The Impact of Risk on Regional Economic Integration in the Southern African Customs Union (SACU)

By

Skhumbuzo Samkelo Bryan Mlipha

Submitted in partial fulfilment of the requirements for the degree of

PhD in Agricultural Economics

Department of Agricultural Economics, Extension and Rural Development

Faculty of Natural and Agricultural Sciences

University of Pretoria

South Africa

January, 2021

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DEDICATION

In loving memory of our dearly departed family matriarch, Mrs Bella S. Nsibande, thank you Mbulazi for the sacrifices you made to get us here!

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DECLARATION

I, Skhumbuzo Samkelo Bryan Mlipha, declare that this thesis hereby submitted for the PhD in Agricultural Economics at the University of Pretoria is entirely my own work. I further declare that it has not been previously submitted or considered anywhere for a degree or otherwise.

Parts of the thesis have been submitted for consideration for publication and even published in journals.

All errors in writing, thinking and omission are entirely my own responsibility.

Signature:___________________________

Date:_______________________________

ACKNOWLEDGEMENTS

Glory be to God, the Almighty.

This thesis is the culmination of the prayers and sacrifices of the one person who has always believed in me, Ntungwa, thank you, I did it!

I am greatly indebted to a number of people who have contributed immensely to the completion of this study. I would like to acknowledge the support and mentorship of Prof. M.B. Masuku (Rest in eternal peace, Nhlane!). My sincere gratitude also goes to Prof. C. Blignaut whose encouragement made a huge difference. I will never forget his parting words, “I know you will deliver a great thesis.” I hope this suffices.

Also, I wish to thank Dr. M. Kalaba, my supervisor, who came on board half-way through this journey but made the most telling contribution. He made personal sacrifices to help me finish this study. His deep knowledge of trade issues was invaluable. He was willing to lead and follow, thereby, challenging me to strive for perfection. I am eternally grateful.

My sincere gratitude also goes to Prof. M.P. Dlamini, Prof. J. Kirsten, Prof. C. Tarvey, Prof. N. Chau, Prof. O.T. Edje, and Prof. Mike Masarirambi for their unwavering support. To S.K. Kalundu, Dr. C. Gandidzanwa, Dr. T. Sacolo, Dr Mesay Yami, Dr. Thula Dlamini, Rose Ngwenya and my entire PhD platoon, thank you for pushing and challenging me to deliver my best.

My unreserved and sincere gratitude goes to my wife, Sanele Khumalo, who has been there since day one. Her love and support kept me sane. Thank you *Precious*. To Adi, Panda and Sama, this is the reason Papa was away from home. To my siblings; Bongi, Vuyo, Lisa and Nana, thank you for having my back.
To my father, I hope I have repaid your hard work (Thank you for everything).

Finally, to the African Economic Research Consortium (AERC), I offer my sincere appreciation for the funds provided to embark on this journey.

ABSTRACT

THE IMPACT OF RISK ON REGIONAL ECONOMIC INTEGRATION IN THE SOUTHERN AFRICAN CUSTOMS UNION (SACU)

By

Skhumbuzo S. B. Mlipha

Degree:	PhD
Department:	Agricultural Economics, Extension and Rural Development
Supervisor:	Dr. M. Kalaba
Co-Supervisor:	Prof. C.B. Blignaut

The rapid growth of countries that opened their markets to international trade has led to an increase in the number of Regional Trade Agreements (RTAs). A number of countries have signed these agreements with their regional trade partners in order to reap the benefits of free trade. Such benefits include: trade stimulation, integrated markets, foreign exchange gains, and economic growth, to name just a few. The main objective of RTAs is to stimulate bilateral trade by integrating the markets of member states. However, RTAs have not achieved the same level of success globally. In some regions around the world, intra-bloc trade remains low post RTA ratification, especially in developing countries.

A review of the trade literature revealed a number of reasons for the failure of the regional economic integration model to stimulating bilateral trade. Such reasons include: inadequate economic policies; lack of administrative capacity and infrastructure; protectionist trade policies; political immaturity and instability; and border issues. However, according to trade literature, there is an argument that, in recent years, most of these factors have been taken care of, yet intra-bloc trade remains low. In a quest to provide more answers for this puzzle, trade researchers have identified risk, which is defined as a situation where there are multiple

possible outcomes (with known probabilities), but the ultimate outcome is not known, as a possible answer to the low intra-bloc trade mystery.

Risk has also been identified as a key impediment to bilateral trade, especially between developing economies, where risk is inherent. However, investigations of the trade-risk nexus are still in their infancy, and are said to be flawed. Such investigations which have generally been done in developed countries have focused on the impact of one risk event on trade, in isolation. This approach is inadequate as risk is a multi-dimensional phenomenon with spill-over effects which require a more holistic approach to explore interdependencies between seemingly unrelated events. As such, there is still no framework for aggregating risk in the trade processes of an economy. This means therefore that the impact of risk on trade is still not yet fully understood. This also means that conclusions drawn from trade-risk studies involving developed countries could be misleading for developing countries because of the differences in underlying economic conditions.

This study, therefore, pursued two main objectives: (1) to develop a risk aggregation framework in the form of a composite risk index; and (2) to determine the impact of risk on bilateral trade. In pursuit of the first objective, this study, used the Southern African Customs Union (SACU) as a case study, and developed a framework for quantifying risk. The output of this framework was a composite risk indicator which measures the level of risk in an economy. To construct the composite risk index, this study adapted a framework used to construct other social indexes e.g. the human development index; environmental sustainability index; and disaster risk index. The results from this exercise showed that the SACU member states (Botswana, Eswatini, Lesotho, Namibia, and South Africa) had different levels of risk, as expected. The results also showed that Lesotho and Eswatini had higher risk, which was constant or increased over time. This implies that these countries were less resilient to risk, as they were not able to address the risk over time, probably due to the lack of resources. Botswana, Namibia and South Africa proved to be more resilient as their risk decreased over time. In pursuit of the second objective, this study augmented the gravity model with the constructed composite risk index to determine the impact of aggregate risk on bilateral trade flows.

This study addressed a number of issues around the gravity model related to; specification, and structural econometric concerns. Agriculture commodity trade data (from 2000 to 2018) was also preferred over aggregated trade data. From the results, it was found that imports increased, though marginally when the incidence of risky events increased. The analysis showed that a 10 per cent increase in risky events in the domestic economy increases imports by 0.65 per cent.

This result is probable because risk could potentially disrupt the production of goods and services by domestic producers. As such, domestic producers would be unable to meet domestic demand and, therefore, goods would have to be sourced from external markets. On the export side, risk was found to have quite a substantial negative impact. A 10 per cent increase in the incidence of risky events decreased bilateral trade by 10 per cent. This result is intuitive because risk in the domestic economy is expected to affect exports more than imports. This result was also expected because risky events in the domestic economy affect the production of goods. This means the exporting country would have fewer goods available to satisfy domestic demand and even fewer for export. According to the results, aggregate risk on the importing economy leads to an increase in bilateral trade, whereas it decreased bilateral trade on the exporting end. This means that risk is a major impediment for countries with export-promoting trade policies.

The policy implications are that, SACU member states need to build their individual and collective resilience through effective risk mitigation policies and strategies. SACU operates the common revenue pool (CRP), which is a form of risk mitigation, but it needs proper management. The CRP has a customs component which compensates Botswana, Eswatini, Lesotho, and Namibia for the trade diverting exploits of South Africa in the bloc. There is also a developmental component which is meant to fund developmental projects. The development component of the pool needs to be channelled towards infrastructural development to reduce transportation costs. This needs to be coupled with interventions that build the resilience of domestic producers since risk was found to impede exports. This would reduce the high dependence on the South Africa economy by the other countries in the SACU bloc.

TABLE OF CONTENTS

LIST OF TABLES

List of Tables in Appendix

LIST OF FIGURES

List of Figures in Appendix

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Since the dawn of the 21st century, the world has made significant progress in overall human development. Extreme poverty has been significantly reduced; access to education and health care has also improved; and there has been substantial progress in promoting gender equality. However, according to the United Nations Development Program (UNDP) (2016), poverty remains a key challenge and, by far, SDG1 is the most important of the Sustainable Development Goals (SDGs). This is particularly significant when considering that more than 10 per cent of the world population survives on less than US$ 1.90 per day. This situation is exacerbated by the fact that, of the people living in poverty, 80 per cent of them are in less developed countries of Sub Saharan Africa and Asia (UNDP, 2016). This is where income inequalities are either high or widening; youth unemployment levels are high; and where unsustainable consumption and production patterns are pushing fragile ecosystems beyond their limits. In such situations, the risks associated with macroeconomic instability; disasters linked to natural hazards; for example, Cyclone Ida in Mozambique 2019; environmental degradation; and socio-political unrest all have a negative impact on the lives of millions of people.

Irwin (2008) observed that ever since Adam Smith published *The Wealth of Nations* in 1776, a vast majority of economists have accepted and provided empirical backing to the postulation that free trade among nations improves overall economic welfare. As such, a number of trade agreements have been ratified on the premise of the positive correlation between regional trade agreements (RTAs) and economic growth. Therefore there are a number of examples of such trade agreements across the globe, and these include: the European Union (EU), the Association of South East Asian Countries (ASEAN), the exclusive North Free Trade Agreement (NAFTA), and the South American Common Market (MERCUSOR), to name a few.

In Southern Africa, the Southern African Customs Union (SACU), Southern African development Community (SADC), and the Common Market for East and Southern Africa (COMESA) are examples of such agreements. Sala-I-Martin *et al*. (2012) also supported this argument; stating that even though some recent research casts doubt on the robustness of this relationship, there is a general sense that free trade and regional economic integration have a positive effect on economic growth, especially for countries with small domestic markets. SACU, which was established in 1910, is the oldest customs union in existence. It is an economic agreement between South Africa, Botswana, Lesotho, Namibia and Eswatini (formerly Swaziland) to exchange goods without customs and quantity restrictions. Being a customs union, SACU's external trade policy is harmonised, through a common external tariff (CET). SACU is a unique customs union in that, it operates a Common Revenue Pool (CRP) into which all customs, excise and additional duties are paid. Each member state receives a share from this pool; calculated in terms of a special formula. This trade agreement has gone through certain modifications over the years, namely: in 1910, 1969 and 2002. For the most part, these modifications were concerned with the way the agreement was being administered, and the decision-making power of the BLNS (now BELN) countries (SACU, 2014; McCarthy, 2003).

Free trade is defined as the absence of tariffs, quotas, or other governmental impediments to trade. It allows each country to specialise in the goods it can produce cheaply and efficiently relative to other countries (Baharumshah *et al*., 2007). Economic integration, on the other hand, is defined as treaties between nations to reduce policy-controlled barriers to the flow of goods, services, capital and labour, amongst them. Economic integration is viewed as a vehicle for economic growth and development, through trade. All such treaties fall within the scope of Article XXIV, GATT 1994 and the Enabling clause 1979 (WTO, 2014), which allows for discrimination with regard to goods originating from states outside the trade arrangement. Members of the trade bloc still enjoy the protection of the Most Favoured Nation principle (MFN), which forbids discrimination (Snorrason, 2012; Lwanda, 2011). Some international trade economists have been generally unenthusiastic about regionalism, principally because of the likelihood that preferential trade can cause trade to flow in inefficient ways, that is, trade diversion. Ideally, trade patterns should be determined by comparative advantage and not political reasons.

Those economists have also argued that regionalism has the potential of impeding multilateral trade liberalization as it contravenes the basic MFN principle (Baharumshah *et al*., 2007). RTAs are a form of regional integration, be it on a treaty (regional cooperation), economic (market integration), or developmental level; and as such, their discussion can be approached from any of the three fronts. The discussion of integration, in this study, is from an economic level. The reason for the choice is mainly because countries in Southern Africa, like the rest of the developing world, have over the years, accepted and implemented this model – the regional economic integration model. This model involves the ratification of regional trade agreements which may fall into any of the following categories: preferential trade agreement, free trade agreement, customs union, common market, economic union, and political union. The choice of the level of integration depends on the objectives of the member countries (Freund & Ornelas, 2010).

Countries ratify RTAs with neighbouring states and with natural trading partners, with the aim of reaping the benefits of free trade and regional economic integration. The benefits include: increased productivity and efficiency gained through learning from doing and exploiting economies of scale in production; reduced vulnerability to external shocks; and wider markets for participating countries. Other benefits include: foreign exchange gained from trading with foreign partners; trade stimulation, which is achieved through an increased supply and demand interplay; economic growth; increased consumer welfare; and increased intra-bloc trade (Baharumshah *et al*., 2007; Dunn & Mutti, 2004).

Given all the perceived benefits from the RTAs in place; however, not all participants in any economy support the reduction of trade barriers. Removing a trade barrier on a particular good, harbours the risk of losses in market share (due to the influx of competing goods), and income. This hurts the investors and employees of the domestic industry that produces that good. The influx of competing goods also exposes the domestic economy to a multitude of risks; for example, volatility in prices, uncertainties in supply due to fluctuations in production as well as pests and diseases. It is primarily for this reason that trade barriers still exist, and one of the reasons the global economy has not yet attained free trade (Irwin, 2008). However, risk has been recently identified as potentially the main threat to the success of the regional economic integration model, especially is the developing world.

Risk is part of everyday life and its significance is more pronounced in economic units where decisions, which have a bearing on the productivity and profitability, have to be made. Economic systems are typically complex and as such most of their processes exhibit attributes that cannot be forecast with absolute accuracy. The obvious implication of this uncertainty is that many possible outcomes are usually associated with anyone chosen decision or action. Therefore each decision or action is characterized by some level of risk. This is particularly, because not all possible consequences are equally desirable (Moschini & Hennessy, 2001). Risk is also more important in the context of developing countries, where resources are scarce. Risk is an important feature in world trade to the extent that there have been risk mitigation initiatives by the international trading community e.g. the formation of WTO and ratification of trade agreements (Dutt, Mihov, & Van Zandt, 2013). Risk, which is said to be fraught with confusion and controversy, is understood to mean hazard or danger, often leads to uncertain production and consumption patterns. It also reduces investment, demand, and supply endeavours, has serious implications for economic welfare and growth. Also, it is said to be endemic in developing countries; thus, failure to manage it and its negative outcomes can lead to international crises. Given the level and extent of international interdependence, analysing the impact of risk on trading patterns, the economics of trading, and the general economic welfare of trading has never been more relevant (World Economic Forum [WEF], 2013; Moschini & Hennessy, 2001; Outreville, 1998; Fischhoff *et al*., 1984). Risk is essentially present in every sphere of life such that the WEF (2013) has classified risk into five categories i.e. economic, social, technological, environmental and political.

In recent years, SACU, like the rest of the developing world, has suffered a multitude of challenges, namely: economic – the global financial crisis of 2008; political – the xenophobic attacks in South Africa of 2015; environmental – the El Nino-induced drought of 2015 in Southern Africa; and social – the global Corona virus pandemic of 2020. These disasters have, in turn, greatly disrupted economies through loss of; life, income, production capacity, jobs, and social stability. They have destabilised production and consumption plans, leaving a trail of production and economic losses. In today's globalised economy, these risk events do not only affect the activities of the domestic economy, but also those of other trading partners. In an increasingly interdependent world, one nation's failure to address some risk it is facing can have a ripple effect on the economies of other countries. Therefore, countries and their trade partners are vulnerable to systemic shocks and catastrophic events and their accompanying effects (WEF, 2013).

The performance of developing economies has been, for the most part, characterised by: low production efficiency; low investment and saving capacity; poor infrastructural development; and poor formulation and implementation of pro-development policies. This has not only compromised the development endeavours of developing countries, but it has also eroded their competitiveness in international trade markets (FAO, 2012). These characteristics of developing countries are a result of risk phenomena which is an integral part of such economies that include: high public debt; small, fragile, and fragmented economies; high illiteracy and unskilled labour; high unemployment and poverty levels; erratic weather patterns, and high dependence on the physical environment; and poor infrastructure.

Until the year 2000, however, risk was not included in the list of challenges facing trading countries in empirical international trade studies. For the most part, the emphasis has always been on the impact of the trade agreement on bilateral trade (Martinez- Zarzoso 2013; Behar & Criville, 2010; Freund & Ornelas, 2010; Coulibaly & Fontagne, 2009; Bhagwati, 2008; Baharumshah *et al*., 2007) and later on the effect of the other conditioning variables e.g. distance and the border effect (Bergstrand *et al*., 2013; Westerlund & Wilhelmsson, 2011; Melitz, 2007; Anderson & van Wincoop, 2003). Even now, a majority of the reviewed studies which explore the relationship between trade and risk are done in the context of developed countries; for example, USA, Japan, England, France, Canada, Israel and Chile (Baas, 2010; Long, 2008; Bayer & Rupert, 2004; Nitsch & Schumacher, 2004). This is besides the fact that developing countries are said to be riskier and less resilient to risk, which has been proven to be a major impediment to international trade (WEF, 2013).

In international trade, risk is seen as one of the major barriers to growth in bilateral trade and; consequently, on the growth of the economies of most countries in the global economy (Oh & Reuveny, 2010; EconomyWatch, 2010; Anderson & Marcouiller, 2002). Unfavourable events in the trading system introduce uncertainty which may disrupt the free flow of goods and services between trading partners. The impact of such events has the potential of spilling into the macro economy of many countries due to the important role that international trade plays in the global economic system (Economywatch, 2010; Oh & Reuveny, 2010). Since developing countries are said to be less resilient to risk, it would be conceivable to expect that their fragile economies would be the most impacted by unfavourable events.

