AN EMPIRICAL INVESTIGATION OF FACTORS THAT DETERMINE DEMAND FOR INTERNATIONAL RESERVES IN THE SADC REGION

MASTER OF ARTS (ECONOMICS) THESIS

LASTON PETRO MANJA

UNIVERSITY OF MALAWI
CHANCELLOR COLLEGE

SEPTEMBER, 2018

AN EMPIRICAL INVESTIGATION OF FACTORS THAT DETERMINE DEMAND FOR INTERNATIONAL RESERVES IN THE SADC REGION

Master of Arts (Economics) Thesis

By

LASTON PETRO MANJA
B.Soc. Sc. (Economics) – University of Malawi

Submitted to the Department of Economics, Faculty of Social Science, in partial fulfillment of the requirements for a Master of Arts Degree (Economics)

University of Malawi
Chancellor College

September, 2018

DECLARATION

I, the undersigned, hereby declare that this thesis is my own original work and it has never been submitted for similar purposes to this or any other university or institution of higher learning. Where other people's work has been used acknowledgements have been made. All errors contained herein are the author's sole responsibility.

LASTON PETRO MANJA

_____

Full Legal Name

_____

Signature

_____

Date

CERTIFICATE OF APPROVAL

The undersigned certify that this thesis represents the student's own work and effort, and it makes acknowledgements where other sources of information are used. The thesis is submitted with our approval.

Signature: _____Date:_____

Exley B.D. Silumbu, PhD (Senior Lecturer)

First Supervisor

Signature: _____Date:_____

Regson D.C. Chaweza, PhD (Lecturer)

Second Supervisor

DEDICATION

This one's for me. For all the times I was pressed down but still came out stronger.

To all low income countries, may this be the guide with which you attain the convergence that is theorized.

ACKNOWLEDGEMENTS

I greatly appreciate the candid critical acumens of my supervisors (Dr. EBD Silumbu and Dr. RD Chaweza) since inception of the ideas inscribed in this study. I express my deep gratitude to the following for inspiring and demonstrating unwavering faith in me at a time when I still doubted myself: Dr. Silumbu, Assoc. Prof. Levison Chiwaula, Dr. Martin Phangaphanga and Assoc. Prof. Patrick Kambewa. I am thankful to the Department for providing me a scholarship.

Special thanks go to Martin A. Carree (University of Maastricht), Maurice J.G. Bun (University of Amsterdam) and Jean Marcelin B. Brou (University Felix Houphouet Boigny, Abidjan, Côte d'Ivoire) for the important methodological comments. I take credit for all errors and mistakes herein.

I am enormously pleased to highlight the ongoing and steadfast support of my family. My mother, Annie. My brothers, Fexton and Luke. My sisters Patricia, Mphatso, Ruth and Ritah. Let me also recognize my long list of amazing nephews and nieces. Shakira, Esther, Boniface, Grace, Annie, Shireen, Faith, Shalom, Precious, Micah and Wonderful. I pray that you all grow up in Christ and get to fulfill your dreams. May you know that from anything that you are blessed with, you can achieve so much more than we have.

For all mercies and making me Minister of Academic Excellence, I am indebted to God.

ABSTRACT

With levels of international reserves in countries of the Southern African Development Community (SADC) reaching unprecedented high levels in spite of increased liberalization in the region, the search for responsible factors has reached a fascinating peak. Provided that recent studies covering wider economic structures find precautionary motives to be more relevant in explaining the phenomenon in the modern era, this study aims at unraveling the determinants of demand for international reserves in this economic structure by mainly augmenting the buffer stock model. For a sample period from 1980 to 2015, the study adopts the Blundell-Bond System Generalized Method of Moments (GMM) and the Bias-Corrected Least Squares Dummy Variable (LSDVC) estimators, all due to their suitability in allowing the inclusion of a lagged dependent variable as a regressor in the model while handling any possible endogeneity. It is found that there exists a U-shaped relationship between reserves hoarding and development in the region. Additionally, opportunity costs, exchange rate and reserves volatility (adjustment costs) as well as membership to the Common Monetary Area (CMA) and the MMZT (Malawi, Mozambique, Zambia and Tanzania) are significant determinants of demand for reserves in the SADC. This signals that unions within the SADC will likely result in a higher demand for reserves as economies seek to meet subsequent reserve targets. In terms of the longstanding debate between precautionary and mercantilist motives for reserves demand, the study finds evident precautionary rather than mercantilist factors in the SADC region as is the case with most low income countries.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AfDB	African Development Bank
API	Average Propensity to Import
BOP	Balance of Payments
BWS	Bretton Woods System
CADF	Cross-Sectionally Augmented Dickey-Fuller
CBS	Central Bank of Seychelles
CMA	Common Monetary Area
DRC	Democratic Republic of Congo
ECM	Error Correction Model
EMU	Economic and Monetary Union
ER	Exchange Rate
FE	Fixed Effects
FGLS	Feasible Generalized Least Squares
FTA	Free Trade Area
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
IBRD	International Bank for Reconstruction and Development
IEO	Independent Evaluation Office
IFS	International Financial Statistics
IMF	International Monetary Fund

LIBOR	London Interbank Offered Rate
LSDVC	Bias-Corrected Least Squares Dummy Variable
MABP	Monetary Approach to Balance of Payments
MDG	Millennium Development Goals
MEC	Macroeconomic Convergence
MMZT	Malawi, Mozambique, Zambia and Tanzania
MPI	Marginal Propensity to Import
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
RISDP	Regional Indicative Strategic Development Plan
SADC	Southern African Development Community
SDG	Sustainable Development Goal
SDR	Special Drawing Right
SSA	Sub-Saharan Africa
US	United States
WDI	World Development Indicators

CHAPTER ONE

INTRODUCTION

1.1 Background

One notable characteristic of the trend in global reserve accumulation is that although Asian economies hoard the biggest proportion of reserves, African economies have also experienced an increasing trend overtime. The rationale for such reserve hoardings, nonetheless, remains a debate for all countries (Ra, 2007).

The past few decades have registered countries in the world becoming more market-oriented than centrally regulated. African countries, and specifically those in the Southern African Development Community (SADC), are no exception to this trend. In line with the central bank intervention model, the wish to hold international reserves is justified only when countries pursue fixed exchange rate regimes in which case central banks are expected to intervene in the market to counteract any speculative attacks and defend parities (Flood & Marion, 2002; Batten, 1982). This means that as SADC countries become more liberalized, other things held constant, stocks of reserves are expected to decline as shocks will be self-absorbing and hence there will be little or no market intervention. However, reserve accumulation has been on the rise in the region in spite of

the increased floating of currencies. Against this background, this study seeks to investigate factors that determine demand for international reserves in the SADC region.

By definition, the International Monetary Fund [IMF] (2009) treats international reserves as those external assets that are readily available to and controlled by monetary authorities for direct financing of payments imbalances through intervention in exchange markets to affect the currency exchange rate, among others. This implies that international reserves are subject to central bank intervention in the foreign exchange market whereby an economy faced with a balance of payments (BOP) deficit sells reserves to prevent depreciation of the local currency, while an economy faced with a BOP surplus purchases foreign currency to prevent domestic currency appreciation.

Given that different countries adopt varying degrees of flexibility in the exchange rate regimes, different levels of reserves are also demanded to satisfy mainly transactionary, precautionary, mercantilist and collateral asset motives (Flood & Marion, 2002). While the transactionary motives are captured by scale variables such as income, precautionary motives are risk factors such as volatilities. Specifically, reserves, *inter alia*, help to manage monetary and exchange rate policies; they abate the negative effects of external shocks and they reduce the cost of borrowing (Sinem & Nebiye, 2014). Reserves also help to finance imports and to meet foreign debt for borrowing economies. For the SADC region, countries' reserve hoardings are held mainly to satisfy domestically set legal restrictions, sustain domestic currency credibility in the face of crises and to help with foreign borrowing (SADC, 2011). This is because sections 53, 54 and 56 of the SADC

Model Law only direct central banks to trade gold or foreign currency to manage reserves prudently, while not specifying exact reasons for which to hoard reserves (SADC, 2009).

In spite of the aforesaid benefits for holding reserves, an upward surge in reserve accumulation can be problematic. Theoretically, based on the quantity theory of money, if monetary expansion that corresponds to the hoarding of reserves is not fully sterilized and exceeds growth of money demand, reserves hoarding is inflationary. Although this trend is more likely for countries that operate fixed exchange rates, countries with flexible exchange rates are also affected (Steiner, 2009). Additionally, holding too many reserves is costly because the yield from reserves, usually invested in bonds, is much lower than the opportunity cost of holding those reserves, although this cost is lower than the potential cost of another crisis (Ra, 2007). These costs make it necessary for monetary authorities to understand the motives for reserve accumulation at any point in time, based on legislation and objectives of policy.

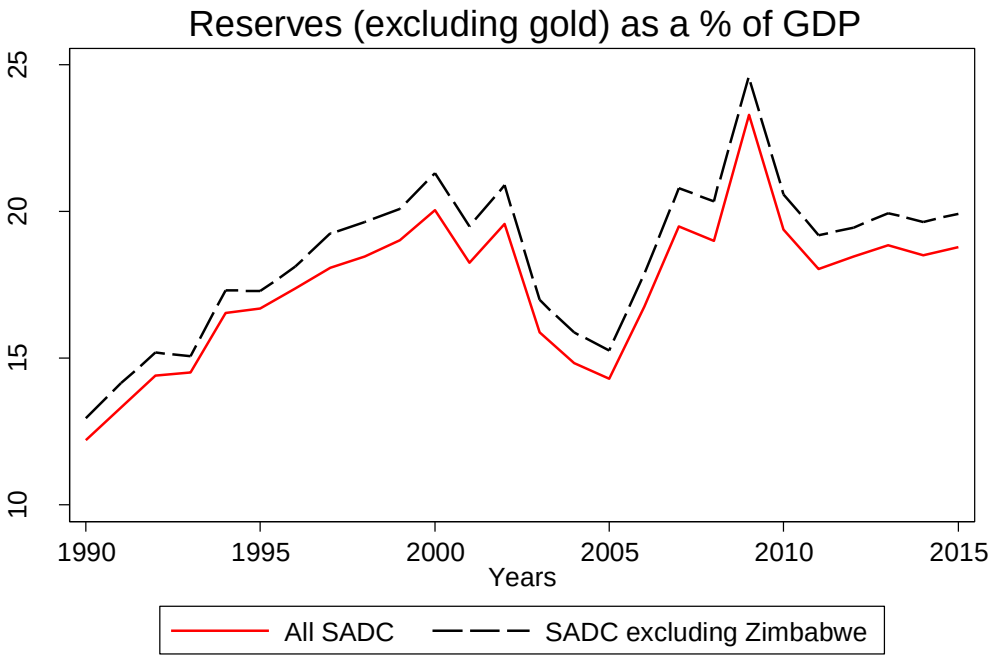
1.2 Problem Statement and Significance of the Study

By 2015, the SADC region had a US$500 billion need for infrastructure (OECD, 2015). The gap between demand and supply for basic infrastructure sectors, such as power generation and telecommunications and transport, was also reported to have been growing since the 1980s (OECD, 2013). In addition, between 1990 and 2011, Africa only attracted 10 percent of global private investment in infrastructure, from which most SADC countries did not benefit. In spite of the infrastructure problems faced in the

region, among other problems, accumulation of international reserves over the past few decades has been on the rise exceeding US$90 billion in 2015.

Specifically, since the year 2000 the increasing demand for reserves has been unprecedented, with the regional average sometimes reaching about 25 percent of GDP. This of course exists in spite of the fact that these economies, with high degrees of flexibility, are expected to hold less international reserves, if any, as per the central bank intervention model (Bastourre, Carrera, & Ibarlucia, 2009; Batten, 1982). The rising reserves accumulation for the region can be observed in Figure 1 below which shows the trend of reserve accumulation in terms of the average reserves (excluding gold) as a percentage of GDP from the year 1990 to 2015.

Figure 1: Average Reserves/GDP (%) for SADC Countries from 1990 to 2015



Source: Author's calculation from WDI Data

The above figure confirms that reserve accumulation has been generally rising overtime for the SADC countries. With the two curves following a similar upward trend, reserve accumulation declined around 2005 and reached an all-time high of about 25 percent in 2009. It is evident from the figure that reserve accumulation in the region was faced mainly with three structural breaks around 1999/2000, 2004/05 and 2007-2009. It is worth noting that the trade protocol signed in 1996 led to launch of a free trade area (FTA) in 2000 and such perceived trade security likely led to a reduction in precautionary reserves. In addition, the Regional Indicative Strategic Development Plan (RISDP) adopted in 2003 called for an improvement of countries' reserve holdings to achieve target import covers. This led to increases in reserve holdings in 2004. For the 2007-2009 break, it was observed that the SADC region was affected by the global financial crisis around that time, such that regional exports as a percentage of GDP fell from 48.6 to 41.5 percent (SADC, 2013). As a precautionary measure against the deteriorating terms of trade, countries increased their reserve hoarding.

Although there has been massive accumulation of reserves in the developing and less developed countries, various concerns have been raised. Elhiraika and Ndikumana (2007) argued that reserve accumulation in Africa is not motivated by returns having found that continued reserve buildup has a weak return effect. Massive reserves accumulation also represents large foregone consumption and investment in the countries which would possibly have good growth prospects. This means countries forego necessary investments on education, health and infrastructure in favor of hoarding reserves (IMF, 2009).

Furthermore, reserve accumulation for mercantilist motives favors export-oriented growth at the expense of domestic-demand oriented growth which is more stable.

