing their funds. Therefore, real shocks cause banks to become insolvent. Depositors know that some banks are insolvent, however, they do not know which ones. Banks know when they become insolvent and, if not liquidated, abscond with whatever funds they possess. To prevent insolvent banks from absconding, depositors withdraw all their deposits when they witness a shock. If depositors were to have the same information as the banks about each bank's viability, then only the insolvent banks would be closed. Panics are therefore caused by an asymmetry in the information between banks and depositors. Thus, this theory is referred to as the asymmetric information theory.

Asymmetric information has two general effects on economic behaviour: adverse selection and moral hazard. Adverse selection arises when better-informed agents use their knowledge before signing a contract with a less-informed party, while moral

hazard arises when agents take some hidden actions after signing a contract with a less-informed party. According to Calomiris and Gorton (1991) under the asymmetric information theory, banking panics are caused by depositor revisions in the perceived risk of bank debt when they are uninformed about bank asset portfolio values and receive adverse news about the macro economy. In this view, depositors seek to withdraw large amounts from banks when they have reason to believe that banks are more likely to fail. Because the actual incidence of failure is unknown, they withdraw from all banks. The availability of reserves through central bank action would not, in this view, prevent panics.

Under the asymmetric information theory, depositors do not withdraw funds from the bank because of sudden needs for resources but rather they withdraw their funds because they are concerned that the bank is going to fail as argued by Carlson (2005). Gorton (1985) argues that banks' returns are uncertain, depositors hold bank deposits as long as the expected return on deposits is higher than the return on holding cash. With full information, depositors would know if returns on bank deposits are lower than the return on money. If that happens, they would withdraw their deposits and close the bank. However, as information is not perfect, depositors receive only an imperfect signal about the returns on the bank's loans. With imperfect signals, depositors close some banks that are solvent and leave open some banks that should have been closed.

The theory is considered one of asymmetric information because the banks know the quality of their loans, but the depositors do not.

#### **2.1.2.1 How adverse selection and moral hazard leads to banking crises**

The proponents of the Asymmetry Information theory believed that macro-economic and regulatory variables contribute to adverse selection and moral hazard which in turn results in bank failures. According to this theory, it is believed that factors leading to the deterioration of balance sheets change incentives facing banks and borrowers (as they have less to lose if projects fail) and contribute to increases in their risk-taking.

Large increases in uncertainty can also be a source of banking crises, given that they make it difficult for lenders to discriminate between good and bad credit risks. A recession or an inflationary spike that increases uncertainty about future relative prices can produce larger uncertainty. Similarly, information problems can lead to banking crises in times of recessions or decline in GDP growth if depositors cannot discriminate among individual banks in terms of their riskiness (Gorton 1988). The lack of bank-specific information may lead to the use of aggregate information in decision making. Thus, panics can occur as a consequence of recessions because depositors might expect a large number of banks to fail during times when output growth falls.

The macro-economic determinants of banking crises can be proxied by real GDP growth rate and terms of trade while the financial determinants of banking crises can be proxied by ratio of private domestic credit to GDP and the ratio of M2 to foreign exchange reserves. These variables and their possible influence on banking crises are discussed below.

### **Real GDP growth rate**

Economic analysts argue that banking crises are commonly preceded by a significant contraction in real GDP growth. Deterioration in real GDP growth rate is generally predicted to increase the probability of banking crises, since borrowers are more likely to default when growth is deteriorating and their activities are less profitable as argued by Keefer (2001). This may lead to lenders advancing loans to risky borrowers who may end up defaulting. Therefore, a decrease in real GDP growth rate increases the probability of failure as banking crises are commonly preceded by a significant contraction in real GDP growth.

### **Terms of trade**

Yilmaz (2003) stated that large terms of trade shocks reduce export prices and the ability of exporters to pay their debts which may result in the deterioration of bank balance sheets. In turn this threatens the solvency of domestic banks. Therefore,

deterioration in the terms of trade is expected to increase the likelihood of bank failure, since it negatively affects the ability of borrowers to pay their loans. As a result, a negative relationship is expected between terms of trade and banking crises.

### **Financial variables**

Pill and Pradhan (1995) argued that the ratio of domestic credit to the private sector to GDP can be utilized to capture the extent of financial liberalization. Since banks would normally prefer low-risk loans to high-risk loans, an increase in lending to the private sector as a fraction of GDP might be associated with growing risk in bank portfolios and increase the risk of systemic insolvency. Demirguc-Kunt and Detragiache (1998) argued that financial liberalisation may weaken the condition of the banking sector because this process may result in an increase in risk-taking opportunities and when not appropriately regulated, in instances of fraud. Therefore, a positive relationship is expected between financial liberalisation and banking crises.

The ratio of M2 to foreign exchange reserves can be used to capture the exposure that banks face to runs associated with currency crises. Gonsel (2008) stated that a sharp increase in the ratio of money supply and a low level of reserves are capable of triggering a currency crisis. In turn currency crises deepen banking crises especially when high interest rates are imposed to defend the exchange rate peg or the foreign exchange exposure of banks as put forward by Kaminsky and Reinhart (1999). Thus, a

positive relationship is expected between the ratio of M2 to foreign exchange reserves and banking crises.

## **2.2. Empirical literature**

To date, there is an extensive empirical literature focusing on the macro-economic, institutional and financial determinants of banking crises in developed and developing countries. Among them, this research distinguishes two basic lines of analysis. One line focuses on the determinants of banking crises in a single country and the other relies on multi-country analysis where researchers used either cross-section or panel data structure. The single-country studies usually try to explain the determinants of banking crises in a single country based on a combination of bank specific and country specific macro-economic factors. The classic study here is by Gungel (2008), which looked at country specific instead of cross country examination of the determinants of banking crises.

Gungel (2008) investigated the links between the micro and the macro determinants of bank fragility in the North Cyprus economy over the period 1984-2002 using a multivariate logit model. The study used bank-specific (micro-economic) variables, macro-economic variables, financial variables and external shocks variables as the explanatory variables. Gungel (2008) found that the growth rate of the GDP is negatively related to banking crises. The study also found that adverse trade shocks as

proxied by terms of trade increases the probability of banks distress. Besides this, the study by Gonsel (2008) also found that, financial liberalisation as proxied by the ratio of the domestic credit to the private sector to GDP and the ratio of M2 to foreign exchange reserves increases the likelihood of banking failures. These results were also consistent with earlier results on multi-country studies by Dermirguc-Kunt and Detragiache (1998), Hutchison and McDill (1999), Hardy and Pazarbasioglu (1999) and Hagen and Ho (2006).

The multi-country studies on the determinants of banking crises recognise the limitations of country-specific analyses and attempt to exploit the higher variability associated with cross-country information. Because this study belongs to this branch of analysis, an extensive literature exposition regarding this category is provided in this research. For those papers which focused on multi-country studies, they are further classified into the limited dependent estimation approach, signal extraction approach and duration models methodologies as put forward by Gaytan and Johnson (2002). Above these three, the Binary Classification Tree (BCT) technique is the recent approach in the multi-country approach to the determinants of banking crises. In analysing these approaches, the main differences between this work and the existing literature is highlighted.

### **2.2.1. The limited dependent model approach**

Most papers which followed the limited dependent approach model proxied banking crisis as a binary outcome, that is, an event which takes one when there is crises or zero when there is no crisis. Notable papers in this category include studies by Demirguc-Kunt and Detragiache (1998) and Klomp (2010). Other papers which followed the limited dependent approach proxied banking crisis as a multinomial outcome, that is, taking more than 2 outcomes. Studies in this category include Hardy and Pazarbasiogi (1999). Most studies which followed the limited dependent model approach treated the determinants of the banking crises as a homogenous cause which implicitly means that a variable that is found significant (in a pooled model) should be significant for all individual banking crises.

Demirguc-Kunt and Detragiache (1998) examined the factors associated with the emergence of systemic banking crises in a large sample of developed and developing countries in 1980-94, using a multivariate logit econometric model. They analysed banking crises as a binary dummy variable which takes the value of 1, when there is crisis and zero, otherwise. They identified a banking crisis in their panel when at least one of the following four conditions held: the ratio of non-performing assets to total assets in the banking system exceeded 10 percent; the cost of the rescue operation was at least 2 percent of GDP; banking sector problems resulted in a large scale nationalisation of banks; and extensive bank runs took place or emergency measures

such as deposit freezes, prolonged bank holidays, or generalised deposit guarantees were enacted by the government in response to the crisis. The major results by Demirguc-Kunt and Detragiache (1998) showed that crises tend to erupt when the macro-economic environment is weak, particularly when growth is low and adverse trade shocks. On the financial variables, the ratio of private domestic credit to GDP and the ratio of M2 to foreign exchange reserves were found to be significant in increasing the likelihood of banking crises.

Hutchison and McDill (1999) used a multivariate probit model on an unbalanced panel to examine the episodes of banking sector distress for both developing and developed countries over the period of 1975-1997. Banking crisis was considered a binary event which takes the value of 1, when there is a crisis and 0, otherwise. In terms of macro-economic developments, Hutchison and McDill found that a sharp decline in real GDP growth is a good indicator that banking problems may emerge soon while a liberalised financial system was found to increase the likelihood of banking sector distress. These results were also consistent with Dermirguc-Kunt and Detragiache (1998).