According to Chavas (2004), the economics of risk has been a fascinating area of enquiry, primarily because there is hardly a situation where economic decisions are made with perfect certainty. There is no sector of life which is immune to risk, be it business, health, or the environment. As the debate on international trade rages on, economists still differ on the real benefits of international trade. On the one hand, the increase in the export market is highly beneficial to an economy but; on the other hand, the increase in imports can be a threat to the economy due to the risks associated with international trade. It has been the worry of the policy makers to strike the right balance between free trade and restrictions (Economywatch, 2010).

Until the risk can be quantified and measured, and its impact on trade understood and managed, with the objective of helping developing countries build their resilience and exploit their comparative advantage, then trade will remain skewed towards more developed countries within trade blocs. This study, therefore, seeks to make a contribution to the body of knowledge, by quantifying risk and measuring its impact on bilateral trade.

1.2 RESEARCH PROBLEM AND MOTIVATION

One of the key findings of studies on RTAs is that bilateral trade in trade blocs is low (and even lower in South-South RTAs), which implies small welfare gains of economic integration for developing countries (Hosny, 2013; Coulibaly & Fontagne 2009; Mayda & Steinberg, 2009; Schiff & Winters, 2003; Anderson, & Marcouiller, 2002). The SACU trade bloc is no exception; there is low intra-bloc trade and members have, over the years, struggled to reach the 30 per cent mark for both imports and exports within the SACU market. This means a bulk of their goods come from, and are sold outside the union (SACU, 2012). Figure 1.1 shows the destination of SACU exports over a ten-year period. Africa, Asia and Europe are the principal destinations for SACU exports. They account for 27, 24 and 22 per cent, respectively, of total exports and 28, 24 and 19 per cent of total imports. Intra-

SACU imports account for only 13 per cent (Figure 1.2) while intra-SACU exports account for 14 per cent over the same period.

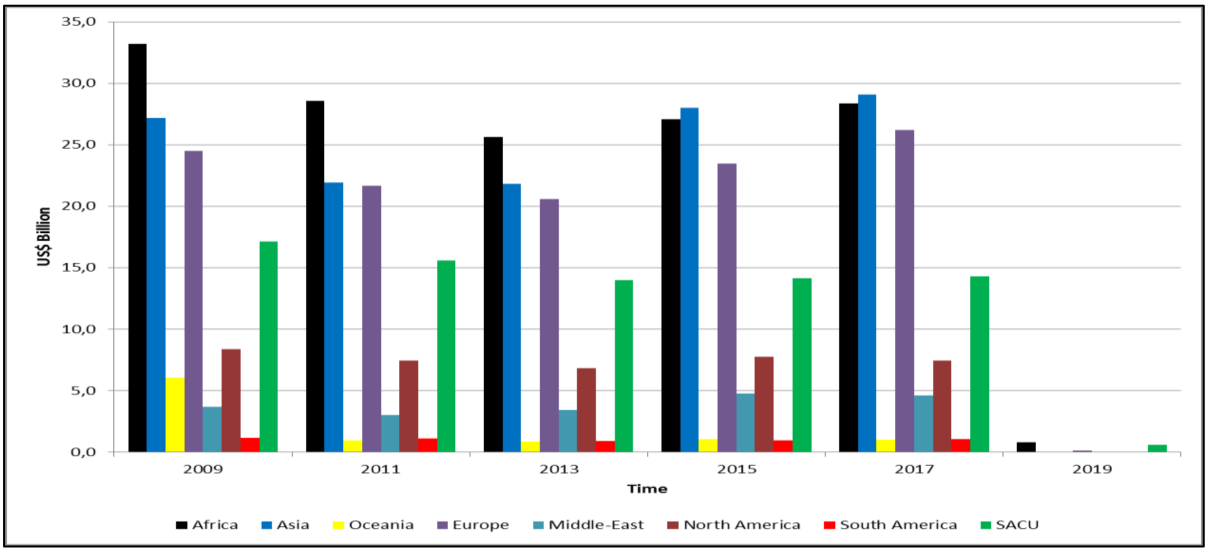


Figure 1. 1: Destination of SACU exports from 2009-2019

Source: Calculated from SACU Database (2018).

This situation goes against trade theory, as the expectation is that the SACU market should be the prime destination for exports and origin of imports for the SACU member states. Even though developing countries tend not to be natural trading partners, due to their small, similar economies endowed with similar factors of production, SACU is an exception. It has different economies, with dissimilar factors of production and should, therefore, be able to exploit economies of scale and realise gains from trade, due to the Heckscher-Ohlin comparative advantage (Behar & Criville, 2010; Egger & Larch, 2008).

A number of possible explanations for the low trade volumes have been forwarded. They include: lack of administrative capacity, infrastructure; presence of protectionist trade policies; politically immaturity and instability (Mayda & Steinberg, 2009; Longo & Sekkat, 2004). However, in the last 20 years, political conflicts and protectionist trade policies (trade barriers) have declined; economic growth is more robust; and economic management, governance and political stability have improved, yet intra-bloc trade still remains low (ECA, 2013; Behar & Criville, 2010; Elva & Behar, 2008; Carrere, 2004, Wiemer & Cao, 2004).

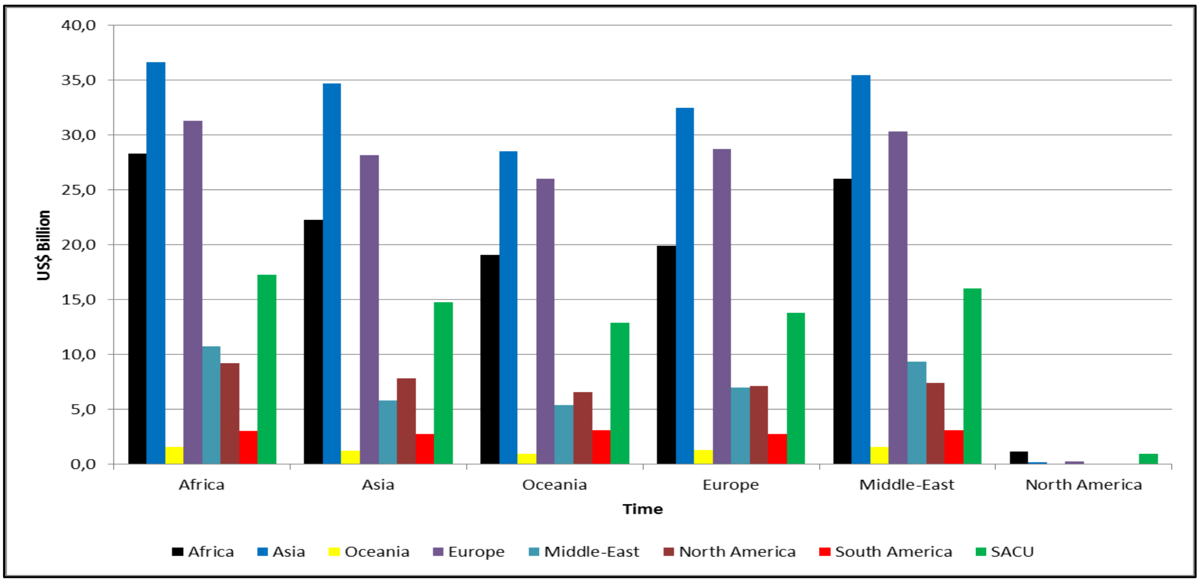


Figure 1. 2: Origin of SACU imports from 2009-2019

Source: Calculated from SACU Database (2018).

This implies that there are other underlying and not well researched obstacles; for example, risk (economic, social, technological, environmental and political), which prevent the member states from taking advantage of the trade agreements (Sandrey, 2013; ECA, 2013; AGI, 2012; WDR, 2009; Elva & Behar, 2008; Carrere, 2004, Wiemer & Cao, 2004; Anderson & Marcouiller, 2002).

Risk has been identified as a possible explanation for the low intra-bloc trade; a key impediment to bilateral trade (Oh & Reuveny, 2010; Long, 2008; Mirza & Verdier, 2008; Nitsch & Schumacher, 2004; Anderson & Marcouiller, 2002; Fosu, 2001; Li & Sacko, 2000). However, the risk-trade literature provides no firm, conclusive evidence on the quantitative importance of risk as an impediment to bilateral trade flows, especially from a South-South RTA perspective (Gunning, 2008). The literature only provides empirical evidence on the impact of individual risks i.e. political (armed conflict, civil war, terrorism, corruption, imperfect contract enforcement, and political instability); environmental (earthquakes, drought); economic (inflation; inequality); social (marginalisation and social exclusion) within a combination of North-North and North-South RTAs (Borodin, & Strokov, 2014; Keshk *et al*., 2010; Oh & Reuveny, 2010; Long, 2008; Li & Sacko, 2000; Fosu, 2001; Nitsch & Schumacher, 2004; Mirza & Verdier, 2008; Holzmann *et al*., 2003).

However, risky events are rarely experienced in isolation, that is, they are usually the result of other risky events, and or lead to other risky events (Luckmann, 2015; Jovanovic *et al*., 2012; Oh & Reuveny, 2010). These interrelated risk dimensions (economic, social, technological, environmental and political) require a new approach to risk analysis that will successfully tackle the challenges posed by integrating data from different risk sources into a single analytical measure. There is a need for a more holistic approach to risk identification, assessment and management. The analysis has to explore interdependencies and spill-over effects between events that initiate impact flows between otherwise unrelated events (Luckmann, 2015; Jovanovic *et al*., 2012). Therefore, the practice of analysing the effect of risky events on trade in isolation, may lead to misleading conclusions due to the spill-over effect of risk; as may the reliance on empirical results done in North-North (NN) and North-South (NS) RTAs due to differences in underlying economic factors (Mayda & Steinberg, 2009).

Given the numerous risks facing countries in South-South RTAs, there is a need for a framework that will identify, quantify, and aggregate the major risks in a South-South (SS) regional trade bloc. It is after all in such a setting where the problem is magnified because according to the IMF (2014) developing countries are less resilient to risk and are characteristically riskier. SACU, being the oldest customs union, and with a good mixture of developing countries (with lower and upper-middle income economies) – in a part of the world where regional integration has not been successful, is a good case study to understand the impact of risk on bilateral trade.

The study addresses the following research questions:

- What is the level of intra-bloc trade between North-North, North-South and South-South?
- What is the level of risk in the SACU member states?
- What is the impact of risk on bilateral trade?

1.3 OBJECTIVES

This study seeks to determine the impact of risk on regional economic integration within the SACU trade bloc. However, to assess such impact requires the quantification of risk through a risk measure (index), and then determine its impact on bilateral trade. Therefore, the achievement of the main objective will depend on the attainment of the following specific objectives, namely to:

a. determine intra-bloc trade between North-North, North-South and South-South RTAs
b. develop a framework to quantify risk
c. construct a composite risk index
d. determine the level of risk in the SACU member states
e. determine the impact of risk on SACU bilateral trade flows

1.4 HYPOTHESES

In this study, the following hypotheses were tested.

i. North-North and North-South RTAs have higher intra-bloc trade compared to SS RTAs

According to Baldwin and Seghezza (2010), developed countries are expected to trade more compared to less developed countries due to a number of reasons like the following; higher demand and supply capacities; relatively higher disposable income; diverse tastes and preferences; and a higher resources base. All these trade shifters are in abundance in developed countries. By default, RTAs between developed countries are expected to trade more than those constituted by developing countries.

ii. The risk in the relatively less developed countries is higher than in more developed countries in SACU

This study postulates that Lesotho and Eswatini are riskier than Botswana, Namibia and South Africa. This is because Eswatini and Lesotho are lower-middle income economies which are less resilient to shocks because of a low asset base. They also have low average growth rates, and high fraction of their population living in poverty; low capital accumulation; lack of clear investment policies; poor infrastructure; slow productivity growth; and poor economic diversity. It may be because of these reasons that they have been unable to fully exploit their comparative advantage in production and trade. Therefore these lower-middle income economies are relatively more vulnerable to the consequences of risky events (Noy, 2009; Raddatz, 2007). According to risk literature, less diversified, and less developed economies are less resilient to risk and, therefore, riskier. Since the BELN countries have smaller, and less diversified economies; they should have a higher risk-trade correlation.

iii. Risk is negatively related to the volume of trade between bilateral trade partners in SACU.

The volume of trade between any two trading partners will be reduced if there is any substantial downside risk involved (Oh & Reuveny, 2010). These risks, which include economic downturns, recurring unfavourable or extreme weather conditions, and escalating poverty and ineffectiveness of any of the institutions involved in trade facilitation, have the potential to decrease trade volumes between trading partners. According to Long (2008), rational expectations by firms are subject to error due to the uncertainty that surrounds risky events. It is expected that since each risk factor is negatively correlated to the volume of trade between trade partners then, aggregate risk will be negatively correlated to trade depending on the weight attached to each factor.

1.5 METHODOLOGY AND DATA

1.5.1 Methodology

Due to its proven track record in trade-related research, in terms of fitting the data well, accuracy in approximating bilateral trade flows; and empirical robustness, the gravity model was used in this study (Bacchetta *et al.*, 2012; Anderson, 2011; Silva & Tenreyro, 2006). The model was augmented to control for other conditioning variables which impede or encourage trade. The conditioning variables include: Gross Domestic Product (GDP) per capita of the importing and exporting country. This controls for the economic size of the trading partners. A number of variables were used to capture trade costs in bilateral trade, and these include: distance (which is a proxy for transport costs), dummies for landlocked countries, contiguity, common language, and common colonial history (these dummy variables control for transport and search costs). The gravity model hypothesises that trade between two trade partners will increase with their economic size and diminish with transport and search costs (Tansey & Touray, 2010).

The analysis involves the use of the panel data technique and random effects estimation with a random intercept, using the method of Poisson Pseudo Maximum Likelihood (PPML), and homoskedastic standard errors. Firstly, the use of the panel data technique controls for a wide variety of country heterogeneity (Westerlund & Wilhelmsson, 2011). Secondly, the use of random effects estimation controls for Multilateral Resistance Terms, an account for the relative attractiveness of origin-destination pairs in trade flows (Feenstra, 2002). Lastly, the PPML methodology allows for the gravity model to be estimated in levels, which is a natural way of dealing with zero values of the dependent variable and it is also consistent in the presence of heteroskedasticity (Westerlund and Wilhelmsson, 2011; Santos Silva & Tenreyro, 2006). The Ordinary Least Squares (OLS), Feasible Generalized Least Squares (FGLS) and Maximum Likelihood (MLE) estimation methods served as robustness checks. The analysis was done in *STATA 12*, *@Risk 7.6* and *Microsoft Excel*.

This study dealt with risk in the following categories: economic, social, technological and environmental, which, according to WEF (2012), form part of the five that encompass all risks. Political risk was excluded from the analysis because it covers issues that may be sensitive or non-quantifiable. Such issues include: quality of institutions, corruption, socioeconomic policies that fuel public discontent, and an incompetent bureaucracy for which data may not be readily available or accurate (Oh & Reuveny (2010),). From the chosen risk categories, the following variables were used to construct the risk factor indices: economic growth and inflation (economic risk); poverty and unemployment (societal risk); rainfall and temperature (environmental risk); and the road and telephone line networks (technological risk). The variables were chosen due to the availability of data; their appropriateness in explaining the risky aspects of the different factors; and because they are major indicators in the different categories. According to Scrivens and Iasiello (2010), data availability and appropriateness are crucial aspects when deciding what indicators to use to construct an index.

This not only captured the effect of the different dimensions of risk, but also provided more information on the interplay between regional trade and risk. The rationale behind this approach is that risky events are rarely experienced in isolation; they are usually the result of other risky events, and lead to other risky events. Therefore, the practice of analysing their effect in isolation may lead to misleading conclusions. The novelty of this study is on the use of a composite risk index – augmenting the gravity model, to capture the impact of four different risk dimensions on bilateral trade flows. This approach will better predict the impact of risk on trade flows, as it quantifies risks in multiple different dimensions of the economy.

1.5.2 Data and Data Sources

This study used secondary data from 2000 to 2018, and it covered trade in the following agricultural commodities (with HS classification) within SACU: sugar (1701), maize (1005), Beef (0201), live cattle (010229), rice (1006), wheat (1001), milk (0401), potatoes (0701), apple and pear (0808), citrus (0805), tea (0902), sorghum (1007), fish (0301), tomatoes (0702), Cabbages (0704), beans (070820), banana (0803), grapes (0806), soybeans (1201), and groundnuts (1202). The commodity trade data used for the analysis was obtained from a number of sources which include:

SACU Database, International Trade Centre (ITC), UN COMTRADE, World Bank, International Monetary Fund (IMF), Food and Agriculture Organization (FAO), World Trade Organization (WTO).

Data on GDP, GDP per capita, inflation and infrastructure was sourced from the World Bank and IMF database. Distance data was sourced from the French Research Centre in International Economics (CEPII) database. Data on RTA membership was sourced from the WTO database. Weather data (rainfall and temperature) was sourced from the Botswana Department of Meteorological Services; Lesotho Meteorological Services; Namibia Meteorological Service; South African Weather Service; Eswatini Meteorological Services; as well as HarvestChoice.