In addition, the IMF highlighted the risk that large reserves accumulation has on stability of the international monetary system (IMF, 2009). As reserve-issuing countries strive to meet the world's ever-increasing demand for reserves, current account deficits are inevitable, a condition known as the Triffin dilemma. This is where the country must satisfy global demand for reserves while simultaneously maintaining its own domestic macroeconomic stability. Eventually, the country runs external deficits which later undermine their currencies and lead to instability of the international monetary system.

The above points show that reserves hoarding clearly has its pros and cons. However, regional motives for the tendency remain unclear; is it self-insurance, protectionism or other factors? Why has reserve accumulation in the SADC region been on the rise yet investments in some of the countries are below optimal? Historically, a number of studies have been conducted, and the determinants mostly fall in four categories: transactionary, precautionary (risk factors), mercantilist or collateral asset motives. Analysis of the studies shows that understanding of the determinants is essential for reserve management, especially since there are plans to launch a SADC central bank in the near future. Nonetheless, with most studies conducted elsewhere, no study has been done for the SADC region as a whole. While some studies looked at Africa generally, or a few African countries as part of the developing countries under focus (e.g. Jung & Pyun (2015); Cheung & Ito, 2009; Elhiraika & Ndikumana 2007), some studies have not even

looked at any country from the SADC to understand the trend. Of the selected studies that are close to explaining the phenomenon in the region, only a few (e.g. Elhiraika & Ndikumana (2007) and Bhattacharya et al. (2018)) at least include some SADC countries and use the recommended methodology.

Additionally, most of the studies have only taken into consideration the traditional variables, mostly transactionary, without concern for other areal-specific determinants (Elhiraika & Ndikumana, 2007; Bhattacharya, Mann, & Nkusu, 2018). This is common though the SADC region faces its own trade policies given the existing treaties and agreements. More often, countries in the region also hold reserves for other motives apart from concern for size of BOP (SADC, 2011). It is therefore proposed in this study that apart from the traditional determinants there are unique factors in the context of Africa, generally, and SADC, in particular, which affect reserve accumulation.

1.3 Objectives of the Study

Generally, this study empirically investigates factors that determine demand for international reserves in the SADC region. Specifically, the study:

i. Examines the effect of scale factors on demand for international reserves in the SADC region.
ii. Assesses the influence of risk factors on demand for international reserves in the SADC region.
iii. Analyzes the effect of mercantilist factors on demand for international reserves in the SADC region.

1.4 Study Hypotheses

From the above stated specific objectives, the following null hypotheses will be tested:

i. Scale factors have no effect on demand for international reserves in the SADC region

ii. Risk factors have no influence on demand for international reserves in the SADC region

iii. Mercantilist factors have no effect on demand for international reserves in the SADC region

1.5 Organization of the Paper

Having introduced the topic in Chapter one, Chapter two provides an overview of the SADC region and a synopsis of international reserves both on the global front and among SADC countries. Chapter three proceeds with a review of literature, both theoretical and empirical, related to the demand for international reserves. While Chapter four describes the methodology employed in this study, Chapter five is a discussion of research findings from the analysis. In manner of conclusion, Chapter six closes up on the whole study and provides study limitations and directions for further research.

CHAPTER TWO

OVERVIEW OF INTERNATIONAL RESERVES AND THE SADC REGION

2.1 Introduction

This section presents a précis of the SADC region and that of international reserves. Hoarding of reserves in the SADC region is also considered. While Section 2.2 presents a history of international reserves in the international monetary system, Section 2.3 explains a background of the SADC region and its economic performance. In Section 2.4, reserve hoarding in the SADC region is then considered.

2.2 Hoarding of International Reserves

2.2.1 Historical Composition, Trend and Current Status

Reserve assets, according to the 6th edition of the BOP Manual (BPM6), are said to consist of monetary gold, Special Drawing Right (SDR) holdings, reserve positions in the IMF, currency and deposits, securities, financial derivatives and other claims (IMF, 2009). Monetary authorities are in this case defined as central banks and institutions whose operations are attributed to the central bank.

Historically, during the international gold standard (1870-1914), monetary gold constituted the only international reserve asset. The gold standard, however, broke down with the advent of World War I and consequently countries diversified to other reserve

assets. For instance in the Bretton Woods System (BWS) that was launched around 1944 by the IMF and International Bank for Reconstruction and Development (IBRD) as World War II was coming to a close, the US dollar was defined to have a value of 1/35 of an ounce of gold, and other countries defined their currency values in terms of the US dollar[1]. The BWS was later abandoned in 1971 with continuing US BOP deficits, escalating inflation and lagging economic growth, leading to a change in the value of gold from $35 to $38 in the Smithsonian Agreement which established a new set of par values.

In terms of current composition, while monetary gold includes unallocated gold accounts and gold bullion (including coins, ingots and gold in allocated gold accounts), an SDR is a paper asset (also called paper gold) created by the IMF in 1969. SDRs can be swapped across countries and hence used to settle BOP deficits. On its introduction, the SDR was defined to be equal to one US dollar, and hence an equivalent of 1/35 of an ounce of gold (Appleyard & Field, 2001). With subsequent devaluations of the dollar, however, equality of each SDR to the dollar was discarded so as to value it as a weighted average of the US dollar, Euro, Japanese Yen and British Pound, and later in 2016 the Chinese Renminbi[2]. On April 30, 2016, the SDR/US dollar exchange rate was US$1=SDR 0.705552 and the US dollar/SDR exchange rate was SDR 1=US$1.41733 (IMF, 2016).

[1] IBRD is now called the World Bank

[2] Currencies are constantly revised, with 41.73, 30.93, 10.92, 8.33 and 8.09 percentages for the US dollar, Euro, Renminbi, Yen and Pound Sterling respectively by October 1, 2016 for the SDR basket currency weighting.

A country's reserve position in the IMF refers to the sum of all foreign currency drawn on short notice (reserve tranche) and indebtedness of the IMF (credit tranche). The reserve tranche is the first 25 percent of countries' IMF quota obtained automatically when countries face BOP difficulties. With securities including liquid and marketable equity and debt securities, financial derivatives include only those that pertain to reserve assets management. Table 1 below gives latest holdings of reserves in the world.

Table 1: Official Global Holding of Reserve Assets: 2010-2017 (Billions of SDRs)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Reserves excluding gold								
Reserve positions in Fund	49	98	103	98	82	64	79	78
SDRs	204	204	204	204	204	204	204	204
Total Fund assets	**253**	**302**	**307**	**302**	**286**	**268**	**283**	**282**
Foreign exchange	6,016	6,647	7,126	7,587	7,997	7,879	7,968	8,004
Total reserves excluding gold	**6,265**	**6,940**	**7,421**	**7,876**	**8,269**	**8,131**	**8,221**	**8,257**
Gold*	905	1,001	1,103	801	857	805	912	993
Total reserves including gold	**7,170**	**7,940**	**8,524**	**8,677**	**9,126**	**8,936**	**9,134**	**9,249**

Source: IMF[3]

Note: All figures are Billions of SDRs for end of year except for 2017 which is for April
1 SDR = 1.34433US$ (December, 2016). Components may not sum up due to rounding off
*Value is at London market price (afternoon price fixed on last business day of period)

[3] See http://www.imf.org/external/pubs/ft/ar/2017/eng/assets/ar17-appl.pdf

From the above table it can be observed that total international reserves, including gold, rose by 2.2 percent in 2016 to reach about 9.1 trillion SDRs at the end of 2016 (US$12.3 trillion). Foreign exchange reserves remained the largest component of reserves reaching SDR 7.9 trillion in 2016, about 87 percent of total reserves, while reserve positions in the Fund were the lowest at SDR 79 billion. For the year 2016, Table 2 below summarizes the reserve assets composition in SDRs for world central banks.

Table 2: 2016 Reserve Assets Composition in Total Reserves (Billions of SDRs)

Reserve Asset	**Value (SDRs, Billions)**	**Percent of Total Reserves (%)**
Gold	912	9.99
SDRs	204	2.24
Reserve Positions in the IMF	79	0.87
Foreign Currency	7968	87.24
Total Reserves including Gold	**9134**	**100.00**

Source: Authors calculation from IMF data
Note: Figures pertain to IMF members
IMF values assets in SDRs; here 1 SDR = 1.34433US$ (December, 2016)
Rounding off done may cause components not to sum up

Table 2 above shows that gold holdings by central banks constitute about 10 percent of reserves, and while the IMF values gold at the previous official price of SDR 35/Ounce of gold, the SDR was equal to $1.34433 as at December, 2016. Although gold accounts for a relatively lower proportion of reserves, it is worth exploring given that countries hold it in varying proportions. The table also shows that while foreign currency is the biggest component reaching as high as 87 percent of the 9134 SDRs (US$12278.6) in 2016, reserve positions to the IMF constitute the lowest proportion of international

reserves standing at less than 1 percent in the same year. SDR holdings were only 2.24 percent of international reserves, clearly showing that the Fund has not been very successful in developing the SDR into the major asset.

While it can be depicted that global reserve holding has been on the rise (from 3 months in 1990 to about 4.5 and 6 months' imports in 2005 and 2010), it is worth noting that Asian countries have registered the greatest reserve holdings with China and Japan holding respectively about 15 and 19 months' imports at the end of 2005, as per the WDI.

2.2.2 Reserves Management and Adequacy of Reserves

Reserves management basically enables authorities to use foreign assets to meet the country's international obligations as they arise. This can either take a microeconomic perspective (focusing on profit maximization) or a macroeconomic perspective (targeting stability to reduce short-term external shocks) (Romanuk, 2010). Within the macroeconomic perspective, reserves may be used to support government payments equaling about 12 months' worth of imports. On the contrary, the microeconomic perspective may be practical for countries that are more liberal and whose financial markets are well established.

Regardless of the rationale for holding of reserves among the different monetary authorities, there exists no universally applied rule of thumb for what is to be defined as adequate reserves. This leaves room for reserve hoarding to be solely determined by each authority's respective motives. As an example, Thamae and Mochebelele (2016) argue that with self-insurance being the ultimate goal for reserve management in an economy,

reserves adequacy may be defined by any level which will be enough to curb the impact of any crises.

Nevertheless, common measures of reserves adequacy include imports, broad money, GDP and external debt. The most traditional rule of thumb, applying to countries with limited access to capital markets, calls for reserves to be at least equal to 3 months of imports (Bernard, 2011). The external debt measure as per the Greenspan-Guidotti rule calls for reserves to be at least equal to the short-term debt level (Greenspan, 1999). Alternatively when perceived in terms of broad money (M2), international reserves are supposed to cover 50 percent of the money (Obstfeld, Shambaugh, & Taylor, 2010).

2.3 The Southern African Development Community (SADC)

2.3.1 Background

The Southern African Development Community (SADC) originated from the organization of Frontline states of Angola, Botswana, Mozambique, Tanzania and Zambia which sought to abolish colonialism in the region in the 1970s. SADC is an inter-governmental organization established as the Southern African Development Co-ordination Conference (SADCC) in April 1980 by 9 of the southern African states of Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. It is recognized by the African Union (AU) as a complement being one of the 8 regional economic communities aimed at forming the African Economic Community. As of 2018, SADC has grown to 16 countries adding to it the Democratic Republic of

Congo (DRC), Madagascar, Mauritius, Namibia, Seychelles, South Africa and most recently (in 2017) the Comoros.

With its headquarters situated in Gaborone, SADC officially emerged from its forerunner SADCC on the 17th of August, 1992. The region comprises about 280 million people covering 554, 919 square kilometers and some of the member states mainly depend on agriculture for economic growth which contributes more than 15 percent of GDP (Rossouw, 2017). The goal of SADC is to further socioeconomic cooperation and regional integration as well as poverty eradication through economic development and ensuring peace and security among the states.

In terms of policy framework, SADC countries are signatories of one charter (on tourism) and a lot of protocols, declarations and memoranda. These include Declarations on Information and Communications Technology (ICT), HIV and AIDS and on gender and development as well as memoranda of understanding on macroeconomic convergence (MEC) as well as on cooperation in taxation and related matters. For development, of key in the SADC region is the Regional Indicative Strategic Development Plan (RISDP) adopted in 2003. The RISDP is a 15 year regional integration development framework aimed at deepening integration in the region, detailing a timeline for the transition of SADC from a free trade area (FTA) (achieved in 2008) to an Economic and Monetary Union [EMU] (SADC, 2017). In this case, economic transition was prearranged to move from the FTA to Customs Union in 2010, then to common market in 2015 and monetary union by 2016. Overall, the region was expected to have a single currency by 2018. The

RISDP also included other major targets in terms of the percentage growth rate, inflation rate, fiscal deficit, percentage of public debt and the current account deficit. The percentage growth rate was set at 7 (in line with target of halving poverty by 2015, as per Millennium Development Goals (MDGs)). Table 3 below summarizes RISDP's MEC targets:

Table 3: Macroeconomic Convergence Targets

	2008	**2012**	**2018**
Inflation (annual rate)	Single digits	5%	3%
Fiscal deficit	5% of GDP	3% of GDP as anchor, with a range of 1%	3% of GDP as anchor, with a range of 1%
Public debt	60% of GDP	60% of GDP	60% of GDP
CA deficit	9% of GDP	9% of GDP	3% of GDP
Import Cover	3 Months	6 Months	6 Months

Source: Burgess (2009)

In spite of the set milestones, however, SADC (2017) reports that only the FTA was achieved, while the other transition objectives were not achieved due to capacity constraints. For the indicators, Burgess (2009) also found that most SADC member states managed to achieve the 2008 targets. Similarly, Simwaka (2016) found that MEC targets were best reached for public debt and worst performance was for international reserves, mainly because MEC targets are ambitious for most of the countries. Eventually, it was observed that the initial indicators were more stringent, hence targets were split into

primary and secondary categories. For example, in primary targets inflation was targeted between 3 to 7 percent by 2018 while for the secondary targets foreign reserves were targeted at a minimum of 6 months import cover, being presumably a permanent goal. These targets are still undergoing revisions with a third secondary convergence target emerging in 2015 directing the current account deficit to be at most 9 percent, though the target was omitted in 2016 (Rossouw, 2017).