Hardy and Pazarbasiogi (1999) examined the determinants and leading indicators of banking crises for the Asian crises. However, rather than predicting the banking crisis as a binary outcome, Hardy and Pazarbasiogi predicted banking crisis as a multinomial outcome. They used banking crisis as an indicator or dummy variable taking the value

of: 2 in period when banking sector difficulties emerged; 1 in the preceding period and 0 otherwise. The idea of treating the pre-crisis year and the crisis year as separate events was seen as advantageous in that firstly, in most cases, the government could intervene when the difficulties could have already started. Thus, economic behaviour in the run-up to the declared start of an episode may differ significantly from that in more normal times. Secondly, this approach was favoured in that it would allow one to establish the predictive power of the leading indicators independently of what is known only in the crisis year, and provides a rough indication of the time to crisis.

In spite of the different approach to the banking crisis event, the study by Hardy and Pazarbasioglu (1999) found that banking distress is associated with a largely contemporaneous fall in real GDP growth and boom-bust cycles in credit expansion and adverse trade shocks which was also consistent with findings by Dermirguc-Kunt and Detragiache (1998) and Hutchison and McDill (1999). Another paper which analysed the banking crisis as a binary outcome is by Tanveer and De Haan (2008). Tanveer and De Haan analysed the impact of financial liberalisation on both systemic and non-systemic banking crises for 33 emerging markets over the period 1981 to 2002 using multivariate probit model.

Tanveer and De Haan (2008) found that systemic and non-systemic crises behave differently. They found that financial liberalisation reduces the likelihood of systemic

crises which is contrast to conventional wisdom. Opposite to the findings in systemic crises, they found that financial liberalisation increases the likelihood of a non-systemic banking crises. On the control variables, they found real GDP growth rate to be significant variable in explaining systemic banking crises with a negative sign. However, this same variable, real GDP growth rate was found to be insignificant in explaining non-systemic banking crises. The ratio of M2 to reserves was found to be significant in explaining non-systemic banking crises with a negative sign. Terms of trade and credit to private sector were found to be insignificant in explaining non-systemic banking crises with negative and positive coefficients respectively.

Klomp (2010), Barrell, Davis and Liadze (2010) and Zistler (2010) followed the study by Dermigurc-Kunt and Detriagiache (1998) to determine the determinants of banking crises using a binary event. Klomp (2010) used a dynamic random coefficient logit model to examine the heterogeneity in the causes of a banking crisis including 110 countries between 1970 and 2007. Zistler (2010) used a multivariate logit model for a sample of 120 mixed countries from 1980-2005 on determinants associated with the emergence of 42 systemic banking crises. Barrell et al. (2010) used panel logit model to analyse the bank regulation, property price and EWSs for banking crises in the Organization for Economic Co-operation and Development (OECD) countries. Barrell et al. (2010) analysed 14 systemic and non-systemic banking crises in the 14 OECD countries for the period 1980-2007.

On the definition of banking crises, Barrell et al. (2010) used two definitions of banking crises: definition 1, a crisis occurs in countries where the government had to inject capital in more than one large bank and/or more than one large bank failed; definition 2, which is less stringent, states countries experienced a crisis when countries undertook at least two of the following policy operations: issue wholesale guarantees, buy assets, inject capital into at least one large bank, or announce a large scale recapitalisation programme. Barrell et al. (2010) found that macro-economic, financial and institutional variables were not significant in explaining banking crises in the OECD countries. These results were in contrast to what Dermirguc-Kunt and Detragiache (1998), Hutchison and McDill (1999), Gonsel (2008) Klomp (2010) and Zistler (2010) found.

Klomp (2010) and Zistler (2010) found that real GDP growth level was significant in explaining banking crises. Klomp found that a one percent increase in the GDP growth decreases the likelihood of a banking crisis by 0.8 percent. The findings by Klomp and Zistler with regard to real GDP growth were also consistent with findings by Dermirguc-Kunt and Detragiache (1998), Hutchison and McDill (1999) and Gonsel (2008). However, Klomp (2010) found conflicting results with regard to private domestic credit to GDP. The ratio credit to private sector variable was found to be insignificant in explaining banking crises although having a positive sign. It is the

growth rate of the credit supplied to the private which was found to be significant in explaining banking crises. An increase of one percent in the growth rate of the credit supplied to the private sector, was found to increase the probability of a banking crisis by 0.3 percent.

One important analysis by Klomp (2010) was that, determinants of banking crises differ between systemic and non-systemic crises and across stages of economic development. Real GDP rate was found to be significant variable in reducing the likelihood of both systemic and non-systemic banking crises. These results were also consistent with findings by Tanveer and De Haan (2008). An increase in credit to the private sector was found to be significant in increasing the likelihood of a systemic banking crisis which was in contrast to findings by Tanveer and De Haan (2008).

In a recent paper by Enowbi and Mlambo (2012), they examined the effect of financial liberalisation and banking crises on the economic performance of African countries during the period covering 1985 to 2010 using a treatment effect, two step methods and a panel probit method. They also treated banking crises as binary event. The research by Enowbi and Mlambo (2012) found that financial liberalisation tends to reduce the likelihood of a banking crisis. These results were in contrast to other results by Dermirguc-Kunt and Detragiache (1998), Hutchison and McDill (1999), Hardy and Pazarbasioglu (1999), Gonsel (2008), Zistler (2010) and Klomp (2010).

### **2.2.2. The duration model category**

The papers in this category criticised the use of banking crises as an event (crisis or no crisis) because of several shortcomings. First, the proponents of anti-banking crisis event, argued that the use of such approach tends to identify banking crises too late. Secondly, there were few objective standards for deciding whether a given policy intervention is “large”. Thirdly, the timing of crisis periods on this basis was subjective as the exact date of policy interventions is often uncertain or unclear. Fourthly, the events method identified crises only when they were severe enough to trigger market events which results in crises successfully contained by prompt corrective policies were neglected which they believed would result in selection bias for the empirical work. Because of these limitations, researchers in this category came up with an alternative way of classifying banking crises as a way of overcoming these problems. The notable papers in this category are by Sachs, Tornell and Velasco (1996) and Hagen and Ho (2006).

Sachs et al. (1996) came up with an alternative way of identifying banking crises, which is the index exchange rate pressure (measured as an average of percent change in devaluation and loss of reserves) to analyse the spillover effects of the Mexican crisis of 1994/95 on a group of 20 emerging market economies. The idea of the coming up with the index exchange rate pressure was to predict which countries would face the greatest pressure in the index in the period of international financial turbulence generated by the

Mexican crisis of 1994. The research by Sachs et al. (1996) revealed that a weak banking system (as measured by the existence of a credit boom to the private sector) explained about 70 percent of the variation of their “crisis index”, a composite measure of the change in reserves and the nominal depreciation.

Instead of using the index exchange rate pressure to identify banking crises, Hagen and Ho (2006) adopted an index money market pressure. They defined banking crises as periods in which there is excessive demand for liquidity in the money market. Empirically, they identified banking crises as periods in which the index of money market pressure exceeds the 98.5 percentile of its empirical distribution. They believed that this would result in a more objective identification than using market events such as large government interventions in the banking sector to identify banking crises. This approach was believed to facilitate the use of high frequency data in empirical work as comparisons made with existing research indicated that the new method was able to identify banking crises more accurately than the events method. With the newly defined crisis episodes, they examined the determinants of the banking crises using data compiled from 47 countries covering the period 1980-2001 using a conditional fixed-effects logit estimator.

The research by Hagen and Ho (2006) found that a decline in the real GDP growth rate causes an increase in the likelihood of banking crises. These results were also consistent

with earlier results by Dermirguc-Kunt and Detragiache (1998), Hardy and Pazarbasioglu (1999) and Hutchison and McDill (1999). Although the ratio of private domestic credit to GDP had a positive sign, it was found to be insignificant which was in contrast to these earlier results.

### **2.2.3. The signal extraction category**

The empirical studies in this category used the signal extraction approach for the prediction of currency and banking crises. The signal approach studies and contrasts behaviours of economic indicators for periods both before and after a crisis and identifies individual variables that best signal an impending crisis based on over or under-shooting of specific threshold values. Classical papers in this category are by Kaminsky and Reinhart (1999) and Goldstein, Kaminsky and Reinhart (1999).

The study by Kaminsky and Reinhart (1999) analysed the linkage between currency and banking crises and search for the origin of twin crises (the convergence of both types of crises). They analysed 76 currency and 26 banking crises for 20 countries during 1970 to mid-1995. They marked the beginning of a banking crisis as bank runs that lead to the closure, merging or takeover by the public sector of one or more financial institutions. They found that both types of crises seem to have common causes. Both crises are preceded by recessions or, at least, below normal economic growth

particularly when exports are particularly hard hit. These results were consistent with earlier findings by Dermirguc-Kunt and Detragiache (1998). In both types of crises, a shock to financial institutions possibly financial liberalisation and/or increased access to international capital markets fuels the boom phase of the cycle by providing access to financing would trigger such crises. These results were also consistent to findings by Dermirguc-Kunt and Detragiache (1998).