1.6 CONTRIBUTION

The contribution of the study is twofold:

i. Methodological contribution

The first contribution of the study is the construction of a composite index, which quantifies and measures aggregated risk in an economy. The risk index was used to quantify the level of risk in the domestic economy, with the view of determining the impact of the aggregate risk on bilateral trade flows.

The variables of individual risk dimensions were also used in an augmented gravity framework to determine the effect of the different types of risk factors on bilateral trade flows. By determining the impact of individual risk dimensions and aggregate risk on bilateral trade, this study has the potential to help solve the mystery of low intra-bloc trade.

ii. Literature contribution

The second contribution of the study was to empirically estimate the impact of risk on bilateral trade in a South-South RTA setting. This is a relatively new route in empirical research, and it still has not been fully explored. Compared to developed countries, developing countries are expected to be the most affected by risky events due to their low resilience and inherently risky nature. As such, there is a need to empirically determine the impact of risk on trade in the setting of a South-South RTA. This is because the results from North-South and North-North RTAs were said to be potentially misleading. Therefore, there is a need to address this gap in the research literature by empirically investigating the impact of risk on intra-bloc trade. With the developing world being characterised by high risk (IMF, 2014) and low intra-bloc trade volumes, such a study is long overdue.

1.7 ORGANISATION

This thesis consists of six chapters organised as follows: The first chapter provides background and context and the second chapter provides a review of literature on international, regional economic integration and socio-economic trends in SACU. It further attempts to embed the study in the body of international trade literature. The third chapter provides a review of the literature on the risk-trade interaction. It seeks to define and describe risk in the context of regional bilateral trade for the purposes of this study. Chapter four provides the conceptual and theoretical frameworks of the methods of analysis. It also presents the construction of the composite risk index which is then used to augment the gravity model of trade. Chapter five presents the impact of risk on bilateral trade flows in SACU. The results from this chapter were published in the journal of *Development Southern Africa* (DSA) in February, 2019. Chapter six provides a summary, concludes and presents policy recommendations.

CHAPTER 2

A DYNAMIC EVOLUTION OF INTERNATIONAL TRADE

2.1 INTRODUCTION

Trade economists, the world over, generally agree that free trade is beneficial. They only differ on how trading countries should make the transition from tariffs and non-tariff restrictions to free trade. The three available approaches to free trade are unilateral, bilateral and multilateral trade reform. Multilateralism is viewed as the desired outcome, but it is relatively harder to achieve. On the other hand, regionalism, a form of bilateral trade facilitation, which is arguably a more feasible outcome, was initially not favoured by economists (Irwin, 2008; Moser & Rose, 2014). However, since the 1990s, regionalism has emerged as the vehicle of choice towards multilateral trade for many countries. Academics and policymakers generally agree that regional cooperation schemes in trade, especially among developing countries (SS RTAs), are a means not only to attain the ultimate goal, free trade, but also more immediate domestic goals of regional economic stability and development (Bhagwati, 2008; Whalley, 1998).

This chapter contextualises this study within the existing body of international trade literature. This is done by first reviewing the literature on international trade in general, and then specifically on regional economic integration. The importance of this chapter is that it identifies the founding principles of international trade which are important in determining the level of transgression by economic players in global trade. It also highlights the different areas where WTO members may be vulnerable to different risky phenomena. It further traces the route which members of the WTO, especially developing countries, have taken as they navigate the global trade arena; highlighting the objectives of the architects of international trade regulations. Finally, it also shows how members of SS RTAs (specifically SACU members) have interpreted and implemented these regulations.

This chapter is divided into six different but interrelated aspects, namely: origins of international trade; regional economic integration; RTAs; characteristics and impact of RTAs; and finally the Southern Africa Customs Union.

2.2 THE GATT/WTO AND INTERNATIONAL TRADE

The origins of formalised international trade can be traced back to an era of global economic turmoil just after World War II when the General Agreement on Tariffs and Trade (GATT) was founded. It substantially reduced the tariff barriers on manufactured goods in the industrial countries from over 40 per cent to less than 4 four per cent (Irwin, 2008). Arguably, the GATT's biggest achievement has to be the overhaul of trading rules during the Uruguay Round (1986-1994) which not only substantially reduced trade tariffs, but also led to the creation of the WTO in 1995. The agenda of the WTO/GATT has been to promote trade; reduce barriers to trade through rounds of trade talks; and provide a platform for settling trade disputes (Dutt *et al*., 2013).

One of the founding principles of the WTO is non-discriminatory trade, but it has special provisions that allow member countries to negotiate discriminatory agreements on trade amongst each other (Lwanda, 2011; Irwin, 2008; Konishi *et al*., 2003). The GATT provides two qualified exceptions to the Most Favoured Nation (MFN) rule:

a) The Enabling Clause, which allows for less developed countries to enter into free trade agreements (FTAs) under less stringent conditions than their developed counterparts (WTO, 2014; Lwanda, 2011).

b) Article XXIV of GATT which lays down the modalities under which a limited number of WTO members can come together and agree to liberalise trade amongst themselves in a discriminatory manner (WTO, 2014; Lwanda, 2011).

2.3 REGIONAL ECONOMIC INTEGRATION

According to Chingono and Nakana (2008), the lack of clarity and consensus on the guiding paradigm for regional integration and how to achieve it, is perhaps, one of the key explanatory factors for limited progress. They argue that the regional integration discourse assumes that neighbouring countries that have similar economic, socio-political and security problems may benefit from integrating their economies because this creates a situation of mutual inter-dependence and development. Also, countries may need regional integration arrangements even if they do not have similar problems. Regional integration creates larger economic spaces and allows for economies of scale, which may increase efficiency, competitiveness, and growth. This is a regional phenomenon where members of a RTA impose lower tariffs on goods from member countries than on those produced outside the trade bloc. A defining characteristic is that, these countries have geographical proximity and, therefore, called a regional trade agreement (Panagariya, 2000; Snorrason, 2012). There are three main approaches to regional economic integration, namely: regional cooperation, market integration, and development integration (Freund, 2000; Mistry, 2000).

2.4 REGIONAL TRADE AGREEMENTS (RTAs)

Agreements between countries about foreign trade policy have long been a key feature of the international political economy, and among the most important agreements of this sort are RTAs (Mansfield & Milner, 2014). These are crucial parts of the current multilateral trading system. The RTAs are generally arrangements among countries whereby members engage in trade at reduced tariff rates. Such benefits do not extend to non-members, and are usually accompanied by a dismantling of quantitative restrictions as well. The arrangements may be partial or total, with respect to the extent of duty reduction or commodity coverage. RTAs are designed to foster economic integration between member states by improving and stabilizing the access that each member has to the other participant’s markets. Nearly all RTAs are regional treaties between nations to reduce or eliminate policy-imposed trade barriers (Snorrason, 2012; Roy, 2010).

RTAs are a broad class of international agreements which include: Preferential Trade Agreements (PTAs), Free Trade Agreements (FTAs), Customs Union, Common Markets, and Economic Unions (Mansfield & Milner, 2014). According to Bhagwati (2008), most existing bilateral arrangements take the form of FTAs or other limited scope agreements, and less than 10 per cent can be considered to be fully fledged customs unions. Facchini *et al*. (2012) argue that this is due to the political viability of FTAs compared to customs unions, and that the political viability of FTAs depends on the degree of income inequality. They also argue that, if income inequality is sufficiently small, an FTA raises welfare relative to a customs union for the member countries.

RTAs are classified into these different categories depending on the level of integration between the member countries. Formal RTAs may cover a spectrum of arrangements, from small margins of tariff preference to full scale economic integration. All RTAs fall within the scope of GATT 1994 Article XXIV (Snorrason, 2012). They can take either one of these four types, which are generally considered to represent a progression, with each level representing a movement towards free trade.

i. *Preferential Trade Agreements (PTAs)*: This is a union of countries where members impose lower trade barriers on goods produced within the union. There is some flexibility for each member on the extent of the tariff reduction (Pomfret, 2006).

ii. *Free Trade Area* (FTA): This is a situation wherein internal trade barriers are removed between members, but each country retains their individual external tariffs to trade with non-members (Roy, 2010), for example, SADC. According to Krishna (2005), FTAs are not as liberalising as the name would suggest. They have hidden protection in the form of rules of origin (RoO), which create what looks like tariffs on imported intermediate inputs, and affect the price of domestically made inputs as well (Dirar, 2009).

iii. *Customs Unions* (CUs): Trade barriers between members are eliminated and trade policies are harmonised through a common external tariff (CET). The CET is characteristic of CUs (Roy, 2010), for example, SACU. Another important distinction between FTAs and CUs is the extent of the role of rules of origin (RoO).

In either preferential regime, RoO are restrictions on the preferential treatment of goods which are not produced or significantly transformed by a member country

(Roy, 2010). RoO have a greater relevance in the context of FTAs due to the potential to act as an additional trade barrier. Custom Unions raise social welfare relative to FTAs in member countries (Krueger, 1999; Krishna, 2005).

The first three types of integration are termed shallow integration in the economic literature, and apart from these types, there is also deeper integration characterised by the following (Ornelas, 2007):

iv. *Common market*: A common market includes all the aspects of a CU. It takes integration a step further by permitting the free movement of goods, services, labour, and capital among member nations. In this type of integration, factor as well as product markets are integrated, for example, the European Union (EU) (Rosson *et al*., 1996).

v. *Economic Union*: From a common market, members can integrate even deeper, and form an economic union. Member countries have to harmonise or unify their monetary and fiscal policies (Sheer, 1981; Salvatore, 2004). This is the most advanced type of economic integration.

vi. *Political Union (Complete Economic Union)*: This is the final stage of economic integration. At this stage the integrated economic units have no or limited control over their economic policy. This stage is characterized by full monetary policy and complete or near-complete fiscal policy harmonisation (Salvatore, 2004). The economic theory has it that: as economic integration increases, the barriers of trade between markets diminish.

2.5 CHARACTERISTICS OF REGIONAL TRADE AGREEMENTS

The following section presents the characteristics of RTAs in the international trade arena. A number of RTAs were studied with the objective of getting an understanding of the dynamics of the different types of RTAs in force. RTAs are classified into three major categories based on whether the signatories are developed, developing, or a mix of the two. The signatories of such RTAs come together and agree to liberalise trade amongst them in a discriminatory manner as outlined in Article XXIV of GATT.

i. North-North (NN) RTAs

These types of agreements tend to yield large trade flows because of scale economies and product differentiation (Mayda & Steinberg, 2009). These are trade agreements that are ratified by developed countries, for example, Japan - Australia, Canada - Israel. Developed countries have characteristics that give rise to potential trade-creation; this further underlines the classification of developed countries as more natural trading partners than developing countries. According to Baier and Bergstrand (2007), the classification of NN countries as more natural trading partners is because they tend to be larger and more similar in economic size. This means they are, therefore, able to fully exploit economies of scale. Developed countries also tend to have wider differences in their relative factor endowments, and as such, their trade agreements lead to trade creation due to the Heckscher-Ohlin comparative advantage. NN trade is characterised by imperfectly competitive firms; realising scale economies; and selling differentiated products. This type of trade tends to be intra-industry trade and constitutes a larger proportion of trade between developed countries (Egger & Larch, 2008).

ii. North-South (NS) RTAs

NS agreements are expected to yield large trade flows because of big differences in relative factor endowments (Mayda & Steinberg, 2009). These are trade agreements between developed and developing countries, for example, the North American Free Trade Agreement (NAFTA), which consists of USA, Canada and Mexico. It has been argued that, in general, NS trade agreements bring about better gains on implementation than SS agreements. Intuitively, this is because NS agreements generally incorporate economies with different technological capabilities and factor proportions and, therefore, the potential gains are usually greater. Furthermore, much of the trade between developed and developing countries, or NS, continue to be the inter-industry trade. According to the Heckscher-Ohlin and monopolistic competition models, the share of inter-industry trade in total trade is expected to be larger when there are big differences in factor endowments, as is usually the case with NS trade (Pant & Paul, 2018).

NS RTAs offer developing countries larger market access, and are more likely to produce efficiency gains. They are also said to be the most likely to result in tangible gains for developing countries as compared to SS RTAs. This is on the basis that they significantly minimise trade diversion costs and also maximise the gains from policy credibility, one of the key conditions in attracting investment inflows (Behar & Criville, 2010). However, although the main rationale of developing countries seeking a North-South trade agreement is to secure market access, it is often the case that Southern countries gain little access in practice (Cieslik & Hagemejer, 2009). Further noted is that, NS agreements impose restrictive RoOs for particular sectors, for example, agriculture, and that deprives developing countries of the perceived increased market access.

iii. South-South (SS) RTAs

The differential and more favourable treatment reciprocity and fuller participation of developing countries decision of 28 November 1979 – commonly referred to as the Enabling Clause, is a legal alternative to the MFN rule. It allows for developed countries to discriminate in favour of less developed countries and also provides the legal framework for developing countries to enter into FTAs under less stringent conditions than their developed counterparts (WTO, 2014; Lwanda, 2011).

SS RTAs are regional trade agreements ratified between developing countries, for example, SACU (Cernat, 2001). SS RTA members typically set up a single value-added rule applicable to all products, and the SS trade is characterised by inter-industry trade. Inter industry trade refers to the type of trade where developing countries export mostly primary goods such as minerals, and import manufactured goods such as cars (Pant & Paul, 2018). According to Behar and Criville (2010), SS agreements can address a larger number of trade barriers and promote bilateral trade to a greater extent compared to NS and NN agreements. However, the authors observe that SS RTAs do not trade as much as they should.

In trying to explain this observation, Mayda and Steinberg (2009) argue that the two main drivers of international trade are comparative advantage and economies of scale. Along both dimensions, they note that developing countries are expected to trade little with each other. This is primarily because low-income countries tend to have similar relative factors supplies;

therefore, the incentive to trade with each other is smaller than it is for dissimilar countries. Developing countries also tend to specialise in sectors that do not exhibit economies of scale, in particular, low-end manufacturing industries. In support of this observation, Behar and Criville, (2010) argue that low-income countries are generally endowed with similar supplies of factors of production. They are economically smaller and usually have a poor network of road infrastructure; hence, higher transport costs. They, therefore, have a lesser possibility of realising the gains from trade, based on comparative advantage and exploiting scale economies within SS trade blocs.

2.6 REGIONAL TRADE AGREEMENTS IN WORLD TRADE

A major feature of the world trading system, since the early 1990s, has been the proliferation of RTAs. As seen in Figure 2.1, the number of RTAs ratified and notified to the WTO has increased exponentially from about 25 in 1990 to about 481 in 2019, and these are agreements that are in force. They cover trade in both goods and services. Interestingly, there are now questions whether RTAs truly promote economic development as first argued by its proponents. These questions stem from the lack of concrete evidence on whether RTAs really increase intra-regional trade (Kagochi & Durmaz, 2018; Pant & Paul, 2018). However, this doubt has not affected the increase in the number of trade agreements being rectified. There has been, generally, a higher proportion of trade agreements covering trade in goods than trade in services. Interestingly, there are more active regional trade agreements (RTAs) than those notified to the WTO (as shown in Figure 2.1). Ideally, RTAs have to be notified (or registered) to the WTO upon ratification. However, according to the WTO (2013), the normal trend among developing countries is to notify the WTO of their agreement a number of years into its existence, and SACU is a classic example. It was established in 1910 but was only notified to the WTO in 2007. RTAs between developed countries, on the other hand, usually come into force in the same year they are notified to the WTO, or in the following year (see Table 2.1).

According to the WTO (2019), a total of 22 countries have applied to join the WTO, which means the number of RTAs will increase in the foreseeable future. As the number of RTAs (notified or not) in the world continue to increase from one year to the next, their level of integration and sophistication continue to deepen and increase. From the 301 RTAs covering trade in goods, about 46 are between developing countries, formed under the Enabling Clause; while 255 are a combination of developed and developing countries, formed under Article XXIV of GATT (WTO, 2019).

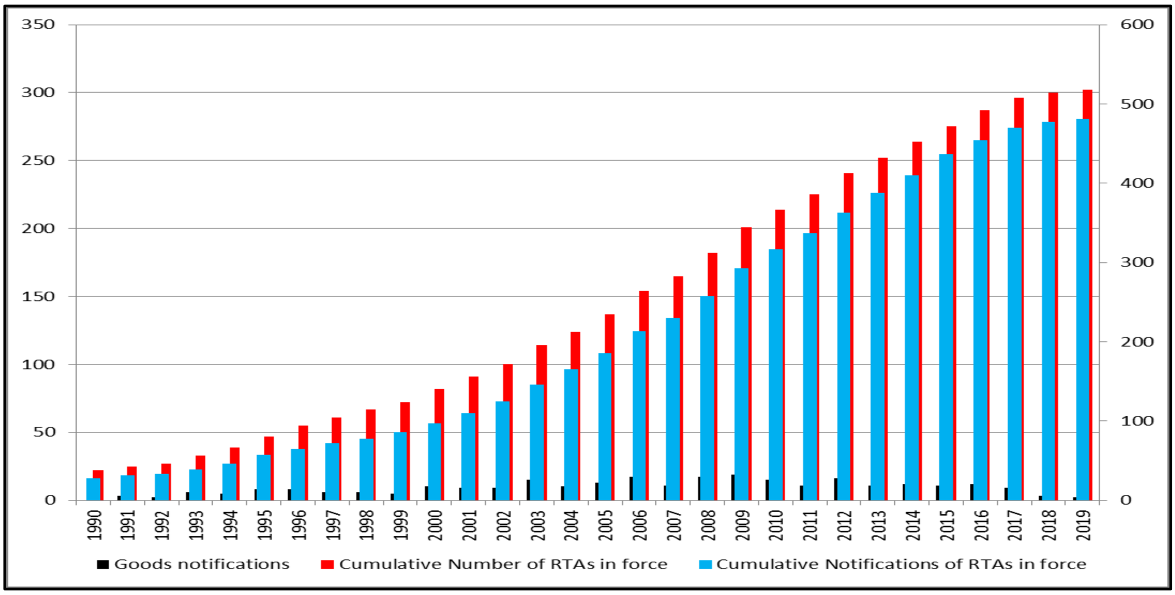


Figure 2. 1: Proliferation of RTAs in world trade, 1990-2019

Source: WTO Secretariat (2019).