2.3.2 Economic Performance

The SADC region represents the largest regional structure in sub-Saharan Africa (SSA) in economic terms, being home to one of Africa's largest economies, South Africa. The region is the richest, with a real per capita income higher than the continental average. In spite of this, the region harbors some of Africa's, and indeed world's, poorer economies indicating presence of disparities across the countries. For example, while Seychelles ranked as a high income economy using the 2015 World Bank classification, countries such as Malawi and Tanzania remained as low income economies. Table 4 below shows the World Bank's latest classification of SADC countries for 2015.

Table 4: Income Classification of Individual SADC countries for 2015

	GDP (Current US$ billions)	GNI per capita (Atlas Method, US$)
High income		
Seychelles	1.4	25,670
Upper middle income		
Mauritius	11.7	9,780
Botswana	14.4	6,460
South Africa	314.6	6,080
Namibia	11.5	5,190
Angola	102.6	4,180
Lower middle income		
Swaziland	4.1	3,280
Zambia	21.2	1,490
Lesotho	2.3	1,280
Low income		
Tanzania	45.6	920
Zimbabwe	14.4	860
Mozambique	14.8	590
Madagascar	9.7	420
DRC	35.2	410
Malawi	6.4	340

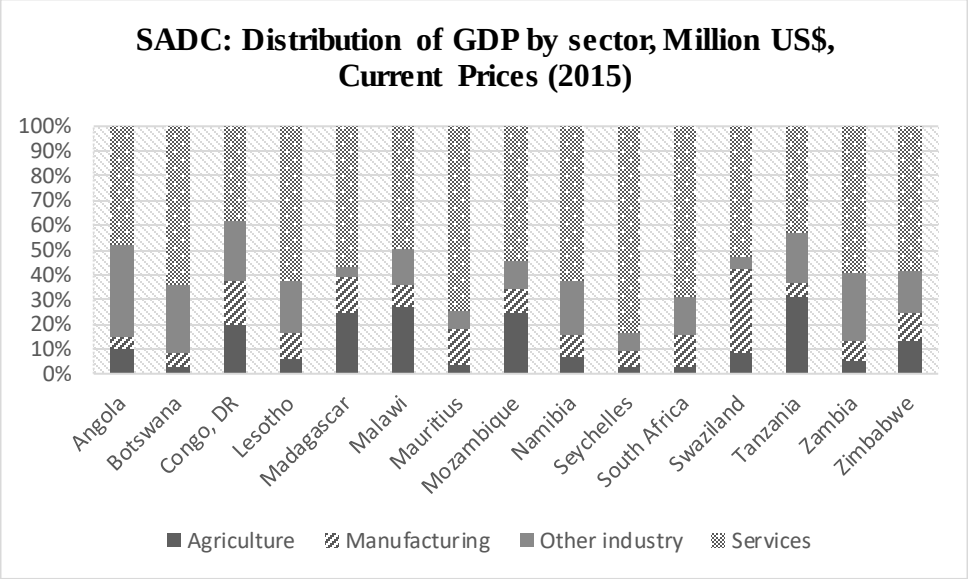
Source: WDI

Note: Income groups: Low-income = $1,025 or less Lower-middle income = $1,026-$4,035
Upper-middle income = $4,036-$12,475 High-income = $12,476 or more

Apart from the income differences shown in the above table, SADC countries also vary in their economic structures. While on a regional level economic growth in the SADC is mainly driven by the services sector which contributes more than half of GDP, some countries are highly dependent on agriculture. Regionally in 2013, for example, the services, manufacturing and agriculture sectors contributed respectively about 55, 31 and 14 percentages to GDP. Nationally, Madagascar, Malawi, Mozambique and Tanzania

reported the highest dependence on agriculture (over quarter), while Seychelles had only 2 percent from agriculture and 82 percent from services due to its vibrant tourism sector. Angola had the greatest share of industry at about 57 percent. In 2015, Madagascar and Mozambique had about 23 percent of GDP from agriculture, with Seychelles still at 2 percent. GDP decompositions by sectors for the countries in 2015 are shown by Figure 2 below:

Figure 2: SADC Countries' GDP Decomposition by Sectors for 2015



Source: Author's calculations from WDI and SADC Statistical Yearbook 2015

Note: Other industry includes construction, mining and quarrying, electricity, gas and water. Services include transport and communication, finance, insurance, real estate and business activities, general government services, wholesale and retail trade, restaurant and hotels and other services.

*2012 figures used for Malawi due to data availability

2.4 International Reserves in the SADC Region

The SADC region managed to accumulate international reserves of about US$88 billion by 2016, less than the US$99 billion accumulated in the previous year (SADC, 2015). Nonetheless and generally, the international reserves position in the SADC region has been on the rise moving from about US$51 billion in 2006. In terms of months of import cover, the statistics indicate that only Angola, Botswana and Mauritius managed to achieve the 6 months RISDP target in 2016. Moreover, it is only Angola and Botswana that have consistently achieved the target over the years. On a sad note, while Zimbabwe has been consistently holding less than 1 month import cover, countries such as Malawi, DRC and Namibia even struggle to attain the internationally recommended 3 months of import cover, as illustrated by Table 5 below which captures individual SADC countries' import covers:

Table 5: Macroeconomic Convergence: SADC Country Import Covers, 2011-2016

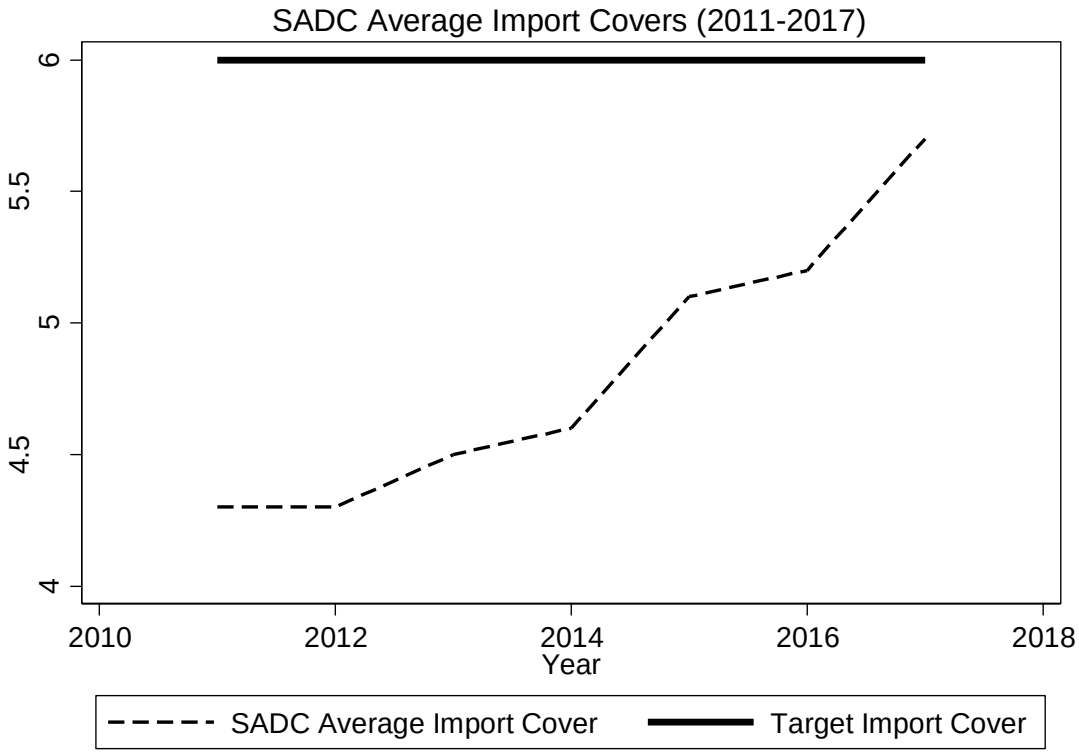
Country	Months of Import Cover					
	2011	**2012**	**2013**	**2014**	**2015**	**2016**
Angola	7.8	8.4	7.8	6.2	7.7	10.5
Botswana	13.2	14.3	15.8	17.6	18.4	16.7
DRC	1.7	2.2	2.1	1.8	1.3	0.9
Lesotho	4.6	4.7	6.2	6.3	6.3	5.1
Madagascar	3.7	3.2	2.2	2.5	2.9	4.0
Malawi	2.3	2.2	3.4	3.1	3.2	2.9
Mauritius	4.6	4.9	5.2	6.2	7.7	9.3
Mozambique	5.2	2.8	3.1	3.2	2.7	3.1
Namibia	3.8	3.0	2.6	1.8	2.8	2.9
Seychelles	2.5	3.0	3.2	3.9	4.9	4.1
South Africa	4.3	4.3	4.3	4.5	4.9	5.4
Swaziland	2.3	2.9	3.9	3.6	3.8	3.6
Tanzania	4.1	4.3	4.6	4.7	5.1	4.6
Zambia	3.6	4.1	3.0	3.5	3.7	3.6
Zimbabwe	0.6	0.7	0.5	0.6	0.7	0.8
Convergence criteria (2013-2018)	Not less than 6 months					

Source: SADC Database[4]

Although some countries in the region have constantly underperformed with respect to the import cover, the SADC average import cover has been improving with time. Figure 3 below captures the trend in the average import cover since 2011 for the SADC region.

[4] See www.sadcbankers.org

Figure 3: Macroeconomic Convergence: SADC Average Import Covers



Source: SADC Database

The figure above shows that the average import cover for SADC has consistently been below the RISDP target level, although it is expected that the two trends will collide in the next few years. This means that the region will soon meet the convergence criterion in terms of import cover. This is the case though some of the countries (such as Zimbabwe) are far from meeting the national target level.

2.5 Conclusion

This chapter provided an overview of the SADC region and international reserves. While the global status of international reserves is presented, the chapter ends by considering the regional average position and national levels of international reserves.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

This section reviews the existing literature, respectively theoretical and empirical, with the aim of creating a platform for effective analysis of demand for international reserves in SADC for this study. While the theoretical literature presented in Section 3.2 relates existing economic theories to the topic, the empirical literature in Section 3.3 reviews papers relating to the topic.

3.2 Theoretical Literature

The field of international reserves was developed with contributions from various theories. This section explores these theories in terms of the buffer stock model, price-specie-flow mechanism, monetary approach to BOP (MABP) and the Baumol-Tobin Model of Interest-Elasticity of Transactions Demand.

3.2.1 Buffer Stock Model

One model that has been widely applied in the context of demand for international reserves is the buffer stock model of money demand (Frenkel & Jovanovic, 1981; Ra, 2007; Sinem & Nebiye, 2014). The buffer stock model of Frenkel and Jovanovic (1981)

defined reserve demand as a Weiner process characterized by the following equation, according to Sinem and Nebiye (2014):

$$dR(t) = -\mu dt + ódW(t) \quad (1)$$

where $R(t)$ is reserves held in time t and $W(t)$ is the standard Wiener process with mean zero and variance t. The distribution of reserve holdings $R(t)$ can therefore be defined as:

$$R(t) = R^* - \mu t + óW(t) \quad (2)$$

where R^* is the optimal stock of reserves, μ is the deterministic part of a sudden change in reserves and $ó$ is the standard deviation of the Wiener increment in reserves. The reserve demand equation is therefore estimated as:

$$lnR_t = \beta_0 + \beta_1 lnó_t + \beta_2 lnr_t + u_t \quad (3)$$

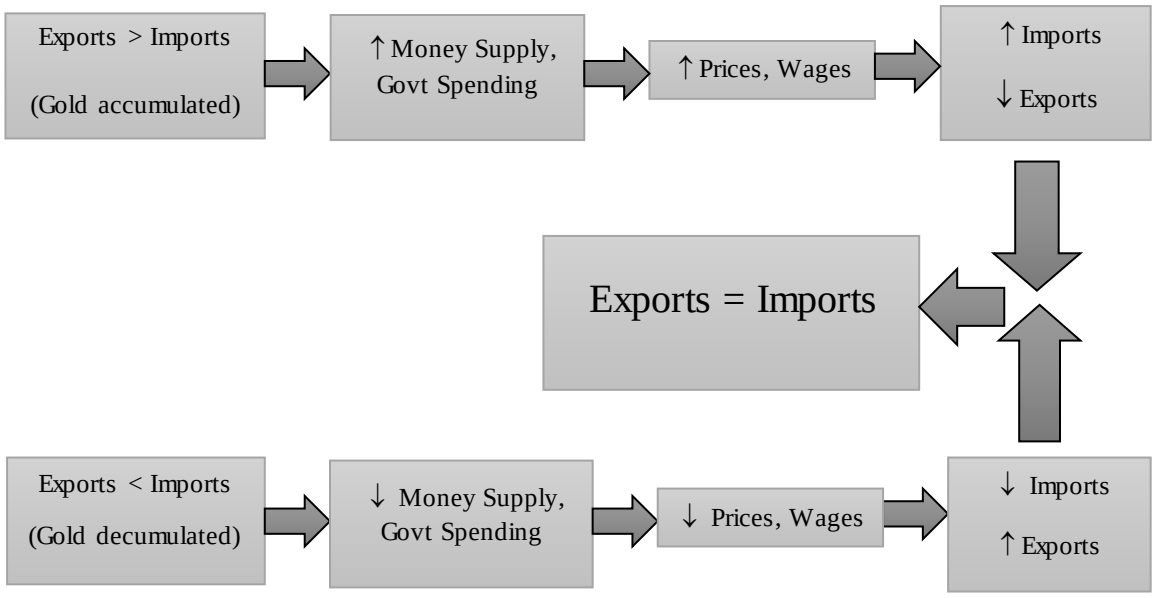
where β_0, $ó$ and r are fixed, adjustment and opportunity costs of holding reserves respectively and u_t is a white noise error term. Equation 3 above defines macroeconomic costs of adjustment ($ó_t$) and the opportunity costs (r_t) - the forgone returns from reserve hoarding - as possible determinants. In this case, reserves are a buffer accumulated by monetary authorities with the goal of avoiding exchange rate crises brought about by a drought of international means of payments. This implies that authorities select the stock of reserves which balances the potential macroeconomic (adjustment) costs, incurred if no reserves were held, with the opportunity cost of reserve accumulation. Empirically, the model was found to have high explanatory power in industrialized and developing economies (Bahmani-Oskooee & Brown, 2002). In addition, the theory is highly relevant

to the achievement of this study's objectives as it helps to map out the link between precautionary motives for reserve holding and the demand for reserves. Given that precautionary motives are key to most open economies, including the SADC region, the model is applied in this study.