Goldstein et al. (1999) developed the earlier paper by Kaminsky and Reinhart (1999) to analyse the linkage between currency and banking crises in an increased sample size. They looked at a sample of 29 banking crises and 87 currency crises in a sample of 25 emerging economies and smaller industrial countries for the period 1970-95. They employed monthly data to analyse banking crises. Although the use of monthly data led to higher frequency data results, it also led to smaller sample of countries as monthly data are available for a smaller number of countries. From the study by Goldstein et al. (1999) a decline in real output was found to be the best monthly indicator of banking crises. These results were also consistent with earlier results by Dermirguc-Kunt and Detragiache (1998) and Kaminsky and Reinhart (1999).

#### **2.2.4. The Binary Classification Tree (BCT) Technique**

The Binary Classification Tree (BCT) is the most recent technique in the estimation of banking crises. The binary recursive provides a fresh perspective on banking crises. In

contrast to the limited and the signals approach, the binary recursive demonstrates that such crises are often underpinned by a combination of weaknesses rather than a single compelling factor. One of the most popular paper in this category is by Duttagupta and Cashin (2011). They came up with the BCT model to analyse banking crises in 50 emerging market and developing countries during 1990–2005. The study by Duttagupta and Cashin (2011) found that low bank profitability which highlight that foreign currency risk, poor financial soundness and macro-economic instability is one condition at which the vulnerability to banking crises increases. Despite BCT having extra benefits such as being able to handle complex relationships for example with datasets that have missing values or extreme outliers, it also has its weaknesses. Unlike the logit/probit regression techniques, it is unable to provide the marginal contribution of a particular variable to the overall probability of a particular outcome which makes it unpopular.

### **2.3. Chapter summary**

In a nutshell, this chapter analysed the theoretical and the empirical literature underpinning the determinants of banking crises. The empirical evidence on the determinants of the banking crises is far from conclusive. The results indicate that there is no clear answer on what are the significant macro-economic and financial causes of a banking crisis. One explanation for the difference in the results is the sample selection as results can be determined by the heterogeneity of the crises (and countries) included

in the sample. For those studies which have utilised the African countries in their sample, they utilised the mixed-country approach. Although the study by Enowbi and Mlambo (2012) analysed the African countries, they did not specifically focus on the SADC region. The other explanation for different results is the different methodology used. Although most studies utilised the logit estimation model, less have analysed banking crisis as a multinomial outcome, that is, taking more than two outcomes. The current study fills these gaps in empirical literature by specifically analysing the determinants of banking crises in the SADC region using multinomial logit model, rather than focusing on a data set consisting of developed and developing countries (mixed country approach). The theoretical and empirical literature analysed in this chapter forms the base for the research methodology presented in the next chapter.

## **CHAPTER 3: RESEARCH METHODOLOGY**

### **3.0. Introduction**

The estimation model in this research was laid out based on the theoretical and empirical literature discussed in Chapter 2.

#### **3.1. The dependent variable (banking crisis)**

In the empirical literature some studies have analysed banking crisis as a binary event, that is, taking the value 1 when there is a crisis and 0 otherwise. Such studies include: Dermigurc-Kunt and Detriagiache (1998); Hutchison and McDill (1999); Tanveer and De Haan (2008); Barrell et al. 2010; Klomp (2010); Zistler (2010); and Enowbi and Mlambo (2012). Other studies like Hardy and Pazarbasioglu (1999) have analysed banking crisis a multinomial event taking three outcomes taking on the value: 2 in a period when banking sector difficulties emerged; 1 in the preceding period; and zero otherwise. The idea by Hardy and Pazarbasioglu (1999) to treat pre-crisis year and crisis year as separate events was due to the fact that in most cases intervention in the banking sector would occur when difficulties had occurred long before.

The present study specifically followed Hardy and Pazarbasioglu (1999) because of their ability to differentiate between the start of a crisis and the period prior to the

banking crisis. In this research, the dependent variable (banking crisis) was considered categorical dummy variable which was equal to: 4 in years and countries when banking sector difficulties are ongoing; 3 in years and countries when banking sector difficulties emerged; 2 in the preceding period and 1 when there is no crisis.

Some of the studies which followed the limited dependent approach utilised the logit model in analysing the determinants of banking crises. These studies include: Barrell et al. (2010); Klomp (2010) and Zistler (2010). This study utilised the logit model to estimate the probability of banking crises. This approach has been widely used in the studies on banking crises and was the preferred method in this research for the following reasons: first, the estimation is easy to implement by using the conventional maximum likelihood estimation(MLE); secondly, under the logit estimation model the scores are interpretable in terms of marginal effects; thirdly this method is more robust as the independent variables do not have to be normally distributed (thus ordinary sum of squares regression and all normality tests are invalid) or have equal variance in each group (thus testing for homoskedasticity is not important); and fourthly, a general logit model also allows one to undertake an analyses of a large number of countries by including those countries that did not experience banking crises for the period under review. However, one disadvantage of the logit model is that it requires large sample of data in order to come up with the best results. Furthermore, the logit model assumes the distribution of the independent variables do not have to be linearly related. In other

words it works well in the absence of multicollinearity among predictors. Multicollinearity makes the Maximum Likelihood Estimator impossible.

The banking crises literature do not present a definite quantitative measure for tracking the onset of a crisis unlike the literature on currency crises. This is primarily due to the lack of sufficiently long time series data. However, as argued by Davis and Karim (2008) the most commonly cited problem with the EWSs developed to date is the inconsistency in the definition of the banking crises dependent variable which is defined with degree of subjectivity which results in some banking crises being recognised as systemic or non-systemic.

Several researchers came up with different definitions of banking crises which resulted in different dates and number of banking crises. To account for the banking crises, this researcher used information on the banking crises episodes provided by Domac and Martinez (2003), Enowbi and Mlambo (2012), Gono (2012) and Laeven and Valencia (2012) to identify periods of systemic and non-systemic crises which occurred in the SADC region between 1985-2011. The 2012 Mid-term monetary policy presented by Gono (2012) was used to identify the banking crisis episode in Zimbabwe between 2003 and 2006. Enowbi and Mlambo (2012) used the data base by Caprio and Klingebiel (1996, 1999), Laeven and Valencia (2008), Reinhart and Tokatlidis (2003)

and Demircuc-Kunt and Detragiache (1998, 2000) in identifying their episodes of banking crises.

The surveys by Domac and Martinez (2003), Enowbi and Mlambo (2012) and Laeven and Valencia (2012) were chosen in this study as they were the most comprehensive and updated ones. Potential inconsistencies between the databases on banking crises were checked and when they exist, other sources such as financial news were used to support the choice in this study. For instance, the episode of non-systematic banking crisis in Botswana between 1994 and 1995 was only found in the data base by Domac and Martinez (2003) and not in the other two data bases by Enowbi and Mlambo(2012) and Laeven and Valencia (2012). The financial news on the overview of Botswana' Financial sector by Jefferies and Tacheba (2010) was used to validate the findings by Domac and Martinez (2003). Jefferies and Tacheda (2010) reviewed that between 1994 and 1995, the Bank of Botswana (BoB) co-ordinated a takeover of Zimbank Botswana, a subsidiary of a Zimbabwean bank, by FNB Botswana in order to pre-empt the collapse of the bank. Furthermore, a Botswana Co-operative Bank originally established to serve the co-operative sector of the economy, obtained a commercial banking licence but never operated profitably and was eventually closed by the BoB in 1995.

Having taken the 2003-2006 Zimbabwean banking crisis into consideration, the current researcher was able to identify 6 episodes of systemic banking crises and 5 episodes of

non-systemic banking crises which have occurred in the SADC region between 1985 and 2011. Table 1.1 in Annex 1 in the list of Annexure offers the list of crises event considered, their classification into systemic and non-systemic episodes and their duration while Table 3.1 in Annex 2 presents the matrix of crises, with bold observations indicating systemic crises. Previous researchers have encountered problems with regard to the demarcation of the start and end dates of the banking crises in the construction of the banking crises dummy. This created problems where successions of crises episodes were found. To avoid double counting, this researcher adopted a strategy where there was at least a gap of two non-crisis years between two crises as done by Klomp (2010).

### **3.2. The independent variables**

A number of determinants of banking crises have been considered in the empirical literature. The most common macro and financial variables included in the determinants of banking crises include real GDP growth rate, terms of trade, the ratio of domestic credit to private sector to GDP and the ratio of M2 to foreign exchange reserves. Therefore in this research, the determinants of banking crises are specified as a function of two macro-economic variables (real GDP growth rate and terms of trade) and two financial variables (the ratio of domestic credit to private sector to GDP and the ratio of M2 to foreign exchange reserves). The choice of these explanatory variables was determined by the empirical and theoretical literature as well as by the availability of

data. Institutional and some macro-economic and financial variables were not included in this research because of data unavailability.

### **3.2.1. Macro-economic variables**

Most literature on determinants of banking crises is dominated by the fact that adverse macro-economic conditions hurt banks by increasing the share of non-performing loans in the economy. Real growth GDP rate and terms of trade were the two macro-economic variables used in this research. A faster real GDP growth is generally predicted to reduce the probability of banking crises since borrowers are less likely to default when growth is rapid and their activities are more profitable. Therefore, a negative relationship is expected between real growth of GDP and probability of a banking crisis. As argued by Yilmaz (2003), deterioration in the terms of trade is expected to increase the likelihood of bank failure, since it negatively affects the ability of borrowers to pay their loans. Therefore, a negative relationship is expected between terms of trade and banking crises.