Figure 2.2 shows the intra-bloc trade between countries who are signatories of the different RTAs. The NAFTA had the highest intra-bloc trade between 1990 and 2010. However, between 2010 and 2017, the Asia-Pacific Trade Agreement (APTA) which is a trade agreement between Bangladesh, China, India, Republic of Korea, Lao PDR, and Sri Lanka, took top spot. The APTA was boosted by the trade exploits of China and was amongst the leading regions in intra-bloc trade in 2017. Third on the list of top traders is the ASEAN Free Trade Area (AFTA), The AFTA is a trade agreement between Brunei, Indonesia, Malaysia, the Philippines, Singapore, Thailand, Vietnam, Laos, Myanmar and Cambodia.

Table 2. 1: Examples of RTAs in world trade

RTA	Type	Date of Notification	Notification	Date of entry into force	Status
Australia - New Zealand Closer Economic Relations Trade Agreement (ANZCERTA)	FTA	1983	GATT Art. XXIV	1983	*In Force*
Asia Pacific Trade Agreement (APTA)	PSA & EIA	1976	Enabling Clause	1976	*In Force*
ASEAN Free Trade Area (AFTA)	FTA	1992	Enabling Clause	1993	*In Force*
Caribbean Community and Common Market (CARICOM)	CU	1974	GATT Art. XXIV	1973	*In Force*
East African Community (EAC)	CU	2000	Enabling Clause	2000	*In Force*
European Free Trade Association (EFTA)	FTA	1959	GATT Art. XXIV	1960	*In Force*
Southern Common Market (MERCOSUR)	CU	1991	Enabling Clause	1991	*In Force*
North American Free Trade Agreement (NAFTA)	FTA	1993	GATT Art. XXIV	1994	*In Force*
SACU	CU	2007	GATT Art. XXIV	1910	*In Force*

Source: World Trade Organization (WTO) (2019).

On the lower part of the trade scale is where the SACU is found. The agreement between Botswana, Eswatini, Lesotho, Namibia and South Africa had the third lowest intra-bloc trade in the time under review. The Caribbean Community (CARICOM), which is a trade agreement between Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago, is also among the regions with lower levels of intra-bloc trade. The East African Community (EAC) is a regional intergovernmental organization with 6 signatories: Burundi, Kenya, Rwanda, South Sudan, Tanzania, and Uganda. This organization had the lowest intra-bloc trade in the period under review. Figure 2.2 proves the conclusion made by a number of researchers (Pant & Paul, 2018; Behar & Criville, 2010; Mayda & Steinberg, 2009) that SS RTAs have lower levels of trade as compared to NN and NS RTAs.

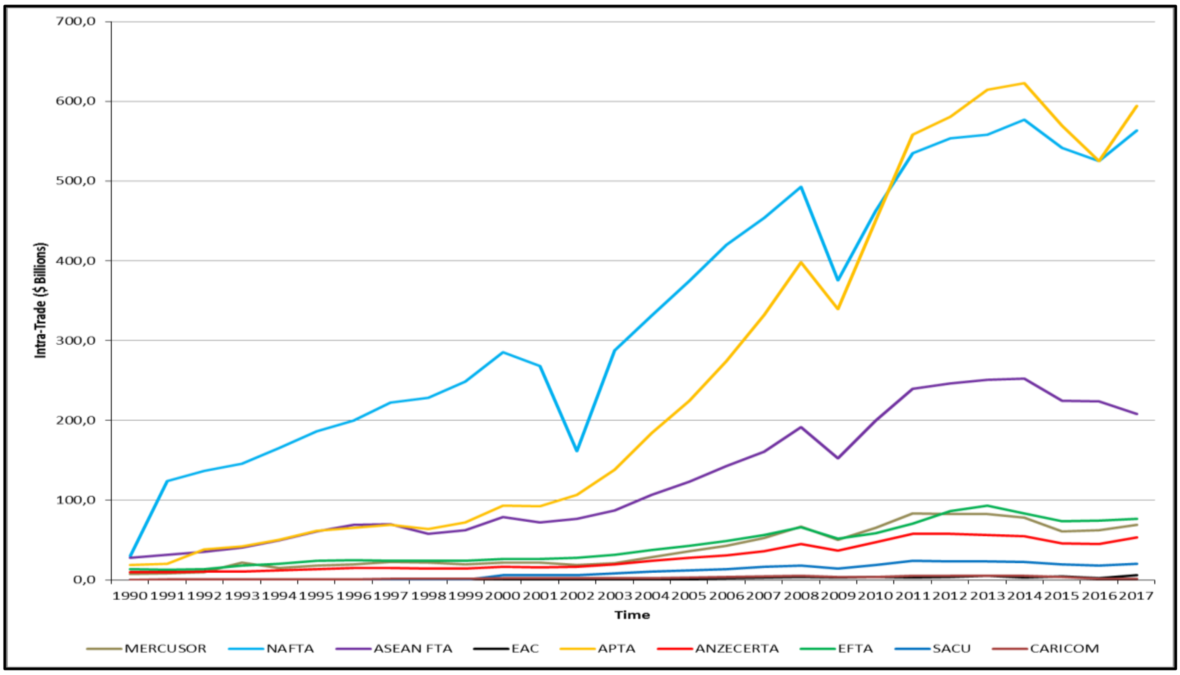


Figure 2. 2: Intra-bloc trade in selected RTAs, 1990-2017

Source: Calculated from Comtrade Database (2018).

Figure 2.3 shows intra-trade between selected countries which are signatories of regional trade agreements. The black-coloured shapes represent bilateral trade between developed countries, that is, NN trade for example, Canada and US, Australia and New Zealand, the United Kingdom and Germany. As expected, NN trade is on the higher end of the intra-trade scale. The NN trade blocs had the most intra-trade in the period between 1990 and 2019 compared to most of the green and red-coloured shaped. According to Pant and Paul (2018), developing countries are able to fully exploit economies of scale due to their larger and more similar economies.

The green-coloured shapes represent NS trade, that is, Australia and Malaysia; Canada and Mexico; Switzerland and China; New Zealand and Korea. This trade, depicted in Figure 2.3, has the largest range of the three classes of RTAs. This may be due to the differences in size and economic development between the trading pairs, which are greatest in this category of RTAs, that is, Switzerland-China, Canada-Mexico and Australia-Malaysia.

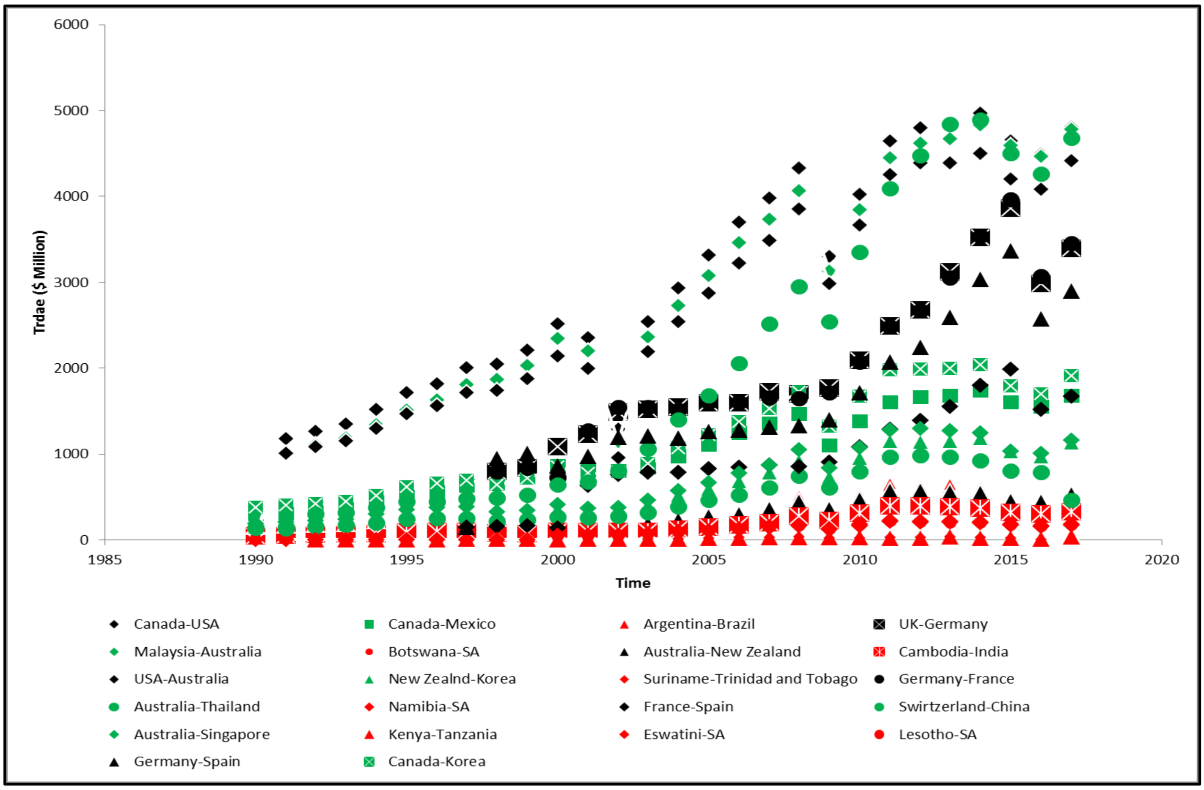


Figure 2. 3: Bilateral trade between NN, NS and SS, 1990-2017

Source: Calculated from Comtrade Database (2018).

The red-coloured shapes represent SS trade, and they had the lowest bilateral trade in the period under review. They also had the lowest range between high and low trade between any pair. This may also be an issue of the marginal differences in economic size between the trading pairs. Bilateral trade between SACU countries is represented by this colour code; for example, South Africa and Botswana, South Africa and Namibia. Other SS examples shown include Argentina and Brazil, Cambodia and India, as well as Kenya and Tanzania.

2.7 THE SOUTHERN AFRICAN CUSTOMS UNION (SACU)

SACU is the oldest customs union in the world, established in 1910. It is a single customs territory and has a common external customs tariff (CET). It consists of five members, namely: Botswana, Eswatini Lesotho, Namibia, and South Africa. SACU operates a Common Revenue Pool (CRP) into which all customs, excise and additional duties are paid. Each member state receives a share from this pool, calculated in terms of the Revenue Sharing Formula (RSF). Goods grown, produced, or manufactured in the Common Customs Area are traded freely among the member states; free of customs duties and quantitative restrictions. The CRP can be seen as some form of risk mitigation. The pool has a customs component which compensates Botswana, Eswatini Lesotho, and Namibia (BELN, formerly BLNS) for the trade diverting exploits of South Africa. There is also a developmental component which is meant to fund capital projects (SACU, 2014a). Over the years, SACU has gone through significant changes in its objectives and overall outlook, but the most important ones were those made in 2002. This was after South Africa was democratised. These changes included SACU being notified to the WTO in 2007, in terms of Article XXIV of GATT 1994 (SACU, 2007). The 2002 Agreement also spells out a new RSF and an institutional framework for the administration of the union (Ngalawa, 2013).

For most of SACU history, the BELN countries have used a common currency, the South African Rand. The Rand Monetary Agreement (RMA), signed in 1974, formalised the use of the South African Rand as the only legal tender in the region. Botswana pulled out from this agreement in 1975. Each member of the agreements has their own currency. Lesotho, Namibia, Eswatini and South Africa, however, are members of a Common Monetary Area (CMA) (Kirk & Stern, 2005; Ngalawa, 2013; SACU, 2014b). The WTO does not have rules that specify how customs revenue, in a customs union, should be divided among member states. It is up to members to decide whether to link tariff revenue to the state of final destination of imported goods, or follow another type of arrangement. In SACU, a special revenue-sharing formula applies. SACU receipts for each member are calculated from a customs component; an excise component; and a development component (Erasmus, 2014).
An important implication of the 2002 RSF is that the volatility of the two components of the CRP – customs revenue and excise collections – is different. South Africa and the BELN countries derive the largest proportion of their respective SACU revenue from different components of the CRP. It can therefore be inferred, that the two are also different in their vulnerability to global business cycles transmitted through the SACU revenue. Customs revenue, a component of the CRP from which the BELN countries get the largest share of their SACU revenues, is susceptible to large volatility, depending on business cycles in SACU's major trading partners, while excise revenue is fairly stable (Ngalawa, 2013; Kirk &

Stern, 2005). Kirk and Stern (2005) observed that the revised 2002 RSF eliminates the risk that South Africa could end up paying out to BELN more than the value of the common revenue pool. A key characteristic of the revised formula is that, it addresses the risk that South Africa was facing without compromising the revenues of the BELN countries.

The size of the CRP has been steadily growing from R83.3 Billion in 2014 to R99.5 Billion in 2017. It declined by 6.3 per cent in 2018 to R93.3 Billion. The distribution of the CRP (Figure 2.4) shows that South Africa has the bulk of the revenue shares; from 41 per cent in 2014 to 47 per cent in 2018. South Africa's share of the CRP has been steadily increasing in the time period under review while the rest of the member states recorded declines in their shares of the CRP (SACU, 2018).

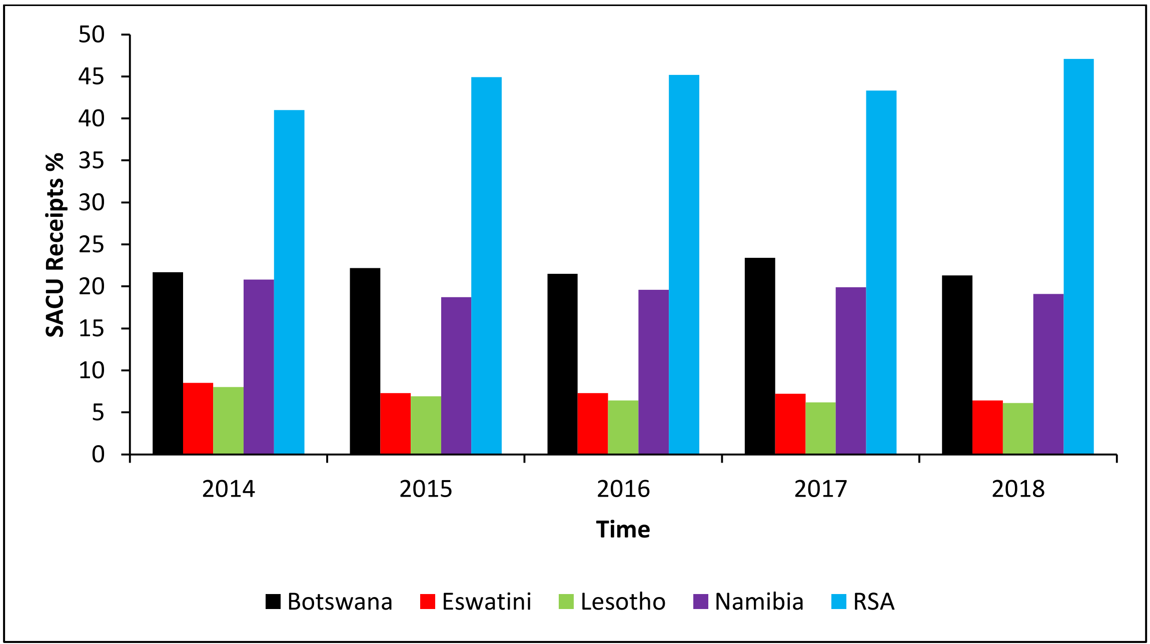


Figure 2. 4: SACU receipts 2014-2018

Source: SACU (2018).

Botswana has the second highest share of the CRP, with an average of 22 per cent, and her share has been declining over the time period, with 21.7 per cent in 2014, 21.5 in 2016, and 21.3 in 2018. Both Botswana and South Africa receive about 66 per cent of the revenue from the pool. Namibia has the third largest share from the pool; however, her share has also been declining since 2014 from 20.8 per cent to 19.6 per cent in 2018. The shares for both Eswatini and Lesotho have been declining since 2014; with a joint share of 16.5 per cent dropping to 14.1 per cent in 2018 (SACU, 2018).