3.2.2 Price-Specie-Flow Mechanism

In the early eighteenth century, Bullionism - defining wealth by the amount of precious metals owned - began to lose support as new philosophies were developed. In this case, classical writers, mainly David Hume (1752) and Adam Smith (1776), challenged the protectionist tenets of Mercantilism. In response to the original Mercantilist thought, Hume (1752) proposed that countries' accumulation of specie (gold) would not continue without repercussions to the countries' own international competitive position (Appleyard & Field, 2001). He argued that Bullionism, through accumulation of gold reserves that results from a trade surplus, increases the money supply and eventually leads to a rise in prices and wages by raising spending. This means that the country then loses export competitiveness and cannot maintain the surplus. Conversely, a trade deficit automatically fosters internal mechanisms that reduce prices and wages thereby restoring competitiveness of exports. Ultimately, countries will have a zero trade balance as exports and imports values are equalized (Appleyard & Field, 2001). Hume's transmission mechanism can be summarized by Figure 4 below:

Figure 4: Price-Specie-Flow Transmission Mechanism



Source: Author's summary of model

The above model, showing existence of a nexus between gold reserve accumulation and trade variables, was done based on a number of assumptions. Hume (1752) assumed, *inter alia*, existence of the gold standard; that there is a formal link between money and prices as provided in the quantity theory of money with full employment; and that demand for tradeables is elastic. These assumptions would clearly not work in the modern world, and hence the theory is irrelevant, in its original, to the SADC region. In addition, believing that movement of two price levels is the equilibrating force is untenable. Consequently, new theories were developed based on this model to better explain the BOP. This becomes handy in analysis of the impact of mercantilist motives, built around trade, as is one objective in this study.

3.2.3 Monetary Approach to Balance of Payments (MABP)

The Monetary Approach to Balance of Payments (MABP) is an approach to BOP determination that was developed in extension of the closed economy monetary theory (like that of Hume). This is an alternative to elasticity and absorption approaches which accentuate the price and real domestic income effects of devaluation respectively. While presupposing a fixed exchange rate, the MABP saw a return of classical tradition of international monetary theory. The contemporary monetary approach basically proposed that the overall BOP as measured by international reserves is essentially a monetary phenomenon (Frenkel & Johnson, 1976; Dornbusch, Fischer, & Startz, 2008). In this case, excessive expansion of domestic credit under fixed exchange rates leads to a BOP deficit and loss of international reserves while excessive contraction of domestic credit leads to a BOP surplus. This change in domestic credit is due to shocks in the banking system.

The model assumes that money demand is a stable function of a few well-defined variables, and that output, employment and other real variables are at their long-run equilibrium levels. Additionally, the model focuses on the long-run such that the monetary consequences of BOP disequilibria cannot be sterilized over a period relevant for policy analysis (Södersten & Reed, 1999). Further, the model makes assumption of a "small country" where goods prices and interest rates are internationally fixed (Johnson, 1977). The basic propositions in the MABP can be derived in the following set of equations, beginning with the definition of money demand (M^d) from the quantity theory of money (QTM):

$$M^d = kPy \tag{4}$$

where k = inverted velocity of money; P = domestic price level; and y = real income. Money supply (M^s) is defined as:

$$M^s = m(DC + FER) \tag{5}$$

where DC = domestic credit; $FER = CA + KA$ = foreign exchange reserves, with CA = Current Account and KA = Capital Account; and m = money multiplier. In this case, given a spot exchange rate S and a foreign price level, P^f;

$$P = SP^f \tag{6}$$

This can be substituted into the money demand function above to have:

$$M^d = kSP^f y \tag{7}$$

But in equilibrium, we have:

$$M^s = M^d \tag{8}$$

Therefore, it implies that:

$$M^s = m(DC + FER) = kSP^f y = M^d$$

$$\Longrightarrow m(DC + FER) = kSP^f y \tag{9}$$

But under the fixed exchange rate regime, the spot exchange rate (S) is not allowed to vary. Therefore, the foreign exchange reserves must vary to maintain the spot rate. Eventually, the BOP adjusts to monetary disequilibrium. Significant from the MABP is the discovery that if the central bank raises domestic credit, money supply exceeds money demand thereby creating pressure for the exchange rate to depreciate.

Consequently, the central bank is forced to sell (lose) international reserves until there is domestic equilibrium. According to this theory, countries' changes in international reserves are solely due to monetary disequilibrium. With the converse being true, the effect can be summarized in the equation below:

$$m(\uparrow DC + \downarrow FER) = kSP^{f}y \tag{10}$$

While the MABP explains terms of trade movements in international adjustment (resulting from adjustment of monetary stock) and frees BOP theory from concentration on BOP adjustment in the context of a "small country", the theory is not limited to such trivial cases. Monetary disequilibrium can be said to have an impact on reserves demand through, among other things, exchange rate volatility. However, use of the theory for the SADC region is still limited due to the fact that demand is not stable in the short-run, full employment is not possible, there are market imperfections and the law of one price is invalid (Frenkel & Johnson, 1976).

3.2.4 Baumol-Tobin Model of Interest-Elasticity of Transactions Demand

Another relevant theory applied in this study is the Baumol-Tobin model of interest-elasticity of transactions demand which extends Keynes' notion that money is demanded for transactionary, precautionary and speculative motives. Baumol (1952) and Tobin (1956) presented the tradeoff that exists between liquidity, the ability to carry out transactions, and interest income gained by holding interest-bearing assets. In the theory, transactions balances are taken as an inventory used to finance routine transactions. These balances have an opportunity cost in terms of the interest foregone had the

balances been invested in interest-bearing assets.

The theory postulates that brokerage costs increase the demand for cash balances. In application to the demand for international reserves, if costs incurred in the investment of reserves are high, central banks will choose to hold more reserves and invest less. Additionally, it can be inferred that an increase in interest rates increases the opportunity cost of holding cash or reserves, thereby reducing the corresponding demand. Given the importance that this model places on interest rates, its applicability to the SADC and ability to address this study objectives is notable.

3.3 Empirical Literature

This section reviews empirical studies conducted on the topic by first considering the different definitions of the regressand and then the models.

3.3.1 Dependent Variable

The dependent variable, international reserves, has been widely researched since the area gained ground in the mid-1900s. Given that this is the level of official international reserves that monetary authorities (central banks) need to hoard, whereby the authority's wish is a demand function, this variable has been used to represent demand for reserves. In history, different proxies have been used for the variable, the most common of which are discussed below:

3.3.1.1 Level of International Reserves or Imports Cover

Traditionally, studies used international reserve levels or the reserves-imports ratio (import cover) as the dependent variable (Frenkel, 1978; 1981; Flanders, 1971; Edwards, 1984). While the level-of-reserves measure does not allow meaningful comparisons across countries, months of import cover are not only less variable across countries but also they may not allow the inclusion of propensity to import as a factor in the model.

3.3.1.2 Reserves to GDP Ratio

In order to include propensity to import as one of the regressors and to allow for variability, most studies employed the ratio of reserves to GDP as the dependent variable (Bastourre, Carrera, & Ibarlucia, 2009; Cheung & Ito, 2009; Bhattacharya, Mann, & Nkusu, 2018). This ratio was therefore employed in this study. Most of these studies, however, used the measure of reserves that excludes gold for several reasons. Among other cited reasons, there are concerns on how to value gold; gold only accounts for a small percentage of global reserve holdings; and gold holdings by developing countries are seen to be negligible (Aizenman & Marion, 2003). However, in any panel some countries may hold significant amounts of gold reserves, such as South Africa, DRC and Mauritius for the SADC. In this case, it is better to use separate models with and without gold to check for possible differences.

3.3.2 Independent Variables

Having reviewed possible definitions of the dependent variable, the actual model can then be considered. This section reviews empirical studies on the demand for international reserves. With a number of studies on the dynamics of international reserves

conducted elsewhere, studies done for African developing economies remain scanty. Around the mid-1900s when the studies on international reserves gained ground, focus was mainly on developing countries outside of Africa. These studies differ in terms of methodologies, assumptions and what they focus on.

The empirics of demand for international reserves were initialized mainly by Machlup (1966) and Heller (1968) who found variability of trade to be a much better measure of reserve demand, and not necessarily its level. It was around this period that studies on the determinants of demand for international reserves sparked remarkable interest amongst researchers. One notable study was by Heller (1966) who revealed that international reserves are hoarded to reduce adjustment costs that would be incurred if no reserves were held, though the cost is balanced against the opportunity cost of holding these reserves. This confirmed key tenets of the buffer stock and Baumol-Tobin models of demand. Additionally, a higher marginal propensity to import (MPI) was found to reduce reserve demand since the marginal cost of adjustment is lowered. Factors that quickly surfaced in the search for determinants of international reserves include variability of international receipts and payments (Kenen & Yudin, 1965; Clower & Lipsey, 1968); propensity to import (Heller, 1966; Clark, 1970; Kelly, 1970); and the size of international transactions (Frenkel, 1978). However, like in many other previous studies, propensity to import - representing the degree of openness - appeared with a positive coefficient, contrary to popular expectations.

Later, Frenkel (1981) in a stochastic framework to explore optimal international reserves used the Ordinary Least Squares (OLS) estimation technique for 22 developing countries from 1971 to 1975 and found imports as well as opportunity and adjustment costs to be significant determinants, in line with both Hume's (1752) price-specie-flow and the buffer stock model. Building on the work by Heller (1966), Frenkel and Jovanovic (1981) proposed reserve volatility as a proxy for adjustment costs. Although Frenkel (1983) discovered that international reserves were increasing even with the floating of currencies in 1973, it was later observed that the likely cause of the paradox was the prevalent capital account liberalization (Grimes, 1993). These studies are still deficient as they did not consider many other possible determinants apart from the traditional ones and, more so, focus was mainly on developed economies.

Edwards (1985) later observed that most studies on demand for international reserves fail to find the expected negative statistically significant coefficient of the opportunity cost because of incorrect measurements of the variable that were employed in different studies. Using data for a group of 17 developing countries from the year 1976 to 1980, the study defined opportunity cost of holding reserves as the spread between the interest rate at which countries can borrow from abroad and the London Interbank Offered Rate (LIBOR). Use of this net opportunity cost resulted in a negative statistically significant coefficient. Like in most studies, it was found that trade openness, level of international transactions and variability of international transactions are positive. This study made a significant contribution by offering a better definition of the cost.

Later studies include Flood and Marion (2002) who presented a comprehensive extension of Frenkel and Jovanovic's (1981) study by modifying not only how volatility is measured, but also incorporating financial crises. Volatility was found to have a significant positive impact on reserve hoardings from this study. Finding similar results, Bastourre et al. (2009) employed a dynamic panel data approach to explain what was driving reserve accumulation for 136 countries from the year 1973 to 2003. While this study surprisingly revealed that countries with flexible exchange rate regimes have higher ratios of reserves to GDP; trade openness, regional imitation, persistence, a U-shaped relationship between reserves and development level and financial and exchange rate deregulation were found to be significant factors affecting hoarding of reserves. These results are in line with what was discovered by Aizenman and Marion (2003); Aizenman and Lee (2007); and Hur and Kondo (2016) who confirmed precautionary motives and found that the exchange-rate arrangement, political considerations as well as size of international transactions and their volatility are biggest determinants of demand for international reserves.

In a cross-country analysis of international reserves for more than 100 economies from 1975 to 2004, Cheung and Ito (2009) discovered that a developed economy tends to hold a lower level of international reserves than a developing one. While no evidence was found that East Asian economies including China and Japan held an excessive amount of reserves, significant factors include propensity to import, opportunity cost, financial deepening and net portfolio liabilities. Nonetheless, Dooley, Folkerts-Landau and Garber (2004) found existence of the mercantilist motive where, citing an example of China, a

strategy of export promotion and consequently the desire for a depreciated currency leads to sizable reserves.

To estimate international reserve adequacy in Central America, Bernard (2011) studied 52 emerging economies from 1993 to 2008. The study found that reserve demand is positively related to traditional factors, and negatively related to population level and exchange rate flexibility which provides the largest effect on reserve demand. Additionally, financial depth was found to be statistically insignificant, contrary to previous studies (such as Edwards 1983; Flood & Marion 2002); Obstfeld, Shambaugh & Taylor 2010). A new contextual factor from this study was "keeping up with the Joneses" effect where Central American countries' policies were found to consider reserve accumulation of large emerging markets in Latin America. However, this effect is not expected for SADC countries as most of them are just target oriented.