### **3.2.2. Financial variables**

Two financial variables included in the logit estimations in this research were: the ratio of M2 to reserves and the ratio of private domestic credit to GDP. An increase in credit extended to the private sector reflects a rise in the risky credit, particularly following financial liberalisation. For this reason, an increase in the private credit is expected to be

positively related to the probability of banking failures. The ratio of M2 to foreign exchange reserves can be utilised to the exposure that banks face to runs associated with currency crises. As argued by Gungel (2008), a sharp increase in the ratio of money supply and a low level of reserves are capable of triggering a currency crisis. Therefore, a positive relationship is expected between the ratio of M2 to foreign exchange reserves and the likelihood of a bank failure.

The theoretical framework of the multinomial logit model has each individual  $i$  faced with  $J$  different choices at time  $t$ . The individual receives a certain level of utility at each choice alternative and chooses the alternative that maximises her utility. The current study assumes four categories: no crisis ( $y = 1$ ); one year before start of a crisis episode ( $y = 2$ ); start of a crisis episode ( $y = 3$ ); and ongoing of a crisis ( $y = 4$ ). Category 1 ( $y = 1$ ) is the base outcome. The pooled multinomial logit model treats each wave for each sample member as an independent observation, such that the total number of independent observations is equal to number of years (in this study 27 years) times the number of sample members. The probability of banking crisis is modeled as a logit probability function of explanatory factors  $X$ . Formally,

$$\Pr(y = 1) = \frac{1}{1 + \sum_{k=1}^3 e^{X\beta_k}} \quad (1)$$

$$\Pr(y = j) = \frac{e^{X\beta_j}}{1 + \sum_{k=1}^3 e^{X\beta_k}}, \quad j = 2, 3, 4 \quad (2)$$

where  $y$  is equal to 1 if there is no crisis, 2 one year before start of a crisis, 3 for the start of the crisis and 4 for the ongoing of crisis and  $\beta_j$  is a vector of parameters, which are normalised to zero for the ‘no crisis’ outcome (the base category) to achieve identification. We find the estimated parameters by maximising the log-likelihood function.

$$\log L = \sum_i \sum_j d_{ij} \log p_{ij} \quad (3)$$

Logit coefficient estimates are not readily interpretable, as the model is non-linear and the effects of individual explanatory variables on the outcome variable depend on the values of the explanatory variables at which they are evaluated. Consequently, rather than report coefficient estimates, the marginal effects of the explanatory variables are reported. The marginal effects shows the relative change of  $p_{ij}$  if  $x$  increases by 1 percent. The marginal effect of continuous explanatory variable  $x_m$  on the probability outcome  $j$  occurs for a country with characteristics  $X^i$  is given by:

$$ME_{j,m}^i = \frac{\partial \Pr(y = j | X^i)}{\partial x_m^i} = \Pr(y = j | x^i) [\beta_{m,j} - \sum_{k=1}^3 \beta_{m,k} \Pr(y = k | X^i)] \quad (4)$$

The coefficients themselves cannot be interpreted easily but the exponentiated coefficients have an interpretation as the relative risk ratios (RRR).

$$\Pr(y_i = j) = pr_{ij} \quad (5)$$

$$\frac{\Pr_{ij}}{\Pr_{i0}} = \exp(X_{ij}\beta_j) \quad (6)$$

The relative risk ratio tells us how the probability of choosing  $j$  relative to 0 (the base outcome) changes if we increase  $x$  by one unit:

$$\frac{\Pr'_{ij}}{\Pr'_{i0}} = \exp((X_{ij} + 1)\beta_j) \quad (7)$$

$$\exp(\beta_j) = \frac{\Pr'_{ij}}{\Pr_{ij}} \bigg/ \frac{\Pr'_{i0}}{\Pr_{i0}} \quad (8)$$

For the IRR interpretation, if  $RRR > (<) 1$ , variable  $x$  increases (decreases) the probability that alternative  $j$  is chosen instead of the baseline alternative.

This current research utilised the data from 1985-2011. Data on the explanatory variables was collected online from the World Bank Economic Indicators for the period 1985-2011 (World Bank, 2011) whilst the data on the banking crises episodes was collected from the data bases by Domac and Martinez (2003), Enowbi and Mlambo (2012), Gono (2012) and Laeven and Valencia (2012). The choice of the sample period of 1985 through 2011 was dictated mainly by two considerations. The first consideration was the availability of published data on the variables considered in this study for the period under review. The second consideration was that, the period from 1985 was able to cover cases of financial liberalisation which has occurred in most SADC countries in the late 1980s as a result of the implementation of the SAPs. The idea of treating the determinants of a banking crisis as a homogenous cause in this research using pooled estimation instead of focusing on one specific country is motivated by the fact that it is believed that the majority of banking crises follow a common pattern of causes and consequences as argued by Englund (1999) and Kaminsky and Reinhart (1999).

Therefore the estimated model is given by:

$$CODEBANKCRIS_{it} = \beta_0 + \beta_1 NONCRISIS_{it} + \beta_2 LOGRGDPGR_{it} + \beta_3 LOGTOT_{it} + \beta_4 LOGPRICREGDP_{it} + \beta_5 LOGM2RESERVE_{it} + e_{it}$$

where *BANKCRIS* is the banking crisis dummy, which is a latent dependent variable, *NONCRISIS* a dummy variable which takes the value 1 when the country experienced banking crisis episode(s) or 0, otherwise, *LOGRGDPGR* is the logged values of real GDP growth rate, *LOGTOT* is the logged values of terms of trade, *LOGPRICREGDP* is the logged values of the ratio of the private domestic credit to private sector to GDP, *LOGM2RESERVE* is the logged values the ratio of M2 to foreign exchange reserves and  $e_{it}$  is the random error term which has been introduced to accommodate the effect of other factors that causes banking crises that are not included in the model.

The dummy variable in the above estimation model was utilized to control the constant and coefficients of the slope within the regression model because limiting the data analysis only to those countries which experienced banking crises for the period under review would have produced a biased sample. Countries which did not experience banking crises for the period under review served as the control group in this research. According to economic theory,  $\beta_2$  and  $\beta_3$  are expected to be negative while  $\beta_4$  and  $\beta_5$  are expected to be positive. The detailed list of these independent variables, their definitions, sources and the expected signs is provided in Table 3.2 in Annex 3.

### **3.3. Chapter summary**

This chapter laid out the research methodology followed in this research based on the theoretical and empirical literature analysed in Chapter 2. The next chapter presents the results of this study based on the logit estimation model presented in this chapter.

## CHAPTER 4: EMPIRICAL RESULTS

### 4.0. Introduction

This chapter presents the empirical results of this research following the multinomial logit regression methodology adopted in the previous chapter. In this chapter the statistical properties of the data is also presented to ensure that the results are more reliable.

### 4.1. Results for the statistical properties of the variables

#### 4.1.1. Descriptive statistics of the regression variables

Table 4.1 below shows the descriptive statistics of the variables used in this research.

**Table 4.1: The descriptive statistics of the variables**

<b>Variable</b>	<b>Number of observations</b>	<b>Mean</b>	<b>Std. deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<i>CODEBANKCRIS</i>	405	1.4	0.9662626	0	1
<i>RGDPGR</i>	328	0.841292	8.205906	-30.4544	154.7239
<i>TOT</i>	399	81.93721	33.6599	9.832371	204.8457
<i>PRICREGDP</i>	374	26.1539	31.10834	0.6876862	167.536
<i>M2RESERVE</i>	369	5.911606	10.34381	0.1908626	140.9017
<i>NONCRISIS</i>	405	0.3333333	0.4719873	0	1

From table 4.1, variable *LOGTOT* has the highest standard deviation. Table 4.2 below shows the frequency of the dependent variable, *CODEBANKCRIS*. As indicated in Table 4.2, category 1, that is, non crisis occasions have highest frequency compared to other categories. Category 2 and 3 have joint lowest frequency in the data.

**Table 4.2: The frequency and percentages of the dependent variable**

	Frequency	Percent
Category 1	340	83.95
Category 2	11	2.72
Category 3	11	2.72
Category 4	43	10.62

#### **4.1.2. Correlations**

Table 4.3 and Table 4.4. below shows the contemporaneous correlations and correlation matrix of the logged variables respectively. By looking at contemporaneous and correlation of logged variables, it can be said there was not any significant indications of correlations in either case. Therefore it can be noted that there is no interdependences in the data set. From Table 4.3 below, it can be said that banking crisis is negatively correlated with contemporaneous terms of trade, real GDP growth rate and the ratio of

domestic credit to GDP but positively correlated with contemporaneous ratio of M2 to foreign exchange reserves.