The BELN countries are most dependent on the SACU transfers with Lesotho and Eswatini being more dependent than Botswana and Namibia. This means the two countries are the most vulnerable to fluctuations in SACU revenue. This state of affairs is worrying seeing that both countries depend on the SACU revenue for their national budgets. SACU revenue contributed close to 30 per cent for Lesotho and Eswatini for the 2017 national budgets (African Development Bank [ADB], 2019). The SACU revenue sharing formula exposes these member states to instabilities arising from global business cycles more than it does South Africa. Customs revenue, a component of the CRP from which these countries get the largest share of their SACU revenues, is susceptible to large volatility depending on business cycles in SACU's major trading partners, while excise revenue, a portion of the CRP from which South Africa gets the largest share of its SACU revenues, is fairly stable (SACU, 2014; Ngalawa, 2013; Kirk & Stern, 2005).

It is expected that SACU, being the oldest trade agreement in the world would have achieved the objectives of the member states by now i.e. economic prosperity, high bilateral trade flows, increased intra-bloc trade, transference of production technologies. However, this has not been the case. The realistic situation is of low intra-bloc trade, complete domination by South Africa and, trade diversion (Ngalawa, 2013; SACU, 2014). This has been attributed to poor policy formulation and implementation coupled with the collapse of agricultural sectors in the BELN. This section therefore presents the economic outlook of the SACU members and well as their agriculture sectors.

2.7.1 Socio-Economic Status of SACU Member States

Botswana's economic policies have been pro-poor, for the most part, such that there has been a significant and rapid reduction in poverty, especially in the rural areas. In the period, 2002-2016, the share of the Tswana people, living on less than US$1.90 a day, declined steadily from 29.8 per cent to 18.2 per cent (Table 2.2). This has been driven by equitable growth, job creation and expansion of social safety nets (ADB, 2019). However, inequality remains one of the biggest challenges in Botswana. With a Gini coefficient of 60.5, Botswana is lagging behind other nations in addressing income inequality (World Bank, 2018).

Table 2. 2: SACU socio-economic and productivity indicators

	Population (Million)	Land Area ,000 km^2	GDP (Million US$)	GDP per capita (US$)	Poverty	Unemployment (2010-2018)	Gini Coefficient
Botswana	2.3	582	41.8	17. 9	18.2	17.8	60.5
Eswatini	1.4	17	4.7	4.1	42	27.1	51.5
Lesotho	2. 3	30	6.9	1.2	59.6	26.6	54.2
Namibia	2.6	824	12.6	4.9	22.6	21.3	61.0
South Africa	57.4	1.219	790.9	6.2	18.9	25.2	63.0

Source: African Development Bank (ADB) (2019).

It would seem the economic growth achieved by Lesotho since independence has not been shared equally as poverty has remained stubbornly high. With the poverty rate at 59.6 per cent, Lesotho is among the poorest countries in the region. The poverty is mostly concentrated in the isolated rural areas where there are limited income opportunities. In addition, the majority of the poor depend on the performance of the agricultural sector which has been underperforming, following the El Nino induced drought in 2015 (World Bank, 2018). Lesotho has also made little progress in addressing unemployment. With 26.6 per cent of the Sotho population outside gainful employment, the country’s development plans may not yield the intended results. Although Lesotho is now more equal to its neighbours, it remains one of the 20 per cent most unequal countries in the world, with a Gini coefficient of 54 (ADB, 2019).

Even though Namibia has achieved notable economic progress since independence, this has not been enough to deal with the country’s high poverty and unemployment rates. Poverty has remained stubbornly high, at 22.6 per cent of the working population, in 2017. Unemployment rates are slightly lower at 21.3 per cent. A small segment of poor Namibians benefits from employment income, while the majority rely, instead, on subsistence farming or social grants and other transfers. Namibia has the second high inequality rates in SACU, with a Gini coefficient of 61. The country is one of the most unequal in the world (ADB, 2019). South Africa, on the other hand, has made considerable strides toward improving the wellbeing of its citizens since its transition to democracy in 1994, though progress has been slow. About 19 per cent of the 57 million South Africans are still poor (Table 2.2). Unemployment also remains a key challenge, standing at 25.2 per cent. The unemployment rate is even higher among youths, at around 55.2 per cent (ADB, 2019). With a Gini coefficient of 63, South Africa has the highest level of income inequality in the world (World Bank, 2018).

Eswatini is classified as a lower-middle-income country, but poverty levels have remained high since independence, with 42 per cent of the population living under the poverty line in 2017. Unemployment remains high at 27.1 per cent, as does human development outcomes, which are far below the norms for middle income countries. Even though the level of inequality is the lowest in Eswatini compared to the other SACU states, it is still high. With a Gini coefficient of 51, the country has quite a skewed income distribution (World Bank, 2018).

2.7.2 Macroeconomic Performance

As shown in Figure 2.5, economic growth continues to be uneven across the SACU. This, to a large extent, is due to the differences in economic performances in different sectors and resource endowments. Botswana has enjoyed, arguably, the most stable economic growth since independence. However, more recently, Botswana's diamond-led development model has been less effective such that, economic growth is slower, whilst inequality, poverty, and unemployment are high (World Bank, 2018). Since 2013, Botswana's GDP has grown by 4.7 per cent on average. This growth is mostly attributed to growth in the mining and trade sectors. However, Botswana's fiscal position has been under pressure due to depressed production in mining, along with weak growth in receipts from the SACU. The growth in GDP has been buoyed by a steady decline in inflation since 2012, with the average around 4.8 (ADB, 2019).

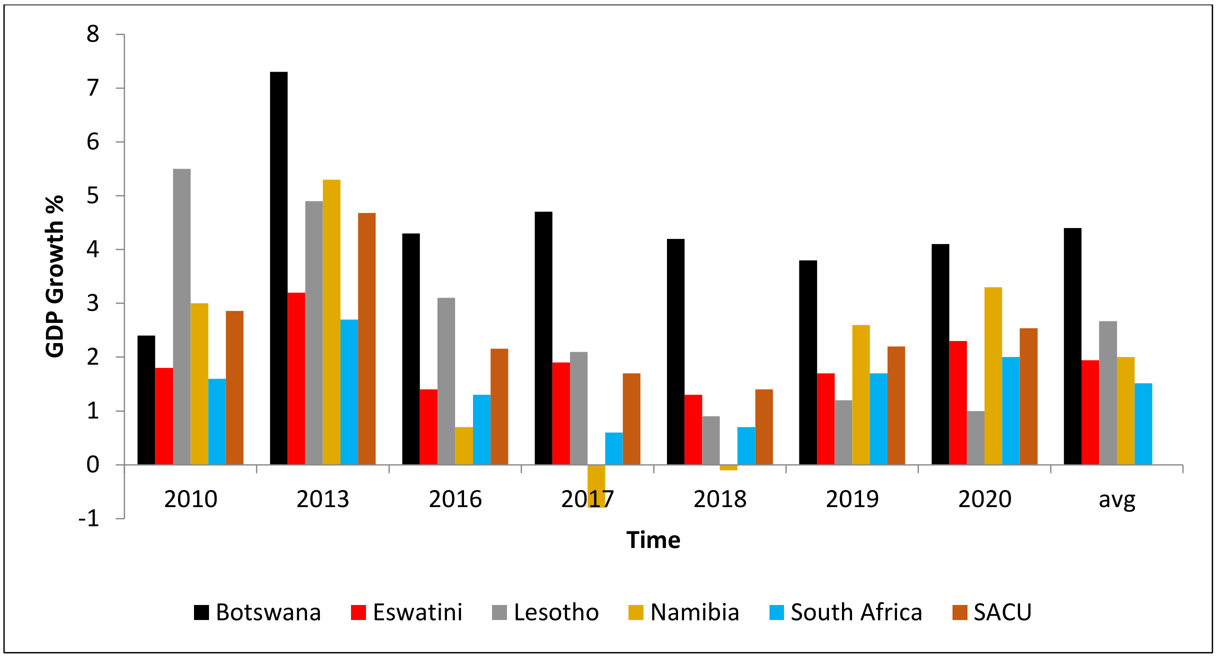


Figure 2. 5: SACU member states GDP growth rates (%)

Source: African Development Bank (ADB) (2019).

Lesotho's economy has been negatively affected by political instability, and a prolonged period of slow growth in South Africa, which has led to falling SACU revenue and subsequent liquidity challenges. Economic growth has averaged 1.4 per cent between 2015 and 2018. This is attributable, in part, to growth in the construction and mining sectors. The fiscal deficit is projected to narrow due to increased tax collection, and the reduction of government expenditure. The decline in SACU revenues continues to pose a challenge to the country's fiscal outlook: SACU revenues fell from 30 per cent of GDP in 2012 to an estimated 17.7 per cent of GDP in 2017 (World Bank, 2018).

Namibia is largely a desert with a long coastline on the South Atlantic. The country's natural mineral deposits; a tiny population; political stability, and sound economic management have made it an upper-middle-income country. The economic recession continued in 2018. The real economic activity contracted by 0.4 per cent in 2018, from a deeper contraction of 0.9 per cent in 2017. The depressed economic activity reflects the continuation of the fiscal consolidation process that acted as a major drag on the economy, and the tepid growth performance of the neighbouring countries that had additional adverse effect on the demand for Namibia's exports (World Bank, 2018). The economic growth gradually recovered in 2019; up to 2 per cent and is expected to improve into 2020. Growth recovery will be driven by the mining activity, especially uranium, as its prices are expected to rise and terms of trade improve (ADB, 2019).

After having realised impressive economic growth rates after independence, the economy of Eswatini has taken a downward spiral in recent years. From such phenomenal levels as 8.3 per cent in the 1980s, to 3.1 per cent in the 1990s, to 2.1 per cent in the early 2000s, Eswatini's economy has lost ground. This state of affairs is attributable in part, to unfavourable weather conditions, and changes in geopolitics in South Africa (Dlamini *et al*., 2018). The GDP growth in 2018 was 2.4 per cent from 2 per cent in 2017, partly driven by a recovery in the primary and service sectors. However, due to escalating fiscal challenges (reflected through accumulation of domestic arrears, which stands at 30 per cent of GDP), the 2019 GDP for the country is projected to decline to 1.3 per cent (World Bank, 2018).

South Africa is an upper middle income country with an estimated population of 58 million (about a quarter of the total Southern African population). The South African GDP is estimated at $350 Billion and the economy grew by 1.3 per cent in 2017 and 0.8 per cent in 2018. The World Bank projects 2019 growth at 1.3 per cent, accelerating further to 1.7 per cent in 2020. South Africa's inflation has been quite stable for the past 6 years, with an average of 5.6 per cent (World Bank, 2018).

The world has experienced a decline in average prices in the last couple of years due to a steady decrease in the price of petroleum products. This situation has seen inflation rates continuously falling short of expected targets. The SACU has also experienced this downward trajectory in inflationary rates since 2012, as shown in Figure 2.6. Botswana experienced the most decrease in inflation in the period under review.

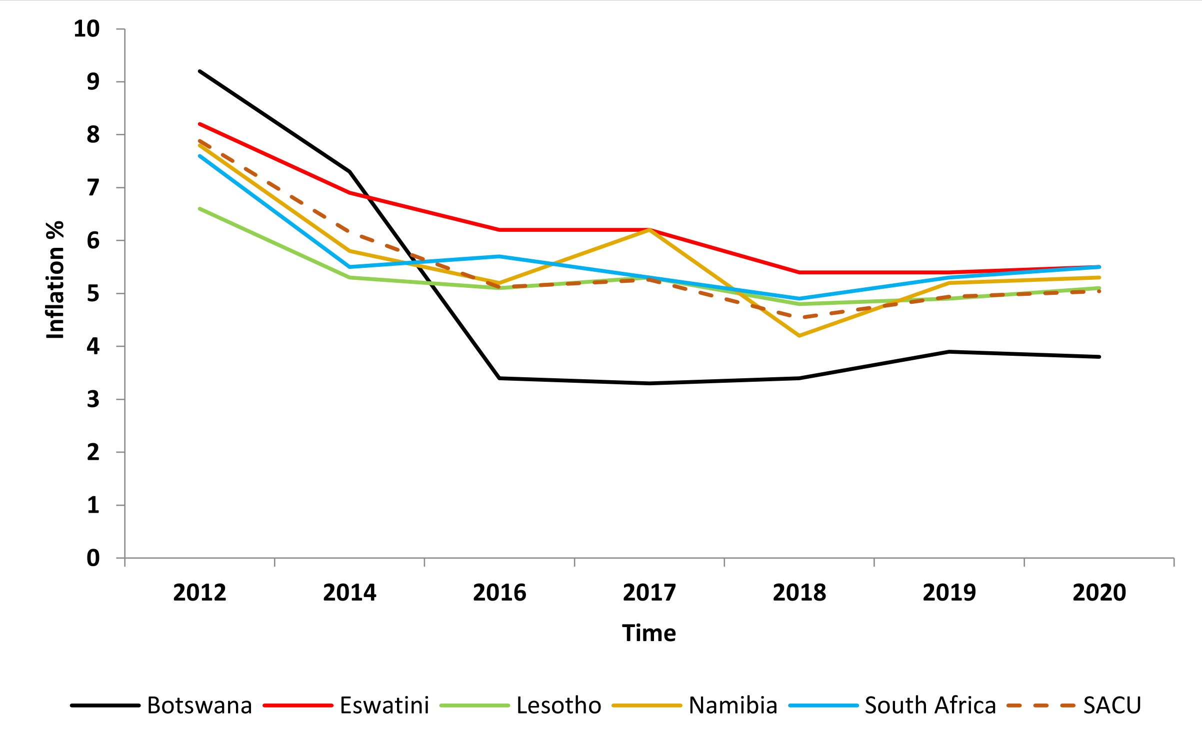


Figure 2. 6: SACU average annual inflation rates (%)

Source: SACU (2018); *World Bank* (2018).

Inflation rates dropped from 9.2 per cent in 2012 to 3.4 per cent in 2016; however, inflation rates were on an upward trajectory between 2017 and early 2019 due to rising prices in food and non-alcoholic beverages (SACU, 2018). Lesotho and Namibia had the joint second lowest inflation rates interchangeably. Lesotho had the lower inflation rates of the two countries between 2012 and 2018, 6.6 per cent compared to 7.8 per cent for Namibia. In 2018, Namibia had the lower rate of the two countries, 4.2 per cent compared 4.8 per cent for Lesotho (World Bank, 2018).

Eswatini had the highest inflation rates between 2014 and the projected 2020 rates. However, the rates were also decreasing, from 8.2 per cent in 2012 to 5.4 per cent in 2019. This was due largely to more stringent monetary policies and increasing agricultural production. South Africa’s inflation rate was the closest to the SACU average, decreasing from 7.6 per cent to 4.9 per cent in 2012 and 2018 respectively. The downward trajectory in the South African economy was also caused by robust growth in the agriculture sector (SACU, 2018).

2.7.3 The Agriculture Sector in the SACU Member States

There are a lot of glaring differences in characteristics between the SACU member states. These differences include: physical and economic size; population; official languages; resource potential; political environment; economic infrastructure; and human capital. There are also a number of similarities; the most obvious being the signatory of the SACU agreement. Another major similarity is the importance of agriculture to the domestic economies of the SACU member states. The agriculture sector is crucial for food and nutritional security, employment, poverty reduction, and foreign exchange earnings in all member states (UN, 2018). The SACU member states agreed to cooperate on agricultural policies in recognition of the importance of agriculture to their individual economies. This agreement is explicitly set out in Article 39 of the 2002 SACU Agreement, and it deals with agricultural policy development (SACU, 2018).

The contribution of agriculture to the Botswana economy has fallen drastically over the years; from 40 per cent at independence to 2.5 per cent in 2019 (see Figure 2.7). This decline in agriculture has contributed mainly to: rapid growth in other sectors; for example, mining, and poor agricultural production and output growth due to unfavourable climatic conditions. This is despite the policies and interventions by government to stimulate agricultural growth (ADB, 2019; World Bank, 2018). Although the economic significance of subsistence agriculture has been declining for a while, it remains important for people in the rural areas. About half of Botswana’s population still resides in rural areas with agriculture as the main source of income. Furthermore, agriculture accounts for about 2 per cent of formal and informal employment. Botswana is a net exporter of beef, exporting some 90 per cent of production to the EU and South Africa. The major subsistence crops are sorghum, maize, beans, groundnuts, and horticultural crops (cabbages, tomatoes, and potatoes). Food security and agricultural development remain high on the government priority list (ADB, 2019; World Bank, 2018).