More recently, studies have moved towards including more financial variables in the determinants. This can roughly be traced back to Obstfeld, Shambaugh and Taylor (2010) who adopted a financial stability view for reserves demand. In ancient times, this view was raised by Thornton (1802) who said domestic capital outflows can place extraordinary demand on reserves. In that spirit for a sample of 51 emerging and developing economies from 1990 to 2011, Jung and Pyun (2015) employed difference-generalized method of moments (GMM) and system-GMM estimators. Above confirming the previous results, it was found that financial deepening is positively associated with reserves. Another recent study on different kinds of reserves for G-7

countries from 1990 to 2014 used a fixed effects panel regression model (Oktay, ÖZTUNÇ, & SERİN, 2016). The study, while confirming existence of both precautionary and mercantilist motives as well as scale factors of reserves demand, found that imports have a positive effect on demand whereas net financial openness and private capital flows have a negative impact. Bhattacharya et al. (2018) also attested to the existence of precautionary motives especially for low-income countries. These studies confirm plausibility of, among others, the buffer stock model. Table 6 below summarizes a few selected cross-country studies on the demand for international reserves adding a few more common independent variables to the traditional ones.

Table 6: Studies on the Demand for International Reserves

Author(s) (Year)	Countries (Period)	Dep. Var	Method	Independent Variables															
				Inertia (lagged reserve)	Population level	Development level*	ER Volatility	Regional imitation	Joneses' Effects	Variability of transact.	Capital Account	M2/GDP	Short-term debt/GDP	Current Account	Financial openness	External debt/GDP	Terms of Trade	Trade Openness	Currency Crises
Frenkel (1978, 1981)	22 Developed and 32 LDCs (1963-1975)	$lnReserves$	OLS			+				+								+	
Edwards (1984)	23 Fixed ERS Developing (1965-1972)	$lnReserves$	LSDV	+		+				+								+	
Aizenman & Marion (2003)	125 Developing (1980–1996)	$ln\frac{Reserves}{P}$	FE Panel		+	+	−											+	
Cheung & Ito (2007)	100 economies	$\frac{Reserves}{GDP}$	Panel		−							( )				−		( )	
Bastourre et al (2009)	136 countries (1973-2003)	$ln\frac{Reserves}{GDP}$	System GMM (dynamic)	+		+, −	( )	+										+	
Bernard	52 non-dollar	$\frac{Reserves}{GDP}$	Panel		−		−		+			( )	+					+	

(2011)	Central Amer. (1993-2008)																		
Aizenman & Lee (2012)	53 emerging & developing (1980-2000)	$ln\frac{Reserves}{GDP}$	Panel		+		( )				+			−			+	+	
Jung & Pyun (2015)	51 emerging & developing (1990-2011)	$\frac{Reserves}{GDP}$	Dynamic Panel	+	( )	−	−					+	−		( )	+	+	+	+
Oktay et al. (2016)	G-7 countries (1990-2014)	Multiple	FE Panel		+	( )					−			( )	−				
Bhattacharya et al. (2018)	EMs, AEs and LICs	$ln\frac{Reserves}{GDP}$	FE & CCEPMG									+							+

Source: Author's summary of key studies

Note: + *Positive impact* − *Negative impact* ( ) *Statistically insignificant*

*****First sign is for development level and second sign is for its square

3.4 Conclusion of Literature Review

Section 3.2 linked existing economic theories to the demand for international reserves. Within the empirical literature in Section 3.3, it is observed that demand for reserves is best proxied as a ratio to GDP, where reserves are defined both with and without gold. The empirical literature also showed that international reserves accumulation can be attributed to scale factors. Other studies also distinguish between the mercantilist motive - competitiveness in international trade - and the precautionary view – where reserves are hoarded for precaution against sudden risks. It was in the period between mid-1960s and mid-1970s when a more elaborate theory of optimal reserves was developed. The new theory advocated for the inclusion of scale variables (transactions motive), measures of uncertainty (precautionary motive) as well as measures of adjustment and opportunity costs in the reserve demand function, as per theoretical constructs of the buffer stock, price-specie-flow mechanism, MABP and interest-elasticity of transactions demand. Although the theories were derived within microeconomic contexts, recent improvements allow for application to the macro economy. Later studies proposed inclusion of variables associated with the capital account and other financial variables. Relating the empirical studies reviewed in this section to the relevant economic theories shows that the buffer stock model is the most widely applied theory, and probably the most relevant to regions as is SADC, and in the achievement of this study's objectives. Extensions to the model were therefore applied in this study.

CHAPTER FOUR

METHODOLOGY

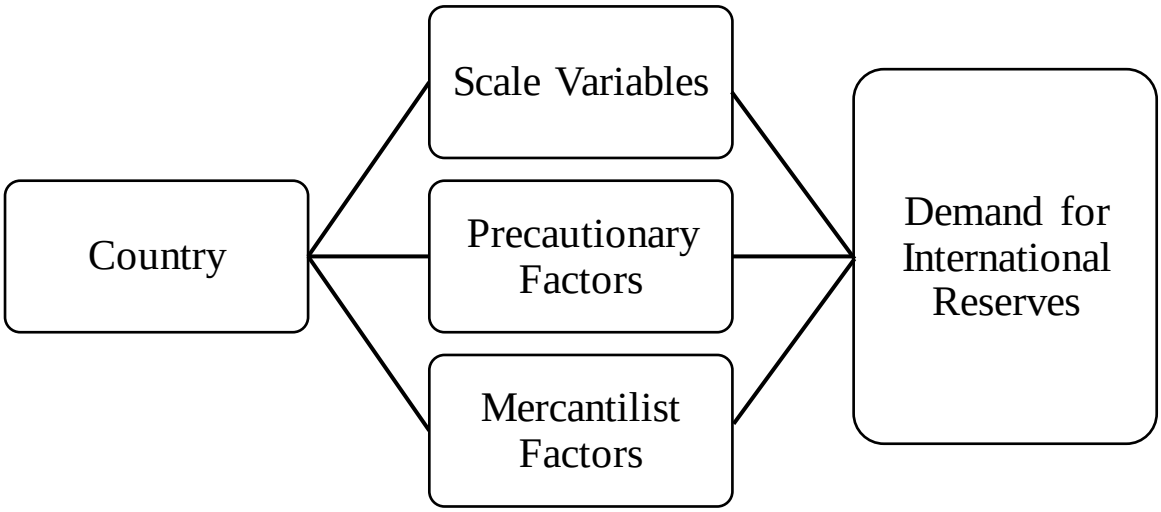
4.1 Introduction

Based on the previous chapters, this chapter explains the empirical analyses that were conducted in this study so as to determine the factors responsible for observed reserve accumulation in the SADC region. Consideration was made for the theoretical and empirical literature discussed in the previous chapter.

4.2 Conceptual Framework

Although the role of international reserves has evolved with changes in the global financial market, demand for reserves can fundamentally be attributed to transactions, precautionary and mercantilist factors. Therefore, demand in this study was modeled after the three variable categories. This is presented in Figure 5 below:

Figure 5: Conceptual Framework for Demand for International Reserves



In Figure 5 above, a country's scale variables, such as income, proxy the transactionary motive and they affect BOP status of the economy and consequently the country's demand for reserves. While with precautionary factors central banks seek to use reserves to hedge the effects of a crisis thereby affecting demand for reserves, a central bank with mercantilist motives aims at protecting the country's exports hence employment, and so they demand reserves so as to be able to undervalue the local currency to promote exports.

4.3 Analytical Model

The study made use of panel data techniques to explore factors that determine demand for international reserves in the SADC region. Apart from offering more informative data, increasing degrees of freedom and improving efficiency, panel models allow for the capturing of dynamics of adjustment so as to estimate intertemporal relations (Hsiao,

2003). These form the benefits of panel models, and the rationale for using the methodology in this study. Capturing dynamics of adjustment was of essence in this study because a country's level of international reserves at any point in time is a function of the immediate previous level of reserves. Additionally, it is observed in Appendix A that accumulation of reserves is heterogeneous both in time and across countries. This calls for adoption of panel models so as to control for individual heterogeneity to avoid obtaining biased results if the data was simply pooled, ignoring the panel data structure. This would produce consistent yet inefficient OLS estimates compared to Feasible Generalized Least Squares (FGLS) estimates (Baltagi, 2005).

4.4 Dynamic Panel Data Models

4.4.1 Blundell/Bond System GMM Estimator

With the level of reserves at any point in time being a function of, among other things, the previous period's level, reserves are dynamic in nature. In this case, a model of demand for reserves must have as one independent variable the level of reserves in the previous period, to be given as in the equation below:

$$y_{it} = \delta y_{i,t-1} + x_{it}'\beta + u_{it} \tag{11}$$

where $i = 1, \dots, N$ for N cross-sectional units and $t = 1, \dots, T$ for T time-periods; δ is a scalar and x_{it}' a vector of $1 \times K$ independent variables. In this case, the error component is assumed to be one-way, such that:

$$u_{it} = \mu_i + \varepsilon_{it} \tag{12}$$

where the error components are independent even with each other; μ_i denotes the

unobservable individual-specific effect and ε_{it} denotes the remainder disturbance.

In the dynamic model above, the dynamic component ($y_{i,t-1}$) is correlated with μ_i. This correlation makes the use of OLS or linear static panel (Fixed and Random effects) models yield biased and inconsistent estimates. As a solution, Arellano and Bond (AB) (1991) derived a consistent GMM estimator for the model. This estimator uses orthogonality conditions of the lag component and the remainder error term to obtain additional instruments for estimation of a dynamic panel data model. The resulting AB one-step GMM consistent estimator of δ with W, a matrix of instruments, and G, an $MA(1)$ Balestra matrix, is given by Baltagi (2005), as:

$$\hat{\delta} = \left[(\Delta y_{-1})' W \left[W'(I_N \otimes G) W\right]^{-1} W'(\Delta y_{-1})\right]^{-1} \times (\Delta y_{-1})' W \left[W'(I_N \otimes G) W\right]^{-1} [W'(\Delta y_{-1})] \quad (13)$$

However, the AB estimator can perform poorly if the autoregressive parameters are too large or the ratio of variance of the panel-level effect to variance of idiosyncratic error is too large. This prompted Blundell and Bond (1998), building on the work of Arellano and Bover (1995), to develop a system estimator that uses additional moment conditions. This, known as the Arellano-Bover/Blundell-Bond linear dynamic panel-data estimator, was employed in this study for estimation of demand for international reserves, because it can capture dynamics of adjustment and outperforms the AB estimator.

4.4.2 Bias-Corrected Least Squares Dummy Variable (LSDVC) Estimator

It was observed that the traditional dynamic panel models, including those by Arellano

and Bond (1991) and Blundell and Bond (1998), may produce biased and imprecise estimates when the number of cross-sectional units is small or moderately large. An alternative approach to IV-GMM estimation in this case is the Bias-Corrected Least Squares Dummy Variable (LSDVC) estimator which was found to outperform the IV-GMM estimators in terms of bias and root mean squared error (RMSE). This study also employed Bruno's (2005) LSDVC which extends the bias approximations in Bun and Kiviet (2003) by allowing for estimation of unbalanced panels, as was the case in this study. From the dynamic model expressed in Equation 11 above, a selection indicator r_{it} equals 1 if (y_{it}, x_{it}) is observed and 0 otherwise. That is;

$$s_{it} = \begin{cases} 1, & \text{if } (y_{it}, x_{it}) = (1,1) \\ 0, & otherwise \end{cases} \quad i = 1, \dots, N \text{ and } t = 1, \dots, T \tag{14}$$

The (possibly) unbalanced dynamic panel data model is expressed as

$$Sy = SD\eta + SW\delta + S\epsilon \tag{15}$$

Consequently, the LSDV estimator with bootstrapped standard errors is defined by:

$$\delta_{LSDV} = (W'M_sW)^{-1}W'M_sW \tag{16}$$

where $M_s = S(I - D(D'SD)^{-1}D')S$ is symmetric and idempotent.

Knowing that the LSDVC does not estimate coefficients of time-invariant regressors, this study made use of both the system GMM (to estimate coefficients of dummy variables) and the LSDVC. In this case, the LSDVC was used to check if the system GMM estimates are biased or imprecise. If estimates of the two estimators came out very similar, then the system GMM estimates are unbiased and precise, and so would be interpreted, otherwise LSDVC estimates would be chosen.

4.5 Empirical Specification

The study adopted a specification and functional form by Jung and Pyun (2015) who, in extension of the buffer stock model of demand, collected widely regarded important determinants of international reserves from various studies (Aizenman & Lee, 2007; Cheung & Ito, 2009; Steiner, 2009; Obstfeld, Shambaugh, & Taylor, 2010). This was augmented with variables relating to the SADC region so as to build a relatively exhaustive and contextual list of factors. An unbalanced panel of 14 SADC countries from 1980 to 2015 was analyzed to achieve the objectives. In exclusion was the recently joined Comoros, and Zimbabwe due to limitations in data availability. To allow for comparability of results from GMM estimation and the LSDVC (which does not estimate the coefficient), an intercept-less model was estimated in both cases. This should not be problematic in this study given that it is meaningless to talk about all regressors being equal to zero anyways. The regression equation was specified as follows:

$$ln\frac{R_{it}}{GDP_{it}} = \alpha_1 GDPc_{it} + \alpha_2 GDPc_{it}^2 + \alpha_3 OPP_{it} + \alpha_4 API_{it} + \alpha_5 ExpGrowth_{i,t-2} + \alpha_6 CMADum_i + \alpha_7 MMZT_{it} + \alpha_8 ERVOL_{it} + \alpha_9 ResVOL_{it} + \varepsilon_{it} \quad (17)$$

where: R is Total Reserves (With or Without Gold)

GDP is Gross Domestic Product in current US$

GDPc is GDP per capita, PPP (Constant 2011)

OPP is the Opportunity Cost of Holding Reserves

API is Average Propensity to Import

ExpGrowth is Lagged Exports Growth

CMADum is a Dummy for the Common Monetary Area

MMZT is a Dummy for Malawi, Mozambique, Zambia and Tanzania

ERVOL is Exchange Rate Volatility

ResVOL is Reserves Volatility

4.6 Variable Definition and Measurement

Below is a list of definitions and measurement plans for the above specified variables:

Scale Variables

Real *GDP per capita PPP* (GDPc): This scale variable measures the level of development of country i at time t. A negative coefficient was expected as stipulated by the Baumol (1952) square-root rule for transaction demand. A square of this variable was included in the model to check for quadratic effects since as countries with more and more incomes are observed, reserve accumulation may decrease at a decreasing rate.