**Table 4.3: Contemporaneous correlations matrix**

	<i>BANKCRIS</i>	<i>RGDPGR</i>	<i>TOT</i>	<i>PRICREGDP</i>	<i>M2RESERVE</i>	<i>NONCRISIS</i>
<i>BANKCRIS</i>	1.0000					
<i>RGDPGR</i>	-0.0466	1.0000				
<i>TOT</i>	-0.0172	0.0700	1.0000			
<i>PRICREGDP</i>	-0.0962	-0.0416	0.2256	1.0000		
<i>M2RESERVE</i>	0.1102	-0.0531	0.0526	0.3632	1.0000	
<i>NONCRISIS</i>	-0.2779	-0.0227	-0.0570	0.0409	0.0582	1.0000

Table 4.4. below shows the correlation matrix of the logged variables in which banking crisis is negatively correlated with real GDP growth rate, term of trade, ratio of private domestic credit to private sector to GDP and the ratio of M2 to foreign exchange reserves. As described in chapter three, in this research the dependable variable, *CODEBANKCRIS*, is a dummy variable which takes the value 1 when there is no episode of crisis (the base outcome), value 2 for one year before the start of the crisis event, value 3 for the start of the banking crisis and value 4 for the ongoing of a banking crisis event.

**Table 4.4: Correlation matrix of the logged variables**

	<i>CODEBA NKCRIS</i>	<i>LOGRGDP GR</i>	<i>LOGT OT</i>	<i>LOGPRIC REGDP</i>	<i>LOGM2RE SERVE</i>	<i>NONC RISIS</i>
<i>CODEBA NKCRIS</i>	1.0000					
<i>LOGRG DPGR</i>	-0.1596	1.0000				
<i>LOGTOT</i>	-0.1348	0.0461	1.0000			
<i>LOGPRI CREGDP</i>	-0.0098	0.2542	0.1149	1.0000		
<i>LOGM2R ESERVE</i>	-0.0280	-0.0432	-0.0989	0.3643	1.0000	
<i>NONCRI SIS</i>	-0.2300	0.1266	0.0305	0.1261	0.3208	1.0000

The independent variables used in this research are: real GDP growth rate; terms of trade; domestic credit advanced to private sector; the ratio of M2 to foreign exchange reserves; and the dummy variable non-crisis which took the value 1 when the country experienced banking episode(s) or 0, otherwise. The multinomial logit model was estimated for the pooled, non-systemic and systemic crises economies in order to determine if the impact of the determinants differs between systemic and non-systemic crises.

## **4.2. Empirical results for the pooled multinomial logit model**

The pooled results of this study presents the results for the pooled multinomial logit regression results when all the systemic, non-systemic and non-crises economies were considered in the sample. These are the main results of this study. These results involve a full sample of the population, that is, all the 15 SADC countries for the period 1985-2011 which are: Angola; Botswana; Democratic Republic of Congo; Lesotho; Madagascar; Malawi; Mauritius; Mozambique; Namibia; the Seychelles; South Africa; Swaziland; Tanzania; Zambia; and Zimbabwe. Countries which did not experience banking crises for the period under review served as the control group in this study. As mentioned in the previous chapter, the non-crises economies were controlling for the constant and coefficients of the slope within the regression model. Limiting the data analysis only to countries which experienced banking crises would produce a biased sample.

### **4.2.1. Odds likelihood ratio results for the pooled model**

When interpreting the regression results, the estimated coefficients do not indicate an increase in the probability of a crisis given a one-unit increase in the corresponding explanatory variables. Instead, the coefficients reflect the effect of a change in an explanatory variable for the likelihood of the occurrence of the alternative event compared to the base outcome. Table 4.5.1 below reports the odds likelihood ratios for Outcome 2 and Outcome 3.

**Table 4.5.1: The odds likelihood ratio results for the pooled model**

	Outcome 2	Outcome 3
<i>LOGRGDPGR</i>	-0.7119586** (0.2790131)	-0.4165959 (0.2768793)
<i>LOGTOT</i>	0.2386761 (0.6519434)	-0.2070191 (1.012088)
<i>LOGPRICREGDP</i>	0.5363586 (0.4897416)	0.6939559** (0.2885675)
<i>LOGM2RESERVE</i>	-0.1997598 (0.7660894)	-0.304345 (0.6918069)
<i>NONCRISIS</i>	-16.14021* (0.6157132)	-16.81312* (0.5632307)
Constant	-6.933094 (3.144559)	-4.953693 (4.993343)
Number of observations	304	304
Pseudo R2	0.1702	0.1702
Prob > chi2	0.0000	0.0000

Note: Numbers in parentheses are the robust standard errors. \* Significant at 1% level.

\*\* Significant at 5% level.

From the results presented in Table 4.5.1 above, it is variable *LOGRGDPGR* which is significant in explaining the period one year before the start of a crisis. This implies that

a decline in real GDP growth rate in the year preceding a crisis can be a leading indicator of a banking crisis as indicated by the negative coefficient value of 0.7119586. However, for the Outcome 3 (start of a banking crisis) it is only variable *LOGPRICREGDP* which is significant at 5% level of significance. This implies if the ratio of domestic credit to the private sector to GDP is higher, the start of a banking crisis is more likely to occur as given by the positive coefficient value of 0.6939559. In this regard, financial liberalisation as proxied by the ratio of domestic credit to private sector to GDP increases the likelihood of start of a banking crisis. This variable has the expected sign which is in line with the theory and findings by Dermirguc-Kunt and Detragiache (1998), Hardy and Pazarbasioglu (1999), Hutchison and McDill (1999), Kaminsky and Reinhart (1999), Goldstein et al. (1999), Hagen and Ho (2006), Gonsel (2008), Klomp (2010) and Zistler (2010) but in contrast to findings by Enowbi and Mlambo (2012). The dummy variable, *NONCRISIS*, is negative and significant for both Outcome 2 and Outcome 3 which indicates it is going in the direction of reduction in banking crises.

#### **4.2.2. Marginal effects results for the pooled model**

While the sign of the coefficient does indicate the direction of the change, the magnitude depends on the slope of the cumulative distribution function. Therefore, it is critical to use the marginal effects to interpret the magnitudes. Table 4.5.2 below presents the marginal effects of the regression results for Outcome 2 and Outcome 3. By

interpreting the marginal effects in Table 4.5.2 below for Outcome 2 and Outcome 3, it can be noted as the real GDP growth rate increases by 1 unit in a year preceding a crisis, the likelihood of occurrence of a banking crisis is 0.01 percent lower and if the ratio of domestic credit to private sector to GDP increases by 1 unit, the likelihood of start of a banking crisis is 0.01 percent higher respectively. Although 0.01 percent is relatively low, there is evidence that if banks increase the credit to private sector, this would result in increase in loan defaults which would result in banking crises.

**Table 4.5.2: Marginal effects results for the pooled model**

	Outcome 2	Outcome 3
	$dy/dx$	$dy/dx$
<i>LOGRGDPGR</i>	-0.0000745	-0.0000393
<i>LOGTOT</i>	0.000025	-0.0000195
<i>LOGPRICREGDP</i>	0.0000561	0.0000655
<i>LOGM2RESERVE</i>	-0.0000209	-0.0000287
<i>NONCRISIS</i>	-0.0173908	-0.0195061

#### 4.2.3. Relative risk ratio (RRR) for the pooled model

The coefficients themselves cannot be interpreted easily but the exponentiated coefficients have an interpretation as the relative risk ratios (RRR). The relative risk ratio tells us how the probability of choosing  $j$  outcome relative to the base outcome changes if we increase an explanatory variable by one unit. Table 4.5.3 below presents the relative risk ratio results for Outcome 2 and Outcome 3.

**Table 4.5.3: The relative risk ratio (RRR) results for the pooled model**

	Outcome 2	Outcome 3
<i>LOGRGDPGR</i>	0.4906822 <sup>**</sup> (0.1369067)	0.6592873 (0.182543)
<i>LOGTOT</i>	1.269567 (0.827686)	0.8130041 (0.8228316)
<i>LOGPRICREGDP</i>	1.70977 (0.8373452)	2.001618 <sup>**</sup> (0.5776019)
<i>LOGM2RESERVE</i>	0.8189275 (0.6273717)	0.7376063 (0.5102811)
<i>NONCRISIS</i>	9.78e-08 <sup>*</sup> (6.02e-08)	4.99e-08 <sup>*</sup> (2.81e-08)
Number of observations	304	304
Pseudo R2	0.1702	0.1702
Prob > chi2	0.0000	0.0000

Note: Numbers in parentheses are the robust standard errors. <sup>\*</sup>Significant at 1% level.

<sup>\*\*</sup>Significant at 5% level.

From Table 4.5.3 above, if real GDP growth rate is increased by 1 unit in a year preceding a crisis, the relative risk for occurrence of a banking crisis event relative to no-crisis event would decrease by a factor of 0.491 given the other variables in the model are held constant. Therefore, the variable *LOGRGDPGR* decreases the probability that Outcome 2 occurs instead of Outcome 1 (the baseline alternative) since the RRR is less than 1. By interpreting the relative risk ratio for Outcome 3, it can be said that if the ratio of domestic credit to private sector to GDP is increased by 1 unit, the relative risk for occurrence of start of a crisis event relative to no-crisis event would increase by a factor of 2.002 given the other variables in the model are held constant. Therefore, the variable *LOGPRICREGDP* increases the probability that the Outcome 3 occurs instead of the Outcome 1 since the RRR is more than 1.