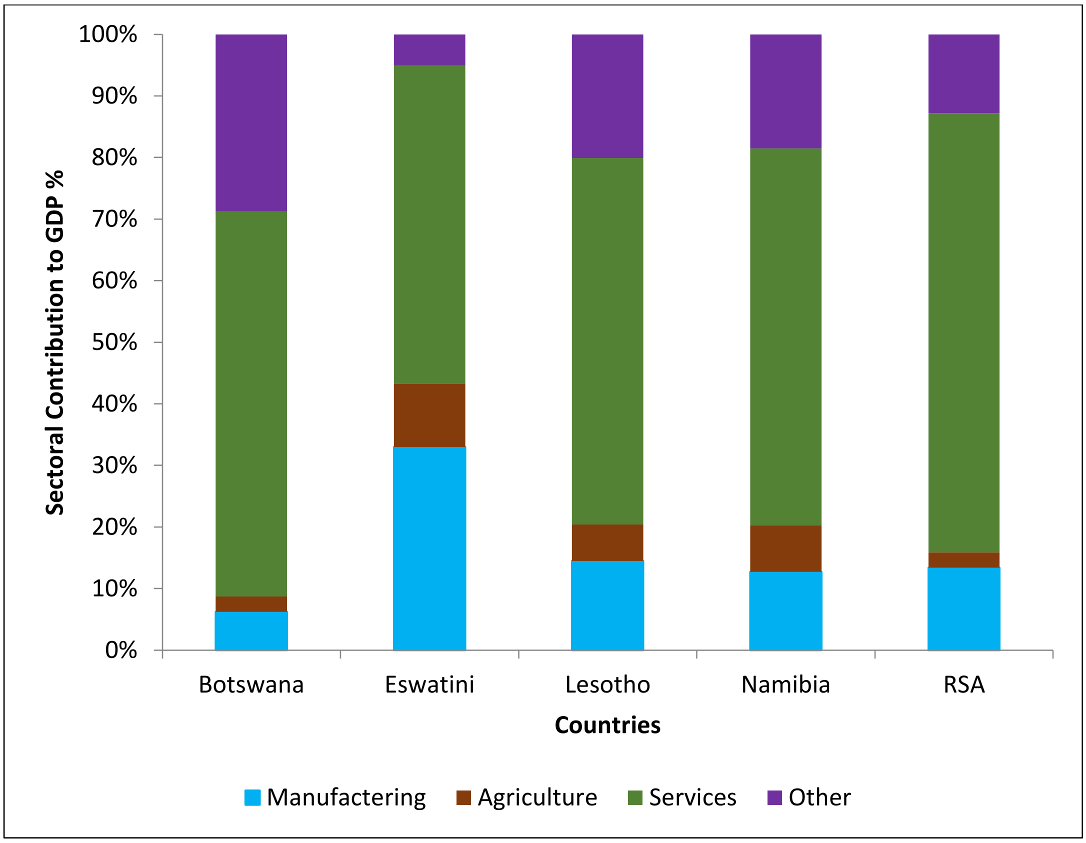


Figure 2. 7: Sectoral contribution to GDP of SACU member states, 2010-18

Source: SACU (2018).

The importance of agriculture in Lesotho's economy is very high, as a majority of Sothos are still dependent on subsistence agriculture. Even though agriculture contributes only 5.9 per cent to the national GDP (Figure 2.7), it is an important source of livelihood for the estimated 80 per cent of the population that live in rural areas. It is also important to the estimated 57.7 per cent that live in abject poverty, and the 60 per cent that is employed in the sector (ADB, 2019). Poverty reduction has been slow ever since the agricultural sector started underperforming following the El-Nino induced drought in 2016. This underlines the importance of agriculture to the Lesotho economy (World Bank, 2018).

In Namibia, adverse weather conditions remain a constant threat to the economic prospects of the poor, whose livelihoods depend on subsistence agriculture. In that regard, food and nutrition insecurity has further exacerbated poverty in the rural parts of Namibia. Agriculture production varies widely in Namibia, depending on climatic conditions, with the sector contributing 7.6 per cent to GDP in 2018 (Figure 2.7). Commercial farming has also shown little growth recently, and subsistence farming now produces about the same value of output (SACU, 2018). Subsistence agriculture consists of rain-fed crops, mainly: sorghum, maize, beans, horticulture crops (pumpkins, groundnuts, and spinach), and extensive livestock grazing on communal land, predominantly in the Northern Communal Areas. Commercial farming focuses mainly on beef production for export to the EU under preferential arrangements (World Bank, 2018).

The growth in the South African economy was mainly driven by agriculture in 2017. Although the sector only accounts for less than 3 per cent of GDP (Figure 2.7), it recovered quickly from the drought of 2015. More than 85 per cent of South Africa's total surface is used for agriculture, which is very diverse due to conditions ranging from temperate to sub-tropical conditions (World Bank, 2018). Agriculture in South Africa is also dualistic; large commercial farms coexist with small-scale subsistence units. There are approximately 50,000 large-scale commercial farmers who provide employment to about 11 per cent of the total formal sector employment. More than half of South Africa's provinces, and about 40 per cent of the population, are dependent on agriculture and related activities (SACU, 2018; World Bank, 2018).

The agriculture sector in Eswatini experienced recovery from the 2015 drought and expanded by 0.5 per cent in 2017. This recovery was particularly driven by growth in sugarcane production. The contribution of the agriculture sector to the GDP stood at 10.2 per cent in 2018 (see Table 2.2) (World Bank, 2018). The livelihood and economic prospects of the poor involved in subsistence farming are dependent on typically adverse weather conditions. The agriculture sector in Eswatini is highly dualistic. There is a commercial, export-oriented wing which earns much needed foreign exchange for the country, and also the informal or subsistence wing which feeds the masses. Commercial agriculture focuses more on sugarcane, meat, dairy products and citrus fruits, while the subsistence sector is devoted mainly to the production of food crops: maize, beans, vegetables, as well as cattle (largely regarded as a store of value, with little commercial significance) (World Bank, 2018).

2.8 SUMMARY

The lack of consensus on how countries could make the transition from tariff and non-tariff restrictions to free trade is a source of great debate in international trade. Therefore, any study on regional economic integration needs to be fully embedded on the foundations and objectives of the GATT and the WTO. This chapter traces the origins of international trade, from the period just after the WWII to the present day, that is, from the inception of the GATT in 1947, to the founding of the WTO in 1995, and to the proliferation of regional trade agreements. This was done in order to present a solid case of how trade has progressed form its origins, and whether it has stayed true to its original objectives. In keeping in line with developments in the trade literature, this chapter discussed the different forms of RTAs, with the view of drawing parallels between them. The chapter also discussed the dynamics of RTAs in world trade and particularly in Southern Africa. The differences between the three classes of regional trade agreements NN, NS and SS were presented and discussed. NN trade had the highest levels of intra-bloc trade followed by NS and lastly SS, as expected. SACU was also studied in great detail.

CHAPTER 3

THE ECONOMICS OF RISK

3.1 INTRODUCTION

Risk is part of everyday life and, thus, its importance and influence on decision making cannot be over emphasized. Its significance is more pronounced in firms and other economic units where decisions, that have a bearing on the productivity and profitability of the unit, have to be made. Risk is also more important in the context of developing countries, where resources are scarce. Such resources determine how quickly a country recovers from shock or crisis. Chavas (2004) argued that risk was everywhere as no decision – economic or otherwise – could ever be made with absolute certainty. This means that, farmers face risk on their farms; manufacturers face risk in their plants; consumers face risk in their households; and traders face risk in their domestic and cross-border transactions.

Risk has always been a feature in world trade to the extent that a lot of work has gone into making the trade environment as conducive as possible for all players in the trade arena. International trade has seen major changes over the years. These include: the formalisation of trade after the economic turmoil of World War II, through the GATT; the founding of the WTO; and the introduction of sanitary and phytosanitary (SPS) measures. For the most part, these changes can be viewed as risk mitigation initiatives by the international trading community (Dutt, Mihov, & Van Zandt, 2013; Irwin, 2008; Dunn & Mutti, 2004). These changes have been, to some extent, necessitated by globalisation.

Globalisation has, for the most part, been driven by breakthroughs in areas like transport and communication, which has countered the effect of natural trade barriers like distance. This means the world is more connected than ever and, as such, exposes trading economies to risks inherent in the economies of trading partners (Haskel *et al*., 2012). In an increasingly interdependent and connected world, one nation’s failure to adequately address some risk it is facing in the domestic economy can have a ripple effect on the economies of other countries. Therefore, countries and their trading partners are vulnerable to systemic shocks, catastrophic events, and their accompanying effects (WEF, 2013). In this chapter, risk is discussed in detail and contextualised in regional economic integration. The next section presents different types of risk which are inherent in the economies of regional economic integration players.

3.2 RISK, UNCERTAINTY AND RESILIENCE

Risk has been extensively studied in different contexts, and each context presents a different dimension and distinctive focus (Azis, 2016; Foa, 2014; Gupta, 2014; Kucheryavyy, 2014; World Development Report, 2014; WEF, 2013; Anderson & Felici, 2012; Jovanovic *et al*., 2012; Kaplan & Mikes, 2012; Timurlenk & Kaptan, 2012; Baas, 2010; EconomyWatch, 2010; Oh & Reuveny, 2010; Pritchard, 2010; Moschini & Hennessey, 2001). According to Anderson and Felici (2012), academic work on risk is often either retrospective looking at a particular incident or abstract, considering general properties of the phenomenon. This study follows the former, in that it seeks to explain the low trade volumes and lack of growth in SACU bilateral trade flows, by bringing in the risk inherent in the members' economies, as a possible reason.

All business transactions and business decisions involve some degree of risk. Lack of internal security; rule of law and stability; inability to enforce contracts; high poverty and inflation are some of the indicators of the indicators of increased risk (Romilly, 2007). Business transactions that occur across international borders carry additional risks not present in domestic transactions. These additional risks typically include risks arising from a variety of national differences in economic structures, policies, socio-political institutions, geography, and currencies. Although uncertainty and risk are ever-present in every sphere of human life, in agriculture and (consequently trade), they particularly constitute an essential feature in the production environment, and arguably warrant a detailed analysis (Moschini & Hennessey, 2001).

3.2.1 Definitions of risk, uncertainty and resilience

Risk is understood to have two distinct meanings. It is understood to mean hazard or danger, that is, some form of exposure to peril. In the other context, it is understood to refer to the probability of suffering an adverse consequence, or of encountering some kind of loss (Adams, 2002). Risk can be generally defined as the potential for experiencing harm; more specifically, it represents the likelihood that a particular situation will lead to adverse effects which are caused by an activity, event or technology (Jovanovic *et al*., 2012). Jovanovic *et al*., (2012) noted that the causal chain is not always one-directional. They argued that the risk agent (hazard) usually impacts on an object which is of value to society. This initiates a chain of events with the impacted risk object causing further risk to other objects, or even to the source of the risk.

Kay *et al*. (2011) provided probably the most complete definition. They defined risk as a situation where there is possibility of loss; volatility of returns; and a situation where there are multiple possible outcomes (with known probabilities), but the ultimate outcome is not known. In such situations, there usually exists more than one possible outcome; some of which may be unfavorable. Usually the variance (standard deviation) is used as a measure of risk by investment analysts and portfolio managers. Uncertainty on the other hand, is when neither the possible outcomes nor probabilities are known. It is usually assumed or estimated with the awareness that there still exists uncertainty in the estimation of those probabilities (Kay *et al*., 2011). Similarly, Rothstein *et al*. (2006) allude to the fact that risk is ideally conceived as a concern both with potential impact (both positive and negative) and the probability of impacts occurring.

According to Robinson *et al*. (2007), risk means different things, to different people, at different times. However, they observed that one element that is common to all concepts of risk is the notion of uncertainty. Valsamakis *et al*. (2000) alluded to the fact that it is difficult to define risk in a universally accepted manner due to the diverse contexts in which risk can be viewed. They noted that this gave rise to interpretations and definitions that are discipline specific. People have generally become aware of the fact that future events cannot be determined with certainty.

Therefore, understanding the notion of risk is still an on-going process (Gupta, 2014). The lack of a universal definition for risk can be an obstacle in understanding the concept. Risk and uncertainty have been handled simultaneously in the literature because, according to Robinson *et al*. (2007), it is not possible to deal with one and not touch on the other. This is no more apparent than in the definition by Luckmann (2015), where risk is defined as the effect of uncertainty on an objective. It is often characterised by reference to potential events and consequences or a combination of these. It is often expressed in terms of a combination of these consequences of an event (including changes in circumstances), and the associated likelihood of occurrence. Uncertainty, on the other hand, is the state, even partial, of deficiency of information related to: understanding or knowledge of an event, its consequence, or likelihood. However, before risk can be managed or controlled, it is important to know its nature, likelihood of occurrence, and its magnitude or severity if it does occur (Luckmann, 2015; DEAT, 2014).

According to Hardaker *et al*. (2004), risk can be defined in many ways. One common distinction is to suggest that risk is imperfect knowledge, where the probabilities of the possible outcomes are known. However, these authors argue that: this is not a very useful definition because cases where probabilities are known are rare. They then present another definition where risk is defined as: uncertain consequences. This is a more useful definition as it not only presents the multiple consequences, but also shows that one of them is desired. Risk is not a value-free statement because there is usually some aversion attached to the different consequences.

In a similar vein, Chavas (2004) also defined risk as representing any situation where some events are not known with certainty. This means a risky event is not known, for sure, ahead of time. He noted that this reveals the basic characteristics of risk. Firstly, it rules out sure events, and secondly, it suggests that time is a fundamental characteristic of risk. Valsamakis *et al*. (2000) recommended a definition which they argued was more rigorous, built on earlier definitions, and added clarity to the more contemporary definitions and interpretations. These authors defined risk as the variation of the actual outcome from the expected outcome. Gupta (2014) argued that the uncertainty of future events is not a definition of risk, but could function as a workable definition.

It may also be defined as an uncertain event or condition that, if it occurs, can cause a significant negative impact which could last for a number of years (WEF, 2013). According to Aimin (2010), risk and uncertainty are basic components to any decision-making framework. It can be defined as a situation where there is imperfect knowledge and the probabilities of the possible outcomes are known. Uncertainty on the other hand, exists when the probabilities are not known. International trade is one of the areas where risk and uncertainty are important. For traders, risk management involves finding the best combination of goods and services to trade. These goods and services are produced under risky conditions, with uncertain outcomes and varying levels of expected returns. However, this study deals predominantly with risk.

According to the WEF (2013), it is inconceivable to discuss risk under any discipline and not touch on resilience. The fundamental emphasis on the concept of resilience is how a system, community or individual can deal with any form of disturbance. This concept is framing current thinking about sustainable futures in an environment of growing risk and uncertainty. Resilience is defined as the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a shock or stress in a timely and efficient manner (WEF, 2013; Mitchell & Harris, 2012). Manyena *et al*. (2011) posited that resilience should be viewed as the ability to "bounce forward" and "move on" following a disaster. However, it is prudent to make a distinction between resilience and vulnerability paradigms, which, notwithstanding their conceptual differences, are still treated as one. Vulnerability and resilience are assumed to lie on the same continuum but on the opposite poles, with vulnerability being negative and resilience being positive.

The majority of approaches, tools, and methods currently available to measure resilience reflect strongly the diversity of disciplines that have appropriated the term. The major multidisciplinary measures of resilience focus on assessing such elements as technological capacity; skills and education levels; economic status and growth prospects; the quality of environment and natural resource management institutions; livelihood assets; political structures and processes; infrastructure; flows of knowledge and information; and the speed and breadth of innovation (Mitchell & Harris, 2012).

3.2.2 Understanding Risk

The history of risk started with a Hindu-Arabic numbering system at the beginning of the 13th century, and can be described as the root of the modern conception of risk, as it is known today (Luckmann, 2015). The first study of risk was during the renaissance period, when new discoveries were made. Risk professionals have acknowledged the existence of risk drivers (positive and negative) which influence the outcome of risk events. After an in-depth analysis of the behaviour of these drivers, it was concluded that there are two types of outcomes, namely, the harmful and the beneficial effects. These forces, detrimentors (negative risk drivers) and the propitious attractors (positive risk drivers), have to be considered during risk management process because of, their influence and their opposing characteristics. As shown in Figure 3.1, risk has a cause which may be negative or positive, and a related negative or positive impact. The negative or positive cause has underlying factors called threat drivers and propitious factors respectively (Luckmann, 2015).

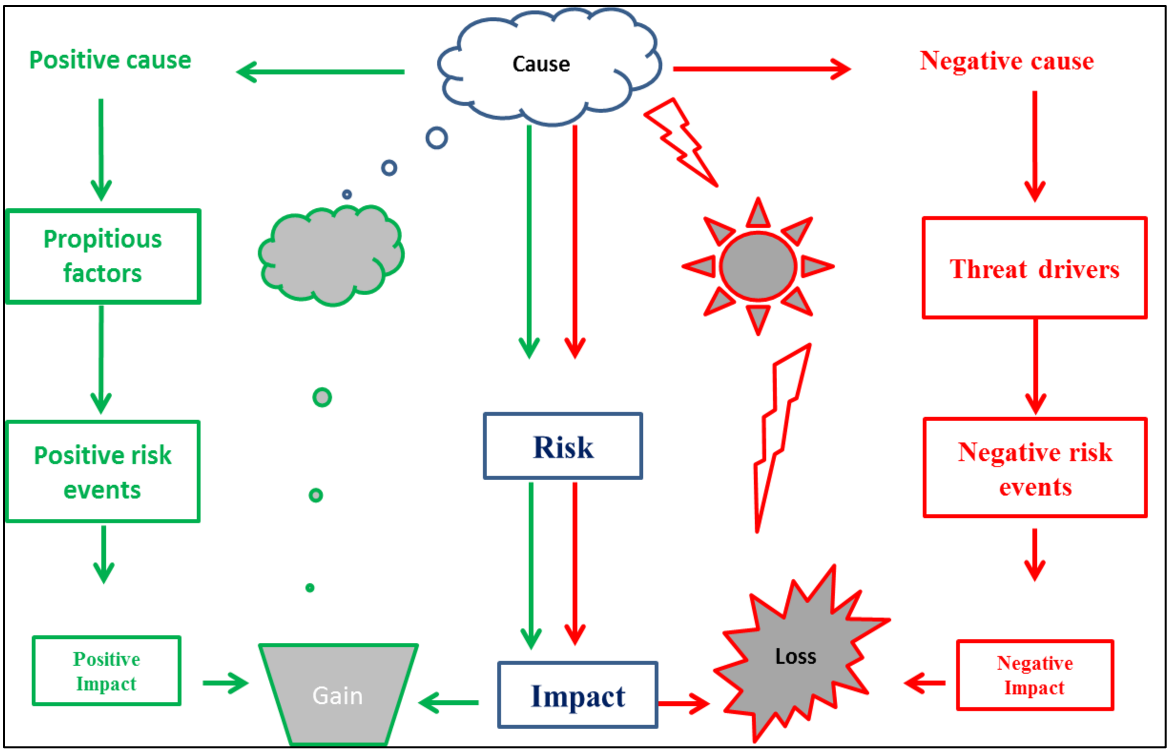


Figure 3. 1: Understanding risk

Source: Adapted from Luckmann (2015).