Precautionary/Risk Factors

Different variables were used in this study to capture precautionary motives; the desire to self-insure again risks. These include volatility measures whose focus in this case was on exchange rate volatility (ERVOL) and reserves volatility (ResVOL) due to data availability. Reserves volatility was inspired mainly from the buffer stock model and was used to capture adjustment costs whereby higher volatility in reserves is expected to induce a higher reserves demand for any particular economy. A positive coefficient was also expected for exchange rate volatility. In addition, these volatility measures were proxied by the standard deviation of 12 monthly values within that year, because data

gaps in some countries under observation could not permit the estimation of GARCH variances, as was proposed by Mishra and Sharma (2011).

Another measure of precaution used in this study was the degree of openness whose sign depends on whether expenditure-switching or expenditure-reducing policies are pursued in an economy (Edwards, 1985). This variable is a proxy for country i's vulnerability to external shocks, and it was measured as a ratio of imports to GDP (average propensity to import - API) which is used in place of marginal propensity to import.

Opportunity Cost of Holding Reserves

The opportunity cost (OPP) of holding international reserves is the cost of foregone imports, expressed in terms of the foregone investment. This could be measured by the rate of return on investment, and perhaps even more specifically for foreign resources (Flanders, 1971). With reserves often held in the form of short-term interest bearing assets, this study measured opportunity costs by the difference between the real return on reserves and the real return to domestic investments (spread between domestic lending interest rate and real US Treasury bill rate), following Edwards (1985). A negative coefficient was expected a *priori*.

Mercantilist Factors

Mercantilism is about accumulating reserves in order to prevent or mitigate appreciation of the local currency with the ultimate goal of increasing export growth. This means reserves hoarding aims at maintaining export competitiveness, as is seen to be the case

for most East Asian countries. In this case, accumulation of reserves is seen as a deliberate policy for an economy to exert negative externalities on trading partners. This study measured the mercantilist motive using export growth (ExpGrowth) (lagged twice) as was done by Aizenman and Lee (2005).

Common Monetary Area (CMA) Dummy

This is a dummy taking a value of 0 for country i in the Common Monetary Area and 1 for country i not in the Common Monetary Area any time. Members of the CMA in the sample are Lesotho, Namibia, South Africa and Swaziland. In this case, it was expected that a country that is member to the CMA demands less reserves as opposed to a non-member, for precaution, thus giving a positive coefficient.

MMZT Dummy

A dummy of Malawi, Mozambique, Zambia and Tanzania was also included in the study because of the countries' preferential treatment in terms of trade waivers, which is expected to reduce their exposure to risks and eventually reserves demand. These countries were given a value of 1 for the entire period, except for Zambia which also took a value of 0 after its reclassification from low to lower middle income countries in 2011. Table 7 below summarizes the variables and their a *priori* expectations.

Table 7: Variable Definitions and Expected Signs

Variables	Definition	Expected Sign
Inertia	Previous Reserves	+
Scale Variables		
GDPc	GDP per capita, PPP (Const. 2011)	-
$GDPc^2$	Squared GDP per capita	+
Risk Factors (Precautionary)		
API	Average Propensity to Import $\left(\frac{M}{GDP}\right)$	+
ER Volatility	Exchange Rate Volatility	+
Reserves Volatility	Reserve Volatility (Adjustment cost)	+
Mercantilist Factors		
Lagged Exports Growth	2 Period-Lag of Exports Growth Rates	**( )**
Dummies		
CMA	Common Monetary Area Dummy	+
MMZT	Malawi, Moz., Tanzania and Zambia	-
Other		
Opportunity Cost	Lending rate – US Treasury Bill rate	-

Source: Author's Summary

4.7 Diagnostic Tests

4.7.1 Multicollinearity

Before the models were estimated, it was worth checking for collinearity between the regressors. If variables in a model are highly collinear, *inter alia*, t-ratios are insignificant, confidence intervals are wide and estimators have large variances, making precise estimation difficult (Gujarati, 2004).

4.7.2 Sargan Test of Overidentifying Restrictions

Consistency for all GMM estimators is attained if and only if the moment conditions are valid. In this study, the Sargan test was employed to check if the overidentifying restrictions are valid for the system GMM estimator, given that there is no method to test

if moment conditions from an exactly identified model are valid. With a null hypothesis that overidentifying restrictions are valid, rejection of the null calls for a modification of the model or instruments, and over rejection signals the presence of heteroskedasticity.

4.7.3 Arellano-Bond Test for Autocorrelation

Moment conditions are also valid only if there is no serial correlation in the idiosyncratic errors. Although residuals of the differenced equation possess serial correlation by construction, difference residuals should not exhibit significant AR (2) behavior for the assumption of serial dependence in original errors to work. Arellano and Bond (1991) proposed a test in the first-differenced errors and this was used in this study.

4.8 Data Description

The study made use of annual data for 14 SADC countries from 1980 to 2015, analyzed using Stata version 14.1. Out of the 15 SADC countries as of 2016, Zimbabwe was excluded from the analysis mainly due to issues of data availability. Appendix B1 presents the full list of countries observed in the study. Although the panel is unbalanced, randomness of such missing observations means this is not worrisome. The study also focused on years after 1980 because prior to that there was the BWS in which case reserve accumulation with the fixed exchange rates was inspired by other motives than those that persisted thereafter. The data was mainly sourced from the IMF's International Financial Statistics (IFS) and the World Bank's World Development Indicators (WDI). Data on US Treasury Securities was sourced from the Federal Reserve. Appendix B2 shows a list of variables, their descriptions and sources. All regressions in the study were based on the full sample period for the 14 countries.

CHAPTER FIVE

EMPIRICAL RESULTS AND DISCUSSIONS

5.1 Introduction

This chapter presents results obtained after employing the methodology described in Chapter four. The specific variable sources are presented in Appendix B2. Blundell/Bond system GMM and the Bias-Corrected Least Squares Dummy Variable estimators were employed on reserves (with and without gold) for comparison. Apart from this introductory part, four main sections are presented in this chapter, namely; data issues, descriptive statistics, results and interpretations as well as summary of the results. The section on results and interpretation also includes diagnostic tests as was required for the estimated panel models.

5.2 Data Issues

With all SADC countries included in this study except for the Comoros (newly joined) and Zimbabwe (due to limitations in data availability), the study employed an unbalanced dynamic panel model for the 14 countries ($N = 14$) from 1980 to 2015 ($T = 36$). Choice of years in the sample not only rested on data availability, but also the fact that during the Bretton Woods system of fixed exchange rates and immediately thereafter, reserve accumulation was inspired by other motives than what is of interest in modern studies (Bhattacharya, Mann, & Nkusu, 2018). In standard microeconometric panel data models

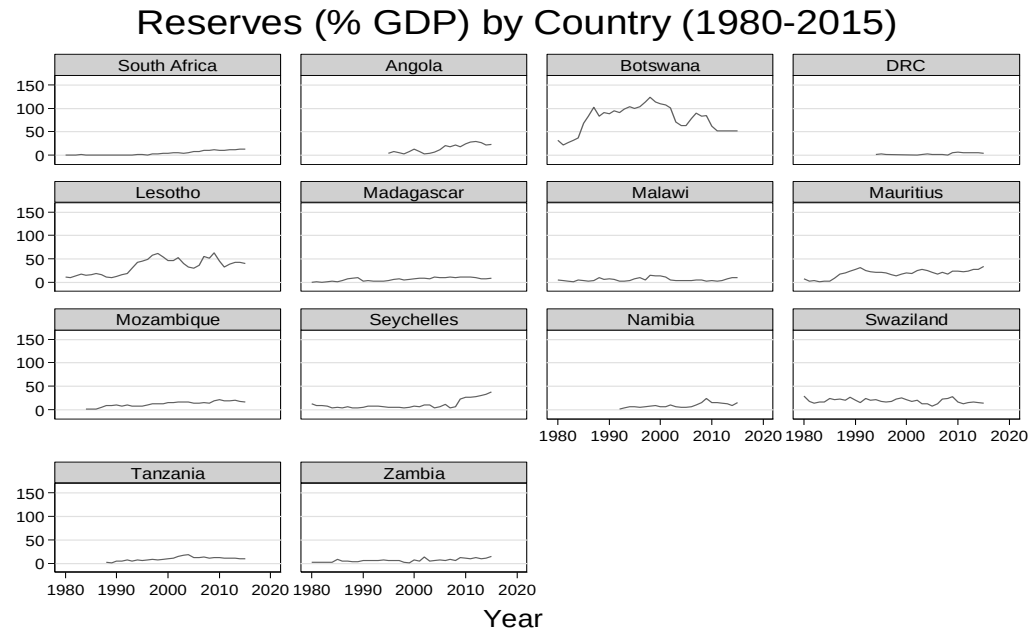
with $N \to \infty$ and fixed T, the assumption of stationarity of the variables is justifiable. However, stationarity becomes more evident as the time dimension increases. Since the data used in this study (with $T = 36$) starts to mimic the characteristics of a macro panel, it was crucial that unit root properties of the variables employed in the empirical model be tested in order to avoid the problem of spurious regressions among non-stationary variables that are not cointegrated. This sets apart this study from most other panel studies on international reserves which simply assume stationarity among the regressors regardless of length of time dimensions. Given that the number of cross-sectional units in the study is less than the time dimension, cross-sectional dependence was no worry.

While a lot of unit root tests have been proposed for panel models, only a few of them can be applied to unbalanced data without inducing bias to the test results. As proposed by Maddala and Wu (1999), this study adopted the Fisher-type testing approach using the Phillips-Perron rather than the Augmented Dickey-Fuller (ADF) test, specifying a null hypothesis of non-stationary. Results of the Fisher-type test (presented in Appendix D) showed stationarity in levels at 5 percent for all variables except reserves with and without gold as well as opportunity costs. For the non-stationary variables, the cross-sectionally ADF (CADF) test from Pesaran (2007) was used. Here, with the null hypothesis specified that the series is stationary, it was verified that all the variables are stationary in levels at 5 percent.

5.3 Descriptive Statistics

To begin with, the dependent variable, almost all countries experienced rising reserves over the study period. These countries have had different patterns of reserve accumulation measured excluding gold, as is traditionally done, as a percentage of GDP. The country trends are shown in Figure 6 below:

Figure 6: Reserves (% GDP) for SADC Countries from 1980-2015



Source: Author's computation from IFS Data

Most notably, from Figure 6 above, Botswana and Lesotho consistently enjoyed the biggest percentages while DRC, Zambia and South Africa have had the lowest percentages over the study period. Nonetheless, all countries have experienced highs and lows of various frequencies in reserve accumulation, a phenomenon which makes a study of the determinants of demand for international reserves necessary for the region. The figure also shows that most countries experienced a structural break around 2003/04, likely with policy changes that came about with introduction of the RISDP. Various

independent variables were used to explain the demand for international reserves. These can be categorized as scale variables (income), precautionary or risk factors and mercantilist motives (export growth). Dummies for the MMZT and countries' membership to the CMA were also included. Table 8 below presents statistics for the non-dummy variables across all countries for the study period:

Table 8: Descriptive Statistics

Variable	Overall Statistics				
	Mean	**Std. Dev.**	**Min**	**Max**	**Observations**
Reserves (includ. Gold, Billions)	2.5810	7.0975	0.0048	50.6881	467
Reserves (exclud. Gold, Billions)	2.3511	6.5024	0.0048	44.8637	467
GDP (Billions)	21.4770	57.0457	0.1467	416.419	474
GDP per Capita (Constant 2011)	5819.94	5595.36	350.973	25524.96	364
Imports (% GDP)	46.74	21.31	9.11	117.03	438
Exports Growth (%)	8.29	18.81	-45.89	155.61	374
Lending rate (%)	22.29	20.16	7.67	217.88	411
10yr US Treasury yield (%)	6.44	3.18	1.80	13.92	504
Opportunity Cost (%)	-16.47	20.54	-211.44	4.42	411
Reserves Volatility (Millions)	145.8735	349.4254	0	3223.3809	468
ER Volatility	7.184	24.715	0	305.826	504

Source: Author's computation from IFS, WDI and Fed. Reserve Data

Note: All monetary variables are in US$

Table 8 above shows that variations exist for different variables between the 14 SADC countries. Among others, total reserves including gold averaged about $2.58 billion with a minimum value of $4.82 million for Tanzania in 1982 and a maximum of $50 billion in 2012 for South Africa. The maximum GDP in current value (about US$416 billion) was observed for South Africa in 2011 while the minimum (US$146 million) was for Seychelles in 1982. In terms of GDP per capita, the lowest value ($350.97) was for Mozambique in 1992 and the highest ($25524.96) was for Seychelles in 2015 with the mean standing at $5819.94. It is only Mauritius, Seychelles, South Africa and Botswana which consistently had incomes above this mean for the recorded data. Related to total reserves, it was observed that the higher the GDP for an economy at any time the higher the demand for total reserves, with and without gold. However, the relationship was less pronounced when considering reserves as a percentage of GDP.