### **4.3. Empirical results for the systemic crises economies**

The results presented here are for the re-estimated multinomial logit regression when the non-systemic crises economies are dropped from the sample. By considering the systemic banking crises economies, this required dropping Botswana, Lesotho, South Africa, Swaziland and Tanzania from the sample. In other words, the sample considered now consisted of 10 countries which are: Angola; Democratic Republic of Congo; Malawi; Madagascar; Mauritius; Mozambique; Namibia; the Seychelles; Zambia and Zimbabwe.

#### **4.3.1. Odds likelihood ratio for the systemic crises economies**

Table 4.6.1 below reports the odds likelihood ratios for Outcome 2 and Outcome 3 when non-systemic banking crises episodes are dropped from the sample. From the results presented in Table 4.6.1, it can be noted that real GDP growth rate is leading indicator in a year preceding a banking crisis. This implies that if real GDP growth is higher in a year prior to a banking crisis, the occurrence of a banking crisis is less likely to occur given the negative coefficient value of 0.6722987.

Furthermore, by interpreting results for Outcome 3 in Table 4.6.1. below, variable *LOGPRICREGDP* is still significant at 1% level of significance. This variable has the expected sign which is in line with the theory and findings by Klomp (2010). This implies if the ratio of domestic credit to the private sector to GDP is higher, the start of a systemic banking crisis is more likely to occur given by the positive coefficient value of 3.491594.

From Table 4.6.1 below, it can be stated that real GDP growth rate in a year preceding a crisis reduces the likelihood of occurrence of a banking crisis. These results remained robust even for Outcome 3 (the start of a systemic banking crisis). This implies that real GDP growth rate is important in explaining the occurrence of a systemic banking crisis. These results are also consistent with findings by Klomp (2010) and Tanveer and De Haan (2008).

**Table 4.6.1: The odds likelihood ratio results for the systemic crises economies**

	Outcome 2	Outcome 3
<i>LOGRGDPGR</i>	-0.6722987*** (0.3892988)	-2.12834* (0.449479)
<i>LOGTOT</i>	3.99467 (3.966012)	0.670864 (1.013829)
<i>LOGPRICREGDP</i>	1.148278 (1.23789)	3.491594* (1.001016)
<i>LOGM2RESERVE</i>	1.037349 (0.8763754)	-3.108778* (0.9493562)
<i>NONCRISIS</i>	-17.40759* (1.58289)	-17.05914* (1.538518)
Constant	-26.78042 (16.75902)	-17.81192 (6.689372)
Number of observations	187	187
Pseudo R2	0.3999	0.3999
Prob > chi2	0.0000	0.0000

Note: Numbers in parentheses are the robust standard errors. \* Significant at 1% level.

\*\*\* Significant at 10% level

For Outcome 3, financial liberalisation as proxied by the ratio of domestic credit to private sector to GDP increases the likelihood of a systemic banking crisis as variable

*LOGPRICREGDP* remained significant at 1% level of significance. In addition, variables *LOGM2RESERVE* is now significant at 1% level of significance. Although the variable *LOGM2RESERVE* is significant, it has a negative coefficient which is in contrast to conventional wisdom and findings by Klomp (2010). The dummy variable, *NONCRISIS*, is negative and significant for both Outcome 2 and Outcome 3 which indicates it is going in the direction of reduction in the systemic banking crises.

#### **4.2.3. Marginal effects for the systemic crises economies**

Table 4.6.2 below presents the marginal effects of the regression results when non-systemic economies are dropped from the sample. By interpreting the marginal effects in Table 4.6.2 for Outcome 2, it can be said that as real GDP growth rate increases by 1 unit in a year preceding a banking crisis, the likelihood of occurrence of a systemic banking crisis is 0.0000690 percent lower. For Outcome 3, it can be said that as real GDP growth rate increases by 1 unit, the likelihood of start of a systemic banking crisis in that same year is 0.0000138 percent lower. Furthermore, it can also be stated that if the ratio of domestic credit to private sector to GDP increases by 1 unit, the likelihood of start of a systemic banking crisis is 0.0000227 percent higher. Apart from this, if the ratio of M2 to foreign exchange reserves increases by 1 unit, the likelihood of start of a systemic banking crisis is 0.0000202 percent lower. Although these variables are significant and in line with theory and findings by other researchers, these marginal

effects values are too small to come up with meaningful conclusion with regard to the impact of these variables on systemic banking crises.

**Table 4.6.2: Marginal effects for the systemic crises economies**

	Outcome 2	Outcome 3
	$dy/dx$	$dy/dx$
<i>LOGRGDPGR</i>	-6.90e-07	-1.38e-07
<i>LOGTOT</i>	4.10e-06	4.35e-08
<i>LOGPRICREGDP</i>	1.18e-06	2.27e-07
<i>LOGM2RESERVE</i>	1.06e-06	-2.02e-07
<i>NONCRISIS</i>	-0.0087971	-0.0004627

#### **4.2.3. Relative risk ratio (RRR) for the systemic crises economies**

Table 4.6.3 presents the relative risk ratio results for Outcome 2 and Outcome 3. In Table 4.6.3 below, if real GDP growth rate is increased by 1 unit in a year prior to a banking crisis, the relative risk of occurrence of a systemic crisis event would decrease by a factor of 0.511 given the other variables in the model remained constant. By interpreting results for Outcome 3, if real GDP growth rate is increased in the same year

the crisis would start, the relative risk of occurrence of start of a systemic crisis event would decrease by a factor of 0.119 given the other variables in the model are held constant. Therefore, the variable *LOGRGDPGR* decreases the probability that the Outcome 2 and Outcome 3 occurs instead of the Outcome 1(the baseline alternative) since the RRRs are less than 1.

**Table 4.6.3: The relative risk ratio (RRR) for the systemic crises economies**

	Outcome 2	Outcome 3
<i>LOGRGDPGR</i>	0.5105337*** (0.1987502)	0.1190343* (0.0535034)
<i>LOGTOT</i>	54.30789 (215.3857)	1.955927 (1.982975)
<i>LOGPRICREGDP</i>	3.152761 (3.902772)	32.83826* (32.87162)
<i>LOGM2RESERVE</i>	2.821726 (2.472891)	0.0446555* (0.042394)
<i>NONCRISIS</i>	2.75e-08* (4.36e-08)	3.90e-08* (6.00e-08)
Number of observations	304	304
Pseudo R2	0.1702	0.1702
Prob > chi2	0.0000	0.0000

Note: Numbers in parentheses are the robust standard errors. \* Significant at 1% level.

\*\*\* Significant at 10% level

Again from Table 4.6.3 above, by interpreting results for Outcome 3, if the ratio of domestic credit to private sector to GDP is increased by 1 unit, the relative risk for occurrence of start of a systemic crisis event relative to no-crisis event would increase by a factor of 32.838 given the other variables in the model are held constant. Therefore, the variable *LOGPRICREGDP* increases the probability that the Outcome 3 occurs instead of the Outcome 1 (the baseline alternative) since the RRR is more than 1. Furthermore, it can also be stated that if the ratio of M2 to foreign exchange reserves is increased by 1 unit, the relative risk of occurrence of start of a systemic crisis event relative to no-crisis event would decrease by a factor of 0.045 given the other variables in the model are held constant.

#### **4.4. Empirical results for the non-systemic crises economies**

This section presents the results of the re-estimated multinomial logit model when systemic crises economies are dropped from the sample. By considering the non-systemic banking crises, this required dropping Madagascar, Democratic Republic of Congo, Mozambique, Zambia and Zimbabwe. In other words, the sample considered here was for 10 countries namely: Angola; Botswana; Lesotho; Malawi; Mauritius; Namibia; the Seychelles; South Africa; Swaziland and Tanzania.

#### 4.4.1. Odds likelihood ratio for the non-systemic crises economies

Table 4.7.1 below reports the odds likelihood ratios for Outcome 3 when systemic banking crises episodes are dropped from the sample.

**Table 4.7.1: The odds likelihood ratio results for the non-systemic crises economies**

	Outcome 2	Outcome 3
<i>LOGRGDPGR</i>	-0.7391054** (0.3213455)	-0.1814269 (0.2801884)
<i>LOGTOT</i>	0.4093168 (1.062813)	-0.1185436 (1.062813)
<i>LOGPRICREGDP</i>	-0.0537962 (0.3817136)	-0.0537962 (0.3817136)
<i>LOGM2RESERVE</i>	0.1935861 (0.8036065)	0.1935861 (0.8036065)
<i>NONCRISIS</i>	-17.32222* (0.822704)	-17.32222* (0.822704)
Constant	-2.880813 (4.849499)	-2.880813 (4.849499)
Number of observations	216	216
Pseudo R2	0.2245	0.2245
Prob > chi2	0.0000	0.0000

Note: Numbers in parentheses are the robust standard errors. \* Significant at 1% level.

\*\* Significant at 5% level. \*\*\* Significant at 10% level

From the results presented in Table 4.7.1 above, the variable *LOGRGDPGR* remained significant at 5% level of significance for Outcome 2. This implies that real GDP growth is a leading indicator for the occurrence of a non-systemic banking crisis. If the real GDP growth rate is higher in a year prior to a banking crisis, the occurrence of a non-systemic banking crisis is less likely to occur given the negative coefficient value of 0.7391054. This variable has the expected sign which is in line with the theory.