3.2.3 Types of Risk

Risk is generally divided into two broad types: *pure* or *downside* risk and *speculative* or *upside* risk. The distinction is on the effect of the possible consequences and the assumptions on which decisions are based. If the likely consequences of an event are considered to be bad, offering no prospect of a gain, it is regarded as pure risk (Robinson *et al*., 2007). Gupta (2014) defined *pure* risk as variability quantified in terms of probabilities that can result in realisation of losses; for example, death of livestock due to drought. The possible events that downside risk poses are treated as hazards, that is, a risk of loss. Pure risk has a negative cause as shown in Figure 3.1. These negative risk events have a negative impact and lead to losses. Drought is a good example of a negative risk event. It may be due to climatic change, which in turn may be a result of pollution. Drought leads to water shortage which may cause losses in agricultural enterprises.

*R*isk is defined as variability quantified in terms of probabilities that can either result in realisation of both gains and losses; for example, a firm launching a new product can either realise increased sales or decreasing demand. If, on the other hand, the possible consequences of a risky event are considered potentially desirable, then that situation is termed speculative risk. Events posed by speculative risk are treated as value added, that is, an opportunity for gain (Robinson *et al*., 2007). It has a positive cause as shown in Figure 3.1. Favourable factors are responsible for such events which are viewed as opportunities, and have positive risk events as outcomes. These positive risk events have a positive impact and lead to gains. Changes in consumer behaviour may lead to increased demand for a firm's goods.

Management of risk in any context requires an understanding of the sources of the risk, and according Kaplan and Mikes (2012), these sources can be grouped into two categories, namely: exogenous and endogenous:

i. *Exogenous risk* emanates from factors which are outside the system under review. These types of risks feed into the system, and they are outside the control of the system; for example, world prices and natural disasters.

ii. *Endogenous risk* emanates from shocks within the system. These risks are inherent in the system and they are within the control of the system. Examples of these include:

corruption and pollution, poverty, crime etc. This category also includes strategic risks which differ from other risks in this category because they are not inherently undesirable.

This study adopted the definition of risk provided by Kay *et al*. (2011) because it is broad in the sense that it accommodates different potential sources, types, and impacts of risk. The definition addresses the possibility of loss, volatility of returns, multiple possible outcomes (which may be favourable or otherwise). This study; therefore, deals with the type of risk which is disruptive to the economy, that is, pure or downside risk. Such risks can either be endogenous or exogenous.

3.2.4 Risk categories

The classification of risk into different categories ideally starts with what is called country risk, which is defined as the risk associated with those factors which determine or affect a country's ability or willingness to meet its financial obligations (Timurlenk & Kaptan, 2012). According to Meldrum (2000), country risk analysis rests on the fundamental basis that growing differences in economic, social, environmental technological or political factors increase the risk of a shortfall in the expected return on an investment. Such differences, in a specific risk factor, map to one or more risk categories. The WEF (2013) classifies risks into five broad categories: economic, environmental, geopolitical, societal and technological risks. Risks are classified based on their global geographic scope; cross-industry relevance; uncertainty as to how and when they may occur; and high levels of economic and social impact.

3.2.4.1 Economic Risks

The economic risk category that encompasses the types of risk which constitute significant concerns in the aggregate economy. These are economy-wide concerns in financial and price systems; production and employment.

Examples of these concerns include: price fluctuations, high inflation, and negative or very low economic growth. These risky events have a negative impact not only on the domestic market but also on the market of the trade bloc. According to Meldrum (2000), economic risk is the substantial change in the economic structure of a country which leads to major changes in the expected return of investments made in that particular country. This type of risk arises due to poor fiscal and monetary policies or significant changes in a country's comparative advantage.

Economic risk is measured using traditional measures of fiscal and monetary policy. These include the size and composition of government expenditure; tax policy; country debt; monetary policy; and financial maturity. For longer-term investments, measures focus on long-run growth factors; the degree of openness of the economy; and institutional factors that might affect wealth creation (Meldrum, 2000). An increase in the level of economic risks may have a negative impact on bilateral trade, and a stagnant economy can have a negative effect on trade in a number of ways. Firstly, firms in the domestic economy need capital to make investments in the production of goods and services. Without such capital investments, they are not able to produce enough goods for domestic consumption and export. As a result of the fall in production, the country has to rely on imports from the international markets.

However, given depressed economic climates (like the one experienced in 2008), they might not have the funds to procure goods from trade partners. The high prices of goods in the domestic market may mean that firms are unable to procure production inputs, and consumers unable to meet their consumption requirements. A high probability of a shortfall of the trade balance, worsens the domestic and trade economy. This has consequences for real income due to reduced production capacity. Private spending, investments, and tax revenues may decline, which reduces public spending. The decline in aggregate demand and supply may reduce trade flows since domestic importers and exporters may not be able to consume or produce the required levels of goods (Oh & Reuveny, 2010).

3.2.4.2 Environmental Risks

The environmental risk category deals with risks of high concern and impact from the physical environment. These include but are not limited to, natural disasters such as extreme weather patterns; for example, droughts, floods, and other man-made disasters like pollution of fresh water sources. These risks have both domestic and cross-border consequences. In the event they occur in high production areas, they could potentially reduce the amount of goods produced and traded. This is a relatively new development in the risk literature. It is traditionally reserved for such incidents as oil spills, earthquakes, and other natural disasters. However, according to Romilly (2007), the recent environmental risk form, discussed in the risk literature, is distinguished from the usual natural catastrophes. This author notes that, this form of environmental risk is related to weather, and its increased importance has seen the establishment of a fast-growing weather derivative market. The World Bank (2010) characterises rainfall variability and increased temperatures as climate related risks.

Environmental factors play an important role in the production process. They affect the availability or the lack thereof of natural production inputs. This means that, poor quality or unavailable environmental factors affect the supply side of the market negatively (FAO, 2012). With most of the food production initiatives in developing countries greatly reliant on rainfall, it is logical to assume that erratic weather patterns will greatly influence production well into the future. From a trade perspective, this means food imports will increase drastically in the developing world, as a consequence of climate change. However, in the short and medium term, more resilient countries in the developing world might experience increases in food exports to less resilient trade partners.

Concerns over rising temperatures (which are partly due to human activity), have had an impact on business activities as the effect of climate-related disasters increase. This has seen the ratification of the Paris Agreement by 175 countries to counter the effects of climate change (UN, 2019). These disasters include: drought (such as the El Nino- induced one experienced in Southern Africa in 2015); floods (for example, Cyclone Idai and Kenneth in South Eastern Africa in 2019); desertification; and mass economic exodus from severely affected areas (Romilly, 2007).

Natural disasters have created mounting pressures on agro-economic systems, and affected upstream economic activities for example, less purchasing power, and increased debt service costs for farming enterprises. In rural communities, the effects of these disasters are direct and immediate. Examples of this include loss of: life, portable water, livestock, and crops. Cases of significant development setbacks have been reported as consequences of environmental risks. Drought is primarily the most important form of environmental risk in rain-fed agriculture. It contributes to 83 per cent of all the risks in sub-Saharan African agriculture, and brings about 40 per cent of economic damages to smallholder farmers in the region (Baudoin *et al*., 2017; Burke *et al*., 2010).

3.2.4.3 Social Risks

Rothstein *et al*. (2006) define social risks as threats posed to members of society by the environment. These societal risks may be due to society's inability of cope with the pressures of the different aspects posed by the external environment. Connected to societal risks are institutional risks, which these authors defined as: risks to organizations (state or non-state) regulating and managing social risks and risks to the legitimacy of their associated rules and methods.

According to Holzmann *et al*. (2003), there is a strong need to address the increased social risks, resulting from globalisation, in an equitable but efficient manner. A number of developing countries are poised to reap the benefits of a globalised trade system. However, there are concerns as to whether or not these improvements will be shared equally among individuals, households, ethnic groups, and communities. Expanded trade has the potential of widening the differences between the rich and poor. It can also increase the vulnerability of major groups in the population which are unable to keep up with and participate in the new trade systems. Trade may also make it difficult for developing countries to pursue independent economic policies tailored to address the plight of the poor, thereby exacerbating marginalisation and social exclusion of the poor.

A decline in the levels of socio-economic factors has the potential of decreasing not only consumption levels, but also the level of trade between trade partners. A domestic economy characterised by high poverty and unemployment rates means a lack of effective demand for both domestic and international goods. Poor households, generally, have fewer assets and may be unable to smooth over even short spells of unemployment. This means, in the event the domestic economy is unable to provide sustainable employment, the consumption levels of the poor will decrease (FAO, 2012; Winters, 2002). This decline in socio-economic factors is responsible for the more than 10 per cent of the world population which still lives in extreme poverty, and is struggling to fulfill even the most basic of needs. The majority of people living in absolute poverty, that is, on less than $1.90 a day, live in sub-Saharan Africa. It would seem even having a job does not guarantee a decent living for the poorest of the poor. As such, about 8 per cent of employed workers and their families worldwide still live in extreme poverty. This situation compromises the global initiative to end poverty in all its forms as outlined in the first of the 17 sustainable goals (United Nations, 2019).

3.2.4.4 Technological Risks

"The technological risk category addresses risks that are of greatest concern in the areas of current and emerging technology. Technological risks include; amongst other technological threats, cyber systems failure and attacks" (WEF, 2012, p. 44). With the level of technology in global economic transactions showing no signs of slowing down, this category poses, arguably, the greatest threat to international trade. The contribution of technology in international trade has been massive in recent times. In an era where emerging technologies have an impact on both what is traded and how, advancements in technology have introduced a different dimension of risk. Examples of technological risks include: poor infrastructure, lack of adequate security in electronic transactions, and outdated technology. These are particularly prevalent in developing countries where technological developments are not at the required level. This may disrupt daily business transactions and, ultimately, international trade as a whole (Anderson, & Felici, 2012; Levinson, 2009).

An investment in infrastructure is said to be crucial in achieving sustainable development and empowering communities. It has been recognised that growth in productivity and incomes; improvements in health and education outcomes require investment in infrastructure (UN, 2019). Differences in the quality of infrastructure may account for differences in transport costs and, hence, variations in competitiveness.

Better transport services and infrastructure improve international market access and increase trade (Bougheas *et al*., 1999). This, therefore, means that technological factors have a direct impact on trade costs, and as such, there is a positive relationship between the state of technology and trade volumes. Poor quality infrastructure, that is, road, rail, and telephone networks, hinders the transportation of goods to and from markets. Coulibaly and Fontagne (2009) found that unpaved roads and poor telephone networks stifled trade. Good quality infrastructure can, therefore, be thought of as a cost-reducing technology as it gives such countries a competitive advantage in trade. Lower costs, in these avenues, mean domestic producers can source and move inputs easier than competitors and, therefore, increase their production and exports. Consumers are able to consume a wider variety of goods and services at competitive prices.

3.2.4.5 Political Risks

The geopolitical category addresses risks that are of greatest concern in the areas of politics, diplomacy, conflict, crime and governance on a global scale. Geopolitical risks are global risks of humanity's own making. The threats of geopolitical risks range from undermining socioeconomic progress to annihilating society and earth's resources (WEF, 2012). According to Brink (2004), the study and analysis of political risk is a highly fascinating and interesting phenomenon, and there is a great challenge in keeping up with its ever expanding nature. Therefore, in studying the risks to willingness to repay debts, one would focus on political factors (government's political legitimacy), and strategic factors (regional stability) (Solberg, 1992).

Keillor *et al*. (2005) share a similar view; they argue that one of the most intriguing and resilient areas of international business research is that which addresses the impact of political risk on the business environment, and the various means by which firms attempt to deal with this risk. Political risk can be broadly defined to include: internal or external conflict; religious and ethnic tension; political instability; weak rule of law; civic disorder; low level of democracy; public and private sector corruption; socioeconomic conditions that promote public discontent; inhospitable investment climate; and incapable bureaucracy (Oh & Reuveny, 2010).

Political risk involves risks due to changes in political institutions which stem from a change in government control, social fabric, or other noneconomic factors. Primarily, political risk covers the potential for internal and external strife; and expropriation risk. Risk assessment requires analysis of many factors which include: the relations of various groups in a country; government's decision-making mechanisms; as well as the history of the country (Meldrum, 2000). Both economic risk and political risk often overlap in some measurement systems since they are concerned with policy.

3.2.5 Impacts of risk

The impact of different forms of risk on production includes: erratic weather conditions, increased incidence of pests and diseases, and market price fluctuations. Borrowing money can also be risky in the face of sudden changes in interest rates. Risk may also occur as a result of changes in government policies. Such policies may have a bearing on the business environment in terms of ease of doing business and government spending. These risks often have a major impact on the production endeavours of domestic producers and, ultimately, affect trade. A critical aspect of most of these risks is that they involve both an element of chance and choice. This means that, to a large extent, risk is a result of a spectrum of factors which a particular country does not have any control over; stretching to those over which it has total control.

Different individuals, households and communities have different capacities of dealing with risk, that is, different levels of resilience. In order to come up with appropriate mitigation strategies, it is important to understand the characteristics of the risk – source, type, impact, correlation, frequency, and intensity – as shown in Figure 3.2.

The sources of risk may be natural (flooding, earthquake), or the result of human activity (global warming, inflation). They can be uncorrelated (idiosyncratic) or correlated (covariant); and they may be low or high frequency. There may also be negative or positive overall welfare effects (Holzmann *et al*., 2003). An ideal situation, therefore, would be one where risk is not a frequent feature, has low impact and intensity, and is generally positive. While the impact of risk on humanity may be deemed to be negative, the impact of risk on trade may vary across time and space. It can principally affect trade in one of two ways: positively (by increasing trade), or negatively (by decreasing trade) (Oh & Reuveny, 2010).

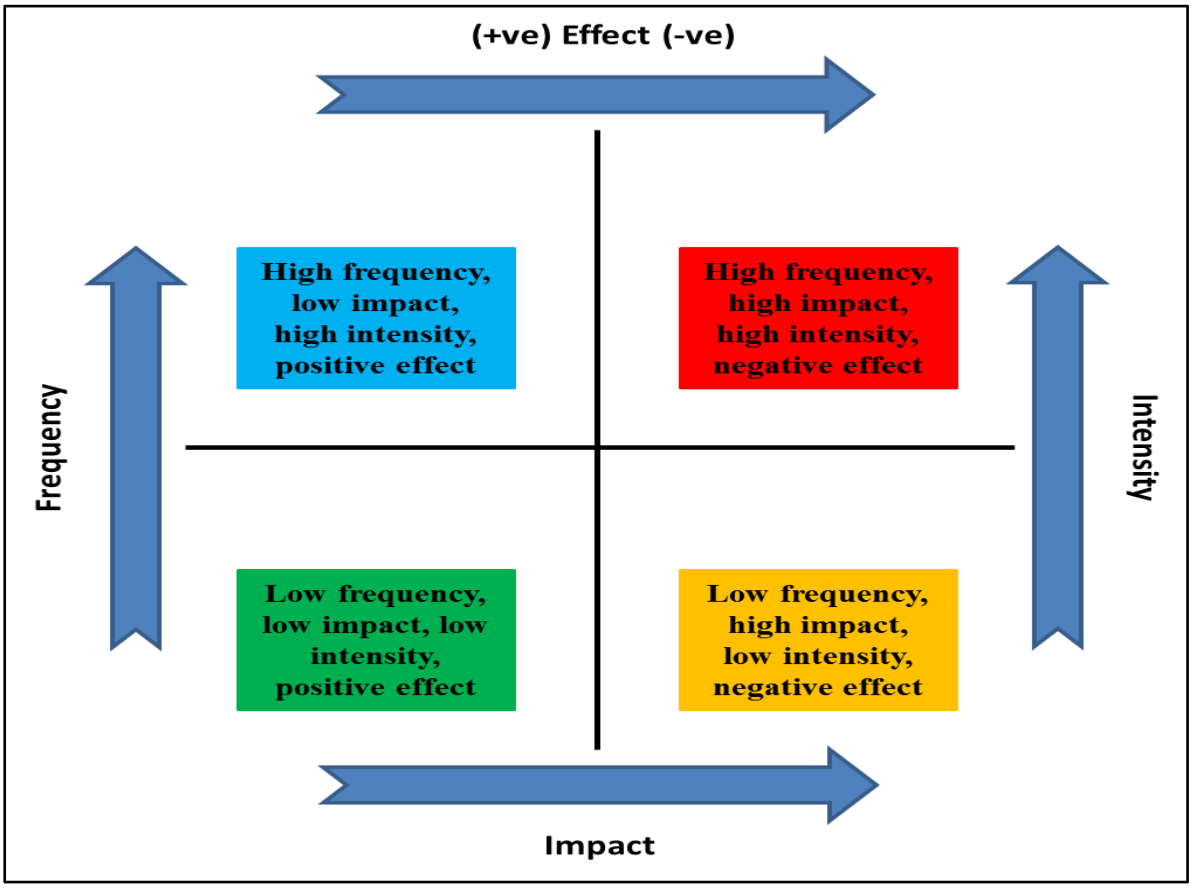


Figure 3. 2: Characteristics of risk

Author's own illustration.