With imports as a percentage of GDP ranging from about 9 to 117 percent, it was observed that most countries with higher ratios also demanded more reserves. A similar observation was also made for reserves volatility where countries that experienced higher risks demanded more reserves. These selected bivariate relationships are shown in Appendix C.

5.4 Results and Interpretations

This section presents and interprets the results that were obtained after employing various econometric techniques.

5.4.1 Diagnostic Tests

Noting that the Blundell/Bond dynamic panel data model makes non-stationary variables stationary through the differencing, a few tests were employed to ensure that the results are reliable. Three important tests are presented below:

5.4.1.1 Sargan Test of Over-identifying Restrictions

The Sargan test was conducted to check if over-identifying restrictions, and consequently moment conditions, are valid so that GMM estimators are consistent. In this case, the null hypothesis was specified as:

H_0: Over-identifying restrictions are valid

Table 9 below shows results from the Sargan test for the system GMM models including and excluding gold:

Table 9: Sargan Test of Over-identifying Restrictions

MODEL	**χ^2-statistic**	**χ^2 df**	**Prob > χ^2**
Reserves including gold	253.8321	243	0.3035
Reserves excluding gold	245.8702	243	0.4365

Source: Author's calculations from IFS, WDI and Fed. Reserve Data

The above results establish that the moment conditions are valid given that we fail to reject the null hypothesis at 5 percent level both for reserves with and without gold. The results also imply that there is no heteroskedasticity since the hull hypothesis is not over-rejected.

5.4.1.2 Arellano-Bond Test for Autocorrelation

This test was conducted to ensure that there is no serial correlation in the idiosyncratic errors so that moment conditions are valid. The hull hypothesis, in this case, was specified as follows:

H_0: There is no serial correlation in first-differenced errors

Results from the AB test of serial autocorrelation for the system GMM with robust standard errors indicated that although there is serial correlation in first-differenced errors at the first order for both models at 5 percent significance level, there is no serial correlation at the second order, as desired. This is presented in Table 10 below:

Table 10: AB Test of Autocorrelation (Robust Standard Errors)

MODEL	Order	z	Prob > z
Reserves including gold	1	-2.2153	0.0267
	2	1.12	0.2627
Reserves excluding gold	1	-2.2589	0.0239
	2	1.2594	0.2079

Source: Author's calculations from IFS, WDI and Fed. Reserve Data

5.4.1.3 Multicollinearity Test

As required for any regression model, independent variables were checked against perfect collinearity (>0.8) before conducting the multivariate analysis to avoid obtaining, among other things, indeterminate regression coefficients and infinite standard errors. Appendix E presents a variance-covariance matrix for the linear independent variables where it was observed that there is no significantly high linear relationship between the regressors. Overall, the estimated model is satisfactory and free from multicollinearity.

5.4.2 Dynamic Panel Model Regression Results

Having successfully satisfied diagnostic tests that are necessary for the dynamic panel model, the analysis then investigated the factors influencing demand for international reserves in the SADC region. While separately estimating the system GMM estimator, the LSDVC estimator was also specified with the Blundell/Bond to initialize bias correction with maximum accuracy of approximation. Bootstrapped standard errors were also specified for the LSDVC since estimated asymptotic standard errors may provide poor approximations in small samples, such that obtained t-statistics and confidence intervals are often not reliable (Bruno, 2005). The LSDVC is important in this study because it helps to determine unbiasedness and precision of the system GMM results. If GMM and LSDVC estimators came out very similar, then the system GMM estimates would be deemed unbiased and precise, and so would be interpreted, otherwise LSDVC estimates would be chosen. Table 11 below presents the regression results:

Table 11: Model Estimation Results for SADC Countries

	System GMM		LSDVC	
	With Gold	Without Gold	With Gold	Without Gold
Inertia	0.7461***	0.7758***	0.8017***	0.8184***
GDP per capita	-0.0001***	-0.0001***	-0.0000	-0.0000
Sq. GDP per capita	0.0000***	0.0000***	0.0000	0.0000
Opportunity Cost	-0.0067**	-0.0062*	-0.0067*	-0.0069*
Degree of Openness	0.0462	0.1405	0.0867	0.0786
Lagged Export Growth	0.0007	0.0005	0.0009	0.0010
CMA Dummy	-0.4434***	-0.3561**	-	-
MMZT Dummy	-0.3149**	-0.2882*	-	-
ER Volatility	0.0018*	0.0018*	0.0021*	0.0021*
Reserves Volatility	0.0000***	0.0000***	0.0000***	0.0000***
χ^2	2402.262	2321.292	-	-
P	0.000	0.000	-	-
N	241	241	241	241

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.4.3 Interpretation of the Results

Having estimated total reserves demand models with and without gold reserves, the numbers of instruments were less than the 13 groups in system GMM, and chi-square statistics for the system GMM estimator were 2402.262 and 2321.292 respectively (both with P = 0.000). These statistics are strongly significant, showing that the independent variables included in the models are jointly significant. Comparing the models with and without gold, not much difference was observed in statistical significance, coefficient signs and magnitudes. This shows that the factors influencing demand for reserves are pretty much the same whether gold is included or not. Within the sample, Angola is a net

exporter of petroleum and may therefore have different experiences in balance of payments compared to the other countries. The results were therefore checked for robustness by estimating the same models without Angola. In this case, no significant differences in the estimates were observed and so Angola was kept in the models. A comparison of system GMM and LSDVC estimators also shows similarity of the estimates, and hence the system GMM estimates were deemed unbiased and precise. Therefore, the interpretations that follow were based mainly on the GMM estimates. With the dependent variable entered in logs, individual coefficient interpretations employ the techniques of a log-lin model for most regressors. Below are the interpretations:

Inertia: Previous period's reserves accumulation was expected to have an impact (positive) on the current level. The results above show that for both models there is a positive statistically significant impact of inertial forces on reserves demand at 1 percent level of significance. This is an elasticity whereby, other things held constant, a 1 percent increase in the previous ratio of reserves to GDP leads to approximately 0.75 and 0.78 percent increases in the current demand for reserves with and without gold respectively for the GMM model, and respectively 0.80 and 0.82 percent increases for the LSDVC. This shows that the inertial elasticity of reserves demand is inelastic. This result is similar to what was found by, among others, Edwards (1984), Bastourre et al. (2009) and Jung and Pyun (2015) in developing countries.

Scale Factors

Income: GDP per capita is statistically significant at all levels. For the system GMM estimator, *ceteris paribus*, a one US dollar increase in the GDP per capita leads to a 0.01 percent decrease in reserves accumulation as measured by the reserves-GDP ratio (0.0001×100). The variable satisfies the a *priori* expected sign in line with Baumol's (1952) square-root rule for transaction demand as well as empirical findings by Cheung and Ito (2009) for developed and developing countries who found that real GDP per capita affects international reserve holdings negatively. In this case, a country with a high per capita GDP is likely to be more stable and therefore less critical of potential external shocks whereas poorer economies are more prone to external shocks and hence likely to demand more reserves. The model also finds the square of income to be highly statistically significant, though not economically significant, exactly as found by Bastourre et al. (2009) and Aizenman and Marion (2003). With significance of income only observed in GMM and not LSDVC estimator, it is evident that the GMM adopts strong instruments capable of detecting original relationships, hence we adopt estimates from the GMM (Bastourre, Carrera, & Ibarlucia, 2009). The result indicates that there is a U-shaped relationship between income and reserves accumulation, such that demand for reserves decreases at a decreasing rate as per capita income increases.

Precautionary or Risk Factors

Of the three risk factors in the model, only volatility measures are found significant

Reserves Volatility: The positive coefficient for both models is in line with the prediction of the buffer stock model of international reserves (Frenkel & Jovanovic,

1981). The variable was included as a proxy for adjustment costs incurred by an economy that was not hoarding enough reserves in the wake of a crisis. From both models it can be observed that a one-unit increase in standard deviation leads to negligible increases in the demand for international reserves for the SADC region, other things held constant. That is, the higher the adjustment costs for an economy, the higher the demand for reserve holdings. This result strongly confirms (at 1 percent level) existence of the precautionary motive for reserve hoarding for SADC economies, where reserve accumulation is directly linked to exposure to sudden stops, capital flight and volatility. For example, within the SADC in light of the high volatility, Lesotho and Swaziland as members of the SACU have been encouraged overtime to deal with revenue volatility by building adequate reserve buffers to augment their resilience to risks from volatility (AfDB, 2018). In addition, most SADC countries went through violent conflicts since the early 1990s, including the Mozambican war of 1989-1992, DRC hostilities of 1996-1997 and Lesotho post-election conflicts of 1998. These issues were always followed by depleted reserve buffers amid an increasing demand for economic restoration. Reserve management has therefore seen countries demanding more reserves to survive such risks.

Exchange Rate Volatility: Countries that experience high instabilities in their exchange rates are found to demand more reserves. This variable shows a positive statistically significant coefficient of about 0.002 for all models. This means that a standard deviation change in the exchange rate results in a 0.2 percent change in demand for reserves, *ceteris paribus*. The result conforms to expectations, although it is in contrast with findings by Bernard (2011) and Bastourre et al. (2009), yet still other studies find the

variable to be statistically insignificant (Aizenman & Lee, 2005). The result also confirms existence of the precautionary motive, in line with a recent paper by Bhattacharya et al. (2018), which is gaining in importance for advanced and low-income countries but not for emerging markets. Related to previous risks, Ben Ltaifa et al. (2009) observed that collapsing trade that resulted from the global financial crisis of 2007-2009 led to higher exchange rate volatility since mid-2008 for Sub-Saharan African countries. In this case, the countries intervened in their foreign exchange markets, demanding more reserves, so as to cushion the economies from the risk.

Dummies

CMA Dummy

Contrary to expectations, the system GMM estimation results reveal that membership to the CMA increases demand for reserves by about 40 percent. This is likely the case because members of the CMA (Lesotho, Namibia, South Africa and Swaziland) constantly set themselves targets to be met in terms of reserves accumulation, led mainly by the regional *de facto* Central bank, the South African. For example, the smaller economies in the CMA are required to maintain foreign reserves at least equivalent to the total amount of local currencies they issue (Wang, Masha, Shirono, & Harris, 2007). Such targets increase reserve demand.

MMZT Dummy

Malawi, Mozambique, Zambia and Tanzania are found to have a lower demand for international reserves compared to the other SADC countries, as expected. Empirically,

the results show that MMZT countries have about 31 percent and 29 percent lower demand for reserves with gold and without gold respectively. For the four countries, it can be said that the special treatment they get in trade agreements due to their income ranking makes it less risky for them and hence they are not inclined to demand more reserves for precaution, *ceteris paribus*.

Other Factors

Opportunity Cost: The results confirm at 5 percent level of significance the a *priori* expected negative coefficient of opportunity cost, as measured by deviation of a country's lending rate from the 10-year US Treasury bill rate. In this case, a 1 percent increase in the opportunity cost reduces the demand for reserve holdings by about 0.7 percent *ceteris paribus*. As an example, due to low interest rates in 2016, the Central Bank of Seychelles reported to have increased investment and demand in foreign currency (CBS, 2016). This shows that improvements in domestic investment earnings reduce countries' demand for reserves to be used in foreign earnings, especially knowing that reserves are usually held in the form of short-term interest bearing assets.

Variables that are found to be statistically insignificant in both models include lagged exports growth (mercantilist factor) and the degree of openness (similar to results of Bastourre et al. (2009)).

5.5 Summary of Results

This chapter has presented and interpreted results from the Blundell/Bond System GMM and the LSDVC estimators both for total reserves (including gold) and reserves excluding gold. Results between the two reserves definitions and between the two estimators have been very similar with only the income variables having significant differences between the estimators, an observation attributed to strength of the instruments used by the system GMM estimator. Fulfilling the main objective, the analysis identified the factors that are responsible for influencing demand for international reserves in the SADC region. While positive determinants from this study include inertial forces and volatilities, negative factors influencing demand include opportunity costs, income, country membership to the CMA and the MMZT. Precautionary motives for hoarding reserves are clearly evident in the SADC region while mercantilist motives are lacking.

CHAPTER SIX

CONCLUSIONS AND POLICY IMPLICATIONS

6.1 Introduction

This chapter summarizes the study's research findings and makes conclusions and policy implications. Direction for further research is also offered herein. This introduction is therefore followed by three main sections; a summary of findings, policy implications as well as direction for further research.

6.2 Summary of Findings

This study set out to empirically investigate factors that influence demand for international reserves in the SADC region. This was done over the sample period from 1980 to 2015 for 14 SADC countries, excluding Zimbabwe and the Comoros Islands. Specifically, the study aimed at investigating the impact of scale variables as well as that of risk (precautionary motives) and mercantilist factors on reserve accumulation. During the study period, it is observed that reserve demand has generally increased in the SADC region as countries sought to actively take precaution against risks, including the various national conflicts between 1995 and 2003 as well as the global financial crisis of 2007-2009. This is the case in spite of the fact that these countries have grown more liberal over time.

To identify factors responsible for the increasing demand for reserves in the region, the study adopted relevant dynamic panel model estimators given the nature of the dependent variable, as well as the (unbalanced) nature of the panel itself, without having to lose observations. These are the Blundell/Bond system GMM (which allows estimation of dummy variable coefficients and performs well even when the autoregressive parameters are too large) and the LSDVC estimators (which performs well with unbalanced panels and even with a small or moderate number of cross-section units). Apart from the variables of interest in this study, other variables such as opportunity costs and dummies for countries' membership to the CMA and MMZT were included.