However, by interpreting the odds likelihood ratio for the Outcome 3 (the start of a non-systemic banking crisis) results in Table 4.7.1, none of the macro and financial variables is significant although the variables *LOGRGDPGR*, *LOGTOT* and *LOGM2RESERVE* have expected signs which is in line with the theory. This finding is similar to the findings by Tanveer and De Haan (2008) who also found none of these variables to be significant in explaining the start of a non-systemic banking crisis. The dummy variable, *NONCRISIS*, in Table 4.7.1 is negative and significant for both Outcome 2 and Outcome 3 which indicates it is going in the direction of reduction in non-systemic banking crises.

#### **4.4.2. Marginal effects for the non-systemic banking crises**

Table 4.7.2 below presents the marginal effects of the regression results when systemic economies are dropped from the sample. By interpreting the marginal effects in Table

4.7.2, for Outcome 2 it can be said that as real GDP growth rate increases by 1 unit in a year preceding a banking crisis, the likelihood of occurrence of a systemic banking crisis is 0.00109 percent lower.

**Table 4.7.2: Marginal effects for the non-systemic crises economies**

	Outcome 2	Outcome 3
	$dy/dx$	$dy/dx$
<i>LOGRGDPGR</i>	-0.0000109	-2.60e-07
<i>LOGTOT</i>	6.05e-06	-1.70e-07
<i>LOGPRICREGDP</i>	5.39e-06	-7.71e-07
<i>LOGM2RESERVE</i>	-6.18e-06	2.78e-06
<i>NONCRISIS</i>	-0.0151992	-0.036088

#### **4.4.3. Relative risk ratio (RRR) for the systemic crises economies**

Table 4.7.3 below presents the relative risk ratio results for Outcome 2 and Outcome 3. In Table 4.7.3, results for Outcome 2 indicates that if real GDP growth rate is increased by 1 unit in a year prior to a banking crisis, the relative risk of occurrence of a non-systemic crisis event would decrease by a factor of 0.478 given the other variables in the model are held constant. Therefore, the variable *LOGRGDPGR* decreases the

probability that the Outcome 2 occurs instead of the Outcome 1 (the baseline alternative) since the RRR are less than 1.

**Table 4.7.3: The relative risk ratio (RRR) for the non-systemic crises economies**

	Outcome 2	Outcome 3
<i>LOGRGDPGR</i>	0.4775409** (0.1534556)	0.8340792 (0.2336993)
<i>LOGTOT</i>	1.505789 (0.9996297)	0.8882131 (0.9440043)
<i>LOGPRICREGDP</i>	1.439963 (0.8345154)	0.9476253 (0.9476253)
<i>LOGM2RESERVE</i>	0.6582945 (0.6367904)	1.213594 (0.9752519)
<i>NONCRISIS</i>	2.11e-07* (2.66e-07)	3.00e-08* (2.47e-08)
Number of observations	216	216
Pseudo R2	0.2245	0.2245
Prob > chi2	0.0000	0.0000

Note: Numbers in parentheses are the robust standard errors. \* Significant at 1% level.

\*\* Significant at 5% level.

#### **4.5. Chapter summary**

This chapter presented the results multinomial logit model specified in Chapter 3. The results are presented for the pooled model, the systemic crises economies and for the non-systemic crises economies.

## **CHAPTER 5: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS**

### **5.0. Introduction**

This chapter presents the discussion and conclusions based on the empirical results from Chapter 4. Recommendations are also made for future studies based on the limitations of this current study.

### **5.1. Discussion**

A number of studies have tried to ferret the determinants of banking crises on a data set consisting of developed and developing countries (mixed country approach). Although reliance on the mixed country approach arguably increases the number of observations, it undoubtedly brings problem due to differences in the structures and system of developing countries and those of developed countries which could lead to biased results. Furthermore, most of these studies have solely relied on the episodes of banking crises constructed by some pioneer researchers such as Dermirguc-Kunt and Detragiache (1998) and Laeven and Valencia (2008, 2010). These data bases have overlooked some important banking crises which have occurred in some developing countries especially those characterised by poor statistical records like the Zimbabwe banking crises of 2003-2006 where more than 9 financial institutions were either liquidated or placed under curatorship. These gaps in the empirical literature can be the

contributing factor to the inconsistent and inconclusive discussion with regard to the determinants of banking crises.

This study attempted to fill the void in literature on banking crises by empirically analysing the impact of terms of trade, real GDP growth rate, the ratio of domestic credit to private sector to GDP and the ratio of M2 to foreign exchange reserves on banking crises in the SADC region over the period 1985-2011. In this research the dependable variable, banking crisis, was treated as a dummy variable which took the value 1 when there is no episode of crisis (Outcome 1), value 2 for one year before the start of the crisis event (Outcome 2), value 3 for the start of the banking crisis (Outcome 3) and value 4 for the ongoing of a banking crisis event (Outcome 4). Following the data base on the banking crises from Domac and Martinez (2003), Enowbi and Mlambo (2012), Gono (2012) and Laeven and Valencia (2012), the current study was able to identify 6 episodes of systemic banking crises and 5 episodes of non-systemic banking crises in the SADC region for the period covering 1985-2011.

The probability of a banking crisis was estimated using a multinomial logit model on real GDP growth rate, terms of trade, the ratio of private domestic credit to GDP and the ratio of M2 to foreign exchange reserves. The model was estimated for the pooled, non-systemic and systemic crises economies in order to determine if the impact of the determinants differs between systemic and non-systemic crises. In all the three

estimated models, real GDP growth rate (*LOGRGDPGR*) was found to be the leading indicator in a year preceding a banking crisis, that is, Outcome 2 (one year before the start of a crisis). This variable had the negative sign which is in line with theory.

In the pooled model, the ratio of private domestic credit to GDP as the proxy for financial liberalisation was found to be a significant variable in explaining the start of a banking crisis (Outcome 3). As the ratio of private domestic credit to GDP increases by 1 unit, the likelihood of start of a banking crisis is 0.01 percent higher. This variable had the expected sign which corroborate findings by Dermirguc-Kunt and Detragiache (1998), Hardy and Pazarbasioglu (1999), Hutchison and McDill (1999), Kaminsky and Reinhart (1999), Goldstein et al. (1999), Hagen and Ho (2006), Gonsel (2008), Klomp (2010) and Zistler (2010) but in contrast to Enowbi and Mlambo (2012) who found that financial liberalisation tends to reduce the likelihood of start of a banking crisis.

The difference between the findings of this current study and that of Enowbi and Mlambo (2012) with regard to relationship between financial liberalisation and banking crises can be conjectured from a few aspects: first, although this research applied the same definition and some of the episodes of systemic and non-systemic banking crises as Enowbi and Mlambo (2012), this current research went a step further in identifying other episodes of banking crises from other databases and reports from other central

banks. For example, in their sample Botswana, South Africa, Swaziland and Tanzania were not considered to have encountered banking crises for the period under review while in this current research they were considered to have encountered non-systemic banking crises between 1985-2011. Furthermore, the 2003-2006 Zimbabwean banking crises is not incorporated in the sample by Enowbi and Mlambo (2012) but was incorporated in this current study. Secondly, they used capital account openness index as proxy for financial liberalisation while in this study, the ratio of private domestic credit to GDP was used as the proxy for financial liberalisation. This can be the explanation for the difference in the findings of this study and that of Enowbi and Mlambo who also analysed the determinants of banking crises for African countries, although not specifically for the SADC region.

The above findings with regard to the effect of the ratio of the domestic credit to private sector to GDP on banking crises also supports the trend in the frequency of banking crises in the SADC region as is noted in Figure 1.2 in Chapter 1. In the late 1980s and early 1990s, a number of countries in the SADC region adopted different Structural Adjustment Programs (SAPs) for instance by liberating their financial system as a way of creating economic growth. It is also during this period when the SADC region reported the highest number of banking crises.

When systemic banking crises episodes were considered in the sample in this current study, the ratio of domestic credit to private sector to GDP remained significant in predicting the start of a crisis (Outcome 3). Besides this, this variable had the expected sign which is in line with the theory and findings by Klomp (2010). In addition real GDP growth rate was now significant although the 0.000000138 marginal effects were too low to come up with a meaningful conclusion on the impact of real GDP growth rate on systemic banking crises. This was expected given that GDP in the SADC region is not largely driven by credit as compared to other economic integrations like the EU (European Union). Although people borrow money, they may not use it on investment which is key to achievement of economic growth. This could be the explanation for the evidence of a weaker relationship between real GDP growth rate and the likelihood of start of systemic banking crises in the SADC region.

Furthermore, in the model with the systemic banking episodes the ratio of M2 to foreign exchange reserves was now significant for the systemic banking crises although having a negative sign (not expected a priori based on the reviewed literature) which is in contrast to conventional wisdom and findings by Klomp (2010). The possible explanation in difference in the findings of this current research and that by Klomp (2010) can be attributed to the different methodology used. Klomp (2010) utilised a mixed country approach (data set consisting of developed and developing countries) for

a sample of 120 countries whilst this current approach utilised only 15 developing countries.

When non-systemic banking crises episodes were considered in the model, for the Outcome 3 (the start of a banking crisis), none of the macro and financial variables turned out to be significant although real GDP growth rate, terms of trade and the ratio of M2 to foreign exchange reserves had the expected signs which is in line with theory and findings by Tanveer and De Haan (2008).