Before model estimation, the variables were all tested for stationarity, mainly for the LSDVC, where all were then confirmed to be stationary at standard significance levels. For the system GMM technique, consistency of the obtained estimates was ensured by testing for validity of moment conditions using the Sargan test, and also testing for serial correlation in the first-differenced errors using the Arellano-Bond test. For all these tests, the models were deemed well specified. The long-run results were then estimated using the system GMM estimator whose estimates' unbiasedness and precision was verified by the LSDVC.

In both models, firstly, it is observed that there are no significant differences between the determinants of reserves demand with and without gold. This makes sense because only a few countries in the sample recorded different figures for the two variables over the whole period (South Africa, DRC, Malawi, Mauritius and Mozambique), with the others

reporting the same figures at one point or another. It is observed from the system GMM estimates that income (as measured by GDP per capita), opportunity cost, CMA and MMZT dummies, as well as exchange rate and reserves volatilities play a role in influencing reserve hoarding. Precisely, income, opportunity cost and MMZT membership have negative impacts on demand for reserves, while CMA membership and volatilities have positive effects. One variable that is unexpectedly found to be statistically insignificant using both estimators is the degree of openness. This is the case for the SADC region probably because the picture is too mixed, with some countries being net importers, suffering BOP deficits, and others enjoying positive trade balances (such as Angola, South Africa and Zambia). In that regard, the traditional determinant has no effect on demand for reserves.

Linked to economic theory and previous empirical studies, the results from this study are supported. Among other things, the study finds significant the opportunity and adjustment costs, in line with the buffer stock model. Additionally, various determinants as found to be significant in this study were also found so by other empirical studies, especially those done in developing economies.

The results imply that in order to keep countries' accumulation of reserves to check and to avoid any losses that may result from crises, there are various policy actions that must be put in place by the managers at the regional level.

6.3 Policy Implications

Given that reserves are accumulated for precautionary motives; that is, to guard against external crises for the different economies, it is important that central banks build adequate reserve buffers to boost countries' resilience to risks that result from volatility. This finding implies that improving stability of the monetary system is essential, in order to maintain a substantial demand for reserves. One way to ensure stability of the monetary system is to put in place sound reserve management policies. This is because prudent reserve management has an effect on macroeconomic performance in terms of, among others, economic growth and price stability by reducing various costs, including opportunity and adjustment costs. With such economic growth comes increased employment and, assuming the presence of a suitable environment for trickle-down and spill-over effects to prevail, there will likely be achievement of poverty eradication. These effects have direct synergies with the achievement of Sustainable Development Goals (SDGs) 1 (no poverty) and 8 (decent work and economic growth).

The study revealed that countries with higher incomes, with high economic stability in the sample, place a lower demand for reserves. This stresses the need for central banks to continue implementing policies that improve stability of their economies to avoid ballooned reserve demands which have a tendency to undermine stability of the global financial system. It is also observed from this study that high opportunity costs reduce demand for reserves. This calls for improvement of returns that central banks can get in the case that they decide to invest and not hoard reserves, through among others reducing risk and offering secure and rewarding financial assets.

Exchange rate management is also a key policy implication from the results. Given that volatile exchange rates increase the demand for reserves as countries seek to cushion their domestic currencies, it is necessary that the monetary authorities switch to more manageable exchange rates that reduce exposure to foreign shocks, such as the managed float. This will make exchange rates less volatile thereby reducing the exacerbated demand being observed. Reserves volatility should also be contained. This can be done by controlling the main source of reserves for the economies. For economies such as Mozambique, Madagascar, Malawi and Tanzania that are heavily reliant on agricultural exports for reserves, there is need to move from the unsustainable production methods that are more prone to risks from erratic rains and bad weather. This means policies aimed at boosting structural transformation and industrialization should be endorsed. Among others, sectors with high potential for value addition, including minerals and gas, should be promoted, all aimed at reducing adjustment costs for the economies.

6.4 Direction for Further Research

With this study having at heart the exploration of determinants of demand for international reserves in the SADC region, there is still more research that can be done in the area of international reserves. Firstly, studies on optimal amounts of reserves for these economies are still lacking, though necessary. This is because this study assumes that the economies demand an above-optimal level of reserves. It is important, however, to empirically determine what the optimal amount of reserves is, both at regional and national levels. Such an attempt will determine whether the current trends in reserve demand are beyond what the economies actually need.

Data allowing, secondly, national studies on determinants of demand for international reserves may also be explored. This would not only help to direct national policies of reserve management, but also increase precision for some of the variables whose picture in panels tends to be too mixed. There is also need to deeply study and test RISDP's macroeconomic convergence criteria so as to be able to make a concrete recommendation for initialization of the planned SADC central bank.

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APPENDICES

Appendix A: Percentage Growth Rates of International Reserves

12. Appendix A: Percentage Growth Rates of International Reserves

PERCENTAGE GROWTH RATES OF INTERNATIONAL RESERVES

	Period			Period	
Country	**1995-2005**	**2006-2015**	**Country**	**1995-2005**	**2006-2015**
Angola	14.02045	1.766798	Namibia	0.412325	2.755027
Botswana	0.343644	0.196081	Seychelles	1.075794	3.747876
Congo, DR	-0.16661	6.869932	South Africa	3.620634	0.792928
Lesotho	0.136562	0.373273	Swaziland	-0.18209	0.471018
Madagascar	3.417065	0.42667	Tanzania	6.582342	0.802702
Malawi	0.437146	3.782077	Zambia	1.513618	3.123325
Mauritius	0.545966	2.254529	Zimbabwe	-0.89054	1.811152
Mozambique	4.645451	1.122273			

Source: Author's calculations from World Bank Development Indicators (WDI)

Appendix B: Data and Country Issues

B1. Countries under Study

Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, Swaziland, South Africa, Tanzania and Zambia

B2. Data Sources

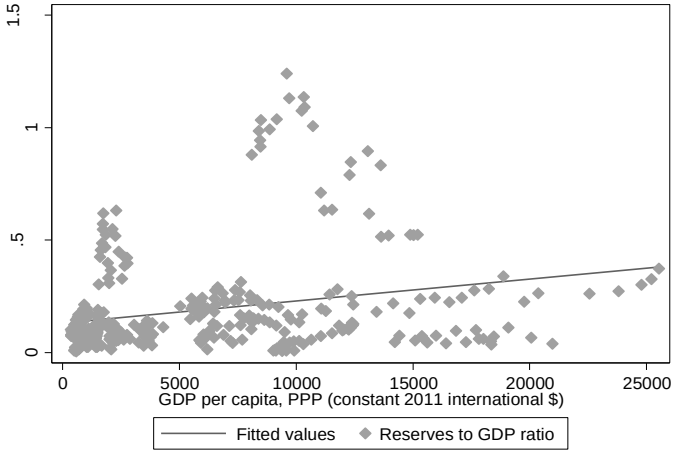
13. Appendix B2: Data Sources

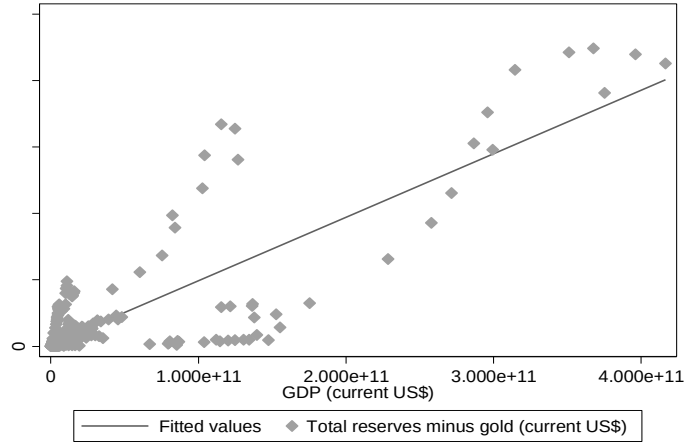
Variable	Description	Source
Total Reserves (Including Gold)	Natural log of the ratio of reserves (with gold) to the value of current GDP (in US$)	IFS
Total Reserves (Excluding Gold)	Natural log of the ratio of reserves (without gold) to the value of current GDP (in US$)	IFS
GDP per capita	Taken on PPP basis (constant 2011, int'l $)	WDI
Squared GDP per capita	Square of the GDP per capita	WDI
Imports	Imports of goods and services as a ratio to current GDP (in US$)	WDI
Lagged Exports Growth	Lags the annual percentage growth of exports of goods and services by 2 periods	IFS
Lending Rates	Lending Rates	IFS
10yr Market Yield on U.S. Treasury Securities	10yr Market Yield on U.S. Treasury Securities	Federal Reserve
Opportunity Cost	Real US treasury bill rate minus the domestic lending interest rate	-
CMA Dummy	Takes 0 for country in the CMA at time t and 1 for country not in the CMA at the time	-
MMZT Dummy	Takes 1 for Malawi, Mozambique, Zambia and Tanzania and 0 otherwise	-
Exchange Rate Volatility	Standard deviation of monthly (period average) exchange rates in each year	IFS
Reserves Volatility	Standard deviation of reserves (excl gold)	IFS

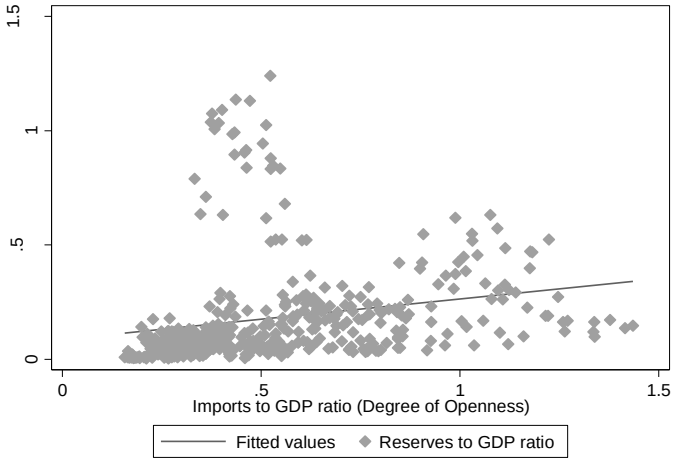
Note: Federal Reserve data is obtained from https://www.federalreserve.gov/releases/h15/

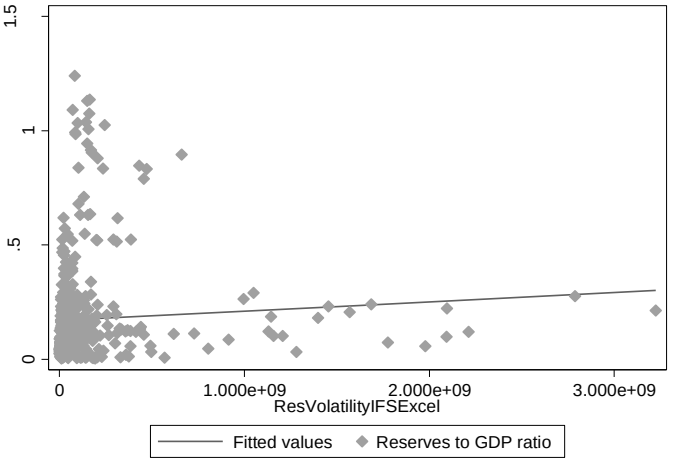
IFS - International Financial Statistics WDI - World Development Indicators

Appendix C: Scatterplots with Regression Lines









Appendix D. Fisher-Type and Pesaran Panel Unit Root Tests

14. Appendix D: Fisher-type and Pesaran Panel Unit Root Tests

	Fisher-type Test χ^2-Statistic (p-value) [H_0: Series is non-stationary]	
Series	**Constant without Trend**	**Constant and time trend**
Total Reserves (Incl. Gold)	39.1341 * (0.0788)	52.4813*** (0.0034)
Total Reserves (Excl. Gold)	37.9789 * (0.0988)	41.7022** (0.0462)
GDP per capita	45.9465 ** (0.0177)	60.2606*** (0.0004)
Squared GDP per capita	82.0369 *** (0.0000)	74.7858*** (0.0000)
Import-GDP	45.2696 ** (0.0207)	50.2165*** (0.0061)
Lagged Exports Growth	244.9296*** (0.0000)	213.7841*** (0.0000)
Exchange Rate Volatility	90.3112 *** (0.0000)	155.4324*** (0.0000)
Reserves Volatility	82.2737 *** (0.0000)	214.4489*** (0.0000)
Opportunity Cost	54.5606 *** (0.0019)	31.5170 (0.2946)
	Pesaran CADF Test Z[t-bar] (p-value) [H_0: Series is stationary]	
Total Reserves (Incl. Gold)	1.866 (0.969)	2.502 (0.994)
Total Reserves (Excl. Gold)	1.814 (0.965)	2.314 (0.990)
Opportunity Cost	-1.305* (0.096)	-1.180 (0.119)

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix E: Variance-Covariance Matrix

15. Appendix E: Variance-Covariance Matrix

	GDPc	Opp Cost	API	Export Growth Lag.	CMA Dummy	MMZT Dummy	ER Volatility	Res Volatility
GDPc	1.0000							
Opp Cost	0.5462	1.0000						
API	0.4235	0.2046	1.0000					
Export Growth Lag.	-0.2059	-0.4060	-0.0549	1.0000				
CMA Dummy	-0.1760	-0.3614	-0.0711	0.1805	1.0000			
MMZT Dummy	-0.5719	-0.2279	-0.3138	0.2260	0.3885	1.0000		
ER Volatility	-0.3656	-0.3172	-0.2356	-0.0949	0.2412	0.1097	1.0000	
Res Volatility	0.2243	0.1437	-0.2782	-0.0285	-0.2853	-0.1094	-0.1084	1.0000