In general, this study found that real GDP growth rate, ratio of private domestic to private sector and the ratio of M2 to foreign exchange reserves are on average the most important causes of a start of a banking crisis. However, their impact differs between the three estimation models for the: pooled, systemic and non-systemic crises economies which makes it difficult to come with a concrete conclusion. It is imperative to note that in these three estimation models, real GDP growth rate is the only variable which was significant in explaining one year before the start of a banking crisis.

## **5.2. Policy implications**

Based on the empirical results in this study, the following policy implications can be inferred. First, this study found that low rate of GDP growth rate in the year prior to the start of a banking crisis is significant in explaining the start of a banking crisis.

Borrowers are likely to default when growth is deteriorating as their activities are usually less profitable. Therefore, policy makers in the SADC region should implement policies aimed at promoting economic growth such as liberalization financial markets. Although such policies are desirable in promoting economic growth, they may lead to the increase in the probability of start of a banking crisis as this study found a positive relationship between financial liberalisation and start of a banking crisis. Thus, the design and implementation of effective economic growth promotion programs should be accompanied by policies aimed at reducing the impact of financial liberalisation on banking crises. The possible benefits of financial liberalisation should be weighed against the costs of banking crises to determine which course of action has the greatest impact. Policy makers should focus on reducing or improving that course of action which has the greatest impact.

Secondly, this current study found that the impact of decrease in banking crises which arises by increasing GDP growth rate due to financial liberalisation in one prior to the start of a banking crisis as measured by the marginal effects in both the pooled and systemic crises model is greater than the resultant increase in the banking crises. In this regard, the benefits (decrease in banking crises) which arise because of implementation of the financial liberalisation policies aimed at improving GDP growth rate are greater than the costs (increase in banking crises) to be incurred. Therefore, policy makers in the SADC region should adopt policies aimed increasing financial liberalisation. This

finding also agree with those who argue that financial liberalisation could promote economic growth.

### **5.3. Recommendations for further studies**

Having said this, one limitation of this study is that institutional and other additional macro-economic and financial variables were not considered in this study due to unavailability of data. Therefore, my recommendation for further studies in this area is that, future research should also consider these variables as they are believed to be important determinants of banking crises. Furthermore, future research could also focus on investigation of the significant parameters in predicting the likelihood of a banking crisis when heterogeneity across individuals is considered since this study assumed homogeneity across individuals (pooled regression). Apart from this, this study did not explore in detail the relationship between financial liberalisation, economic growth and banking crises. Future research should also focus on examining this relationship in order to come up with the cost-benefit analysis of implementing financial liberalisation policies aimed at promoting economic growth.

### **5.4. Conclusion**

Based on the empirical results in this study, it can be concluded that lower rate of GDP growth rate is a leading indicator in a year prior to the start of a banking crisis.

This finding suggests that real GDP growth rates can indeed play an important role in minimising the occurrence of a banking crisis. Although improving GDP growth by adopting policies aimed at financial liberalisation may lead to increase in banking crises, the benefits of financial liberalisation were found to outweigh the costs of financial liberalisation in this current study. This conclusion is consistent with recent studies which underscore the importance of financial liberalisation in promoting economic growth owing to the characteristics of developing countries such as ill developed financial markets which prevents them from benefiting from liberalised financial markets.

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## ANNEXURES

## ANNEX 1

**Table 1.1: List of systemic and non-systemic banking crises in the SADC for the period 1985-2011**

Country	Year of banking crises	Comment	Systemic or non-systemic
Botswana	1994-1995	Between 1994-1995, the Zimbank Botswana, the subsidiary of a Zimbabwean bank was unprofitable, and with an eroding capital base, and the Bank of Botswana (BoB) co-ordinated a takeover by FNB in order to pre-empt the collapse of the bank. Botswana Co-operative Bank originally established to serve the co-operative sector of the economy, obtained a commercial banking licence but never operated profitably and was eventually closed by the BoB.	Non-systemic
Congo, Dem. Rep	1991-1998	Between 1991-1994, four state-owned banks were insolvent; a fifth bank was to be recapitalised with private participation. Between 1994-1998, two state-owned banks have been liquidated and two other state banks privatised. In 1997, 12 banks were having serious financial difficulties.	Systemic
Lesotho	1988-1991	One of four commercial banks suffered from large non-performing loans	Non-systemic
Madagascar	1987-	After the formal abandonment	Systemic

	1992	in 1985 of the previous policy of bank specialization and the appointment in 1986 of separate boards of directors to replace the single board that was shared by all commercial banks, the rehabilitation of the banking system gained speed with the enactment in 1988 of a new banking law, which opened the system to private capital, and the decision in 1989 to write off most of the nonperforming loans of the existing banks.	
Mozambique	1987-1991	Main commercial bank experienced solvency problems that became apparent after 1992	Systemic
South Africa	1989		Non-systemic
Swaziland	1995-1999	Meridien BIAO Swaziland was taken over by the Central Bank. The Central Bank also took over the Swaziland Development and Savings Bank, which faced severe portfolio problems.	Non-systemic
Zambia	1989-1996	Meridian Bank, accounting for 13% of commercial bank assets, became insolvent.	Systemic
Tanzania	1987-1988	In 1987 the main financial institutions had arrears amounting to half their portfolios. In 1995 it was	Non-systemic

		determined that the National Bank of Commerce, which accounted for 95% of banking system assets, has been insolvent since at least 1990.	
Zimbabwe	1991-2003	Two of five commercial banks had high non-performing loans.	Systemic
Zimbabwe	2003-2006	In 2004 nine financial institutions namely Barbican Bank Limited, CFX Bank Limited, CFX Merchant Bank, Intermarket Banking Corporation Limited, Intermarket Building Society, Intermarket Discount House, Royal Bank of Zimbabwe Limited, Time Bank Zimbabwe Limited and Trust Bank Corporation Limited were placed under recuperative curatorship. In 2005, Zimbabwe Allied Banking Group (ZABG) was established by the government where the following banks were amalgamated into ZABG: Royal Banking Corporation Limited; Trust Banking Corporation Limited; and Barbican Banking Corporation Limited.	Systemic

Sources: Domac and Martinez (2003); Enowbi and Mlambo (2012); Gono (2012); and Laeven and Valencia (2012).

## ANNEX 2

Table  
3.1  
Matrix of systemic and non-systemic  
banking crises episodes

<b>Period</b>	<b>AN</b>	<b>BO</b>	<b>DR</b>	<b>LE</b>	<b>MA</b>	<b>M L</b>	<b>M U</b>	<b>M O</b>	<b>N A</b>	<b>S E</b>	<b>S A</b>	<b>S W</b>	<b>T A</b>	<b>Z A</b>	<b>Z W</b>
1985	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1986	1	1	1	1	2	1	1	2	1	1	1	1	2	1	1
1987	1	1	1	2	3	1	1	3	1	1	1	1	3	1	1
1988	1	1	1	3	4	1	1	4	1	1	2	1	4	2	1
1989	1	1	1	4	4	1	1	4	1	1	3	1	1	3	1
1990	1	1	2	4	4	1	1	4	1	1	1	1	1	4	2
1991	1	1	3	4	4	1	1	4	1	1	1	1	1	4	3
1992	1	1	4	1	4	1	1	1	1	1	1	1	1	4	4
1993	1	2	4	1	1	1	1	1	1	1	1	1	1	4	4
1994	1	3	4	1	1	1	1	1	1	1	1	2	1	4	4
1995	1	1	4	1	1	1	1	1	1	1	1	3	1	4	4
1996	1	1	4	1	1	1	1	1	1	1	1	4	1	4	4
1997	1	1	4	1	1	1	1	1	1	1	1	4	1	1	4
1998	1	1	4	1	1	1	1	1	1	1	1	4	1	1	4
1999	1	1	1	1	1	1	1	1	1	1	1	4	1	1	4
2000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
2003	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
2004	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
2005	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
2006	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4
2007	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2008	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2009	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Note: AN-Angola; BO-Botswana; DR-Democratic Republic of Congo; LE-Lesotho; MD-Madagascar; ML-Malawi; MU-Mauritius; MO-Mozambique; NA-Namibia; SE-Seychelles; SA-South Africa; SW-Swaziland; TA-Tanzania; ZA-Zambia; ZW-Zimbabwe

## ANNEX 3

**Table 3.2: Definitions, sources and the expected signs of the explanatory variables**

<b>Variable Name</b>	<b>Definition</b>	<b>Source</b>	<b>Expected Sign</b>
<b>Macroeconomic variable:</b>			
Real GDP growth rate ( <i>RGDPGR</i> )	Is the nominal annual percentage growth rate of GDP at market prices based on local currency deflated by the GDP deflator	World Bank (2011)	-
Terms of trade ( <i>TOT</i> )	Is computed as the value of exports divided by the value of imports	World Bank (2011)	-
<b>Financial variables:</b>			
Domestic credit to private sector ( <i>PRICREGDP</i> )	Is the gross credit from the financial system to individuals, enterprises, nonfinancial public entities not included under net domestic credit, and financial institutions	World Bank (2011)	+
The ratio of M2 to foreign exchange reserve ( <i>M2RESERVE</i> )	This comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government	World Bank (2011)	+

Source: World Bank (2011) and researcher's own elaboration