3.2.5.1 Positive effects

An increase in risk (economic, political, societal, technological and environmental) may lead to an increase in bilateral trade (Oh & Reuveny, 2010) in two ways:

i. It may increase the domestic demand for imports produced under less risky conditions, assuming these imports and domestically produced goods are substitutes.

Economic downturns, poverty, and unfavourable weather patterns may, for example, decrease the productivity of factors of production; reducing the volume of domestic production, leading to an increase in the demand for imports.

ii. Increasing costs of production in the domestic market may cause some domestic producers to exit the market as the risk increases. However, there is a possibility that foreign suppliers may replace them in response to the possibility of making abnormal profits. This is when principles of comparative advantage set in.

3.2.5.2 Negative effects

An increase in the level of any of these risk factors; a decline in the quality of institutions, for example, high incidents of corruption; decreasing SACU revenues; and drought, has the potential to increase the risks a country is exposed to, and ultimately decrease trade (Oh & Reuveny, 2010).

i. This could be through reduced production capacity, damaged goods, and delayed distribution due to neglecting maintenance of damaged transportation and other logistical infrastructure. The main consequence of this is: overall higher costs for suppliers as they have to source inputs from alternative sources using longer routes; paying higher insurance premiums; and using more costly security to cover risks.

ii. Suppliers may fear that trade contracts may not be honoured due to financial constraints following economic downturns, and that extreme weather patterns may compromise productivity of land or make distribution routes inaccessible. At the extreme, formal trade ties may be terminated altogether.

In an attempt to fully capture the impact of risk, this study takes a pessimist view of risk, that is, only deal with pure or downside risk (risks with a negative effect) in the following categories: economic, societal, environmental, and technological. Due to the paucity of data and the fact that it is nearly impossible to access formal data sources (due to its sensitive nature) to verify consequences, the geopolitical risk will not be included in the empirical analysis.

3.2.6 Risk factors and indicators

According to the World Trade Report (WTR) (2013), there are fundamental economic factors which are used by proponents of trade theories to explain international trade and the evolution of trade patterns. The traditional trade theory postulates that: differences in technology (labour productivity) between countries determine comparative advantage. The Heckscher-Ohlin model, on the other hand, postulates that: it is rather relative factor endowments (labour, capital and natural resources) that shape trade patterns. The new trade theory predicts that countries with larger economies, as a result of growth in endowments and incomes, will develop an export edge in those goods consumed in relatively greater quantities in the domestic market (Ossa, 2011). There are numerous factors identified in the economic literature as having an impact on international trade. These include: population dynamics, inflation, technology, national income, investment, energy, institutional framework, and transportation costs. Others include: technical and non-technical trade barriers, exchange rate, relative prices, and economic size and openness (WTR, 2013).

However, the importance and relevance of these factors differ in scope across the global trade arena. Therefore, this study identifies and uses only those factors which are deemed most relevant to the SACU trade bloc realm. These indicators were chosen because they satisfy the three basic requirements of indicators, namely: the research role (describe a system such that it is understood in terms of how it works and how it may be improved); the performance role (monitoring whether a system works according to set standards); and the accountability role (does it allow for the system to be fully scrutinised) (Pencheon, 2008).

The WEF classifies global risks into 5 different categories: economic, social, technological, environmental and political. This risk classification system is used as the first vetting criteria, in this study. The risk indicators are, therefore, chosen because they are fundamental trade shifters across the four risk categories. The risk indicators are economic growth and inflation in the economic dimension; and poverty and unemployment under the social dimension. In the environmental dimension, the selected trade shifters are rainfall and temperature, while road and telephone networks are the chosen shifters in the technological dimension.

When dealing with indicators, one approach is to select a list of indicators to represent aspects of the phenomena of interest (risk in this case) which are deemed to be appropriate. The level and direction of change of each indicator is observed in order to obtain an overall picture of progress (or regress) across the different dimensions of the phenomena of interest. There is a compromise that has to be reached between completeness and availability, that is, the aim is to provide an accessible and manageable amount of information without overly simplifying the issues (Scrivens & Iasiello, 2010). It is because of such a compromise that the choice of indicator(s) is just as important as the reliability of the source. Given the fact that indicators have both supporters and critics, it is imperative to exercise caution when using them, as we must accurately indicate the purpose for their use.

According to Oh and Reuveny (2010), risk is one of the most important impediments to trade due to its ripple effects. However, as far as it could be determined, the ripple effects of risk have not been explored from a SS trade bloc perspective. This thesis, therefore, is a novel attempt at exploring the dynamics of bilateral trade and risk in such a setting. It addresses the impact of various forms of risk on regional economic integration, and makes a contribution to the body of knowledge by empirically studying the impact of risk on trade in a SS RTA setting.

3.3 TRADE – RISK INTERPLAY

Oh and Reuveny (2010) came closest to addressing the ripple effects of risk on trade. They analysed the effect of climatic disasters and political risk (environmental and political risk) on trade using aggregated data, that is, total trade. They found that an increase in environmental or political risk, for either the importing or exporting countries, reduced their bilateral trade volume. They also found that countries with a lower political risk experienced a smaller decrease in their trade flows when hit by more disasters. Countries hit by more disasters experienced an increasingly larger decline in their trade in the midst of political unrest.

Long (2008) examined the influence of armed conflict on bilateral trade in an unspecified number of bilateral trade partners. Relying on the rational-expectations hypothesis, he argued that one should anticipate decreases in trade from both actual conflict and expectations of conflict. Long (2008) found that both domestic and international conflict affected bilateral trade. Bayer and Rupert (2004) found similar results. They further argued that it was unreasonable to expect the same effect across all countries in the system, as conflict could also lead to increased trade. Li and Sacko (2000) offered a theory that resolved the puzzling inconsistent findings and competing theoretical explanations regarding the effects of armed conflict on bilateral trade flows. They argued that conflict reduced trade depending on firms' expectations of the risks associated with the onset, duration, and severity of the conflict. When such expected risks were high, conflict suppressed trade. Keshk *et al*. (2010) alluded to the inconsistency in the findings relating to conflict and trade, but they argued that there was conclusive evidence that conflict reduced trade.

Owing to the increased incidents of terrorism in recent times, a lot of research has recently been done to determine the effect of terrorism on trade (Abadie & Gardeazabal, 2008; Mirza & Verdier, 2008; Nitsch & Schumacher, 2004). The general conclusion was that: terrorism decreased bilateral trade flows even though the effect on average seems to be quite modest. Bougheas *et al*. (1999) noted that the gravity model only uses distance to model transport costs. They presented a theoretical model which shows that transport costs are not only a function of distance, but also of the availability of public infrastructure. They augment the gravity model with variables which capture the effect of public infrastructure on trade.

They argue that infrastructure is positively correlated with trade since higher levels of public infrastructure lowers transport costs. According to Anderson and Marcouiller (2002), there is abundant evidence which suggests that transactions costs associated with insecure exchange (risk) significantly impede international trade. They argued that predation by corrupt officials generates a price mark-up (insurance premiums) equivalent to a hidden tax. These price mark-ups significantly constrain trade where legal systems poorly enforce commercial contracts, and where economic policy lacks transparency and impartiality.

Most of these studies used a gravity model framework and this study employs the same model of analysis, as it has a proven track record in estimating bilateral trade flows (Anderson, 2011; Medvedev, 2010; Martinez-Zarzoso *et al*., 2009; Baier & Bergstrand, 2007; Anderson & Marcouiller, 2002). They analyzed the effect of one type of risk factor on trade, political, technological, and environmental risk (in isolation). Their political risk factor was political instability or terrorism, and their environmental risk factor was natural disasters. The conclusion from all these studies was that: the different risky events were negatively correlated with trade volumes.

There is, however, still a need to investigate the ripple effect of risk on bilateral trade. This is because risky events do not occur in isolation. The occurrence and impact of one risky event may depend on the occurrence and marginal impact of another risky event. It may also lead to the occurrence of other risky event(s) (Oh & Reuveny, 2010). This interrelatedness means, there is a need for a new approach to investigate the economics of risk and their impact on bilateral trade. Such an approach should take into account the interdependencies between events, and how they affect trade individually and collectively. These risk dimensions, though related, still represent different dimensions of risk. They have to be aggregated in a seamless manner which will be cognisant of the challenges posed by integrating data from different risk sources into a single analytical perspective.

Most studies in the literature (Oh & Reuveny, 2010; Long, 2008; Nitsch & Schumacher, 2004) also used a sample of mostly developed countries in their analyses. This study uses a sample consisting of middle and low income countries (developing countries) as this setting is where risk is more prevalent (WEF, 2013).

Such a setting is provided by the SACU, which is one of the oldest trade blocs in existence and, as such, has gone through a number of changes. This trade bloc is also quite a unique agreement in the sense that it operates a Common Revenue Pool (CRP) into which all customs, excise, and additional duties are paid. There is a specified developmental component of the excise duties which accrue to member states. This can be viewed as a risk mitigation strategy and Hansohm (2011) described it as a monetary compensation to the other member states for being part of the trade bloc with South Africa (which is said to distort trade).

Other studies used highly aggregated data sets (Gassebner *et al*., 2010; Oh & Reuveny, 2010; Long, 2008; Bayer & Rupert, 2004; Anderson & Marcouiller, 2002). They used total trade, which means they were able to extract less information, and this compromises the validity of their conclusions. According to Romilly (2007), researchers can only speculate on the reasons for the observed differences in certain variables when there is a high level of aggregation in the data analysis. Aggregated data usually conceals considerable variation in the variables. This study follows a commodity (disaggregated) approach in setting up the data, as this approach offers one the opportunity to obtain more information; and to delve deeper into the results to highlight issues and hidden trends from the individual variables under investigation. Some studies used count data to quantify the effects of the risky events, while others used the binary variable approach (Raddatz, 2007). These two approaches suffer from the following problems: lack of variability due to excess zero data points; attrition problem; and dummy variable trap. This study, therefore, uses a constructed composite index to quantify and measure the risk. This approach isolates and aggregates the impact of different internal risky factors, which according to Raddatz (2007) is a difficult, but worthy task. Table 3.1, is a summary of the studies on the trade-risk nexus.

3.4 SUMMARY

A lot of research has been done in trying to understand the dynamics of regional economic integration (Anderson, 2011; Medvedev, 2010; Gassebner *et al*., 2010; Keshk *et al*., 2010; Oh & Reuveny, 2010; Martinez-Zarzoso *et al*., 2009; Abadie & Gardeazabal, 2008; Long, 2008; Mirza & Verdier, 2008; Baier & Bergstrand, 2007; Raddatz, 2007; Bayer & Rupert, 2004; Nitsch & Schumacher, 2004; Anderson & Marcouiller, 2002; Li & Sacko, 2000; Bougheas *et al*., 1999). This was done to address some of the challenges which international trade players face, particularly low intra-bloc trade in SS RTAs. So far, such efforts have not been successful as the problem of low intra-bloc trade still persists. In recent times, a different path has been explored in the quest to address the low intra-bloc trade, and the impact of risk on trade.

Table 3.1: Summary of trade-risk literature

	Author/s	Objective	Methodology	Findings
1	Oh and Reuveny (2010)	Analysing the effects of climatic natural disasters and political risk on bilateral trade.	Gravity model with country-fixed effects	An increase in climatic disasters or political risk, for *i* or *j* , reduces their bilateral trade.
2	Long (2008)	To determine the influence of conflict on bilateral trade.	Gravity model and rational-expectation theory.	Military conflicts between states short of war can influence trade.
3	Bayer and Rupert (2004	Determine the impact of civil war in one country on the total bilateral trade between the afflicted state and its trade partners	Gravity model using a two-way fixed-effects model.	Civil wars decrease bilateral trade between states by one-third.
4	Li and Sacko (2000)	Determine whether military disputes between two states suppress trade between their firms.	Gravity model and rational expectations and uncertainty theories.	Military disputes reduce bilateral trade substantially ex post.
5	Keshk *et al.* (2010)	Determine relationship between trade and military conflict.	Gravity model and two-stage Simultaneous equations model estimator.	Conflict that reduces trade
6	Mirza & Verdier, 2008	Determine the relationship between international trade, security and transnational terrorism.	Gravity model	Transnational terrorism has a negative effect on bilateral trade flows.
7	Nitsch & Schumacher, 2004	Examines the effect of terrorism and warfare on international trade.	Augmented gravity model	Terrorism and large-scale violence have a negative effect on international trade.
8	Anderson and Marcouiller (2002)	Determine effect of security on the pattern of reduce international trade.	Structural model of import demand.	Transactions costs associated with insecure exchange significantly impedes international trade

Source: Trade literature.

This chapter presented the many definitions of risk and chose one which was more applicable in the context of the study. The definitions of uncertainty and resilience were also presented with the objective to crystalise the understanding of risk. Various risk categories were also presented and discussed. The emphasis was on four – economic, social, environmental and technological – of the five risk categories outlined by the WEF as being relevant for developing countries.

In this chapter, the numerous factors identified in the literature as having an impact on international trade were presented. These include: population dynamics, inflation, technology, national income, investment, energy, institutional framework, transportation costs, technical and non-technical trade barriers, exchange rate, relative prices, and economic size and openness. Risk indicators were also selected and discussed. These were selected from the list that defined particular aspects of risk which were deemed to be appropriate for developing countries. The chapter was concluded with a section that articulated the interplay between trade and risk.

As risk can never be fully eradicated; the best mitigation strategy is to build up the resilience of those affected. Before this can be implemented, there is a need to fully understand the characteristics and impacts of the risk. This is where this thesis becomes important; it builds on the definitions of risk, and further presents the impact of risk from a SS trade perspective using the SACU as a case study. This is particularly insightful as it highlights the impact of an important trade impediment (risk) in an area where risk is said to be most prevalent (SS RTA). The SACU is quite a unique trade bloc in the sense that it is one of the oldest trade agreements, and also has the right mixture of developing countries. Also, it has a revenue sharing instrument, which to a large extent, functions as a risk mitigation strategy.

Another contribution of this study is on the methodology used to capture risk. Most of the reviewed studies on the risk-trade nexus used one risk measure (or at most two) to determine the impact of risk on bilateral trade, but this study presents a more thorough and robust framework for quantifying risk in an economy. This framework is an aggregated risk index which addresses the ripple effect of risk.

CHAPTER 4

CONCEPTUAL FRAMEWORK AND EMPIRICAL MODEL

4.1 INTRODUCTION

Even though the trade policy framework is dynamic, there are certain features that characterise international trade. These features are: the GATT 1947 agreement and the WTO, which have presented a serious effort towards full integration in international trade. These agreements further provide a foundation for national policies which have had a huge influence on international competition, especially on tariffs, quotas, subsidies, and other trade practices. As the level of interdependence between trading nations continue to grow exponentially, the relevance of the founding principles has never been greater.

One of the recent developments in the international trade literature has been the realisation that risk is one of the principal factors which influence bilateral trade flows. As such, it has been added as an independent variable in the gravity model of trade. The risk variable serves to capture and control for the effect of different risky events on the volume of trade between bilateral partners. However, most of the reviewed studies analysed the effect of risk or risky event on trade, in isolation (Keshk *et al*., 2010; Oh & Reuveny, 2010; Abadie & Gardeazabal, 2008; Mirza & Verdier, 2008; Long, 2008; Nitsch & Schumacher, 2004; Bayer & Rupert, 2000; Li & Sacko, 2000). Other researchers, Luckmann (2015) and Jovanovic *et al*. (2012), have argued that this approach is an oversimplification of reality. This study, therefore, addresses this anomaly by constructing a framework that properly captures the trade-risk nexus.

The two previous chapters addressed the dynamics of international trade, specifically, regional economic integration and the interplay between trade and risk in the international trade arena. This chapter presents the theoretical framework of the composite risk index. The gravity model of trade, due to it being the most successful and intensively used model in contemporary trade research, is used for analysis. It is discussed in Section 4.3. Lastly, Section 4.4 presents the empirical model used in this study.

4.2 CONCEPTUAL FRAMEWORK

Globalisation and regional economic integration have been at the fore front of the growth in interdependence between nations. The influence of these two has seen the world labeled as a global village of natural trading partners, with producers and consumers from distant locations of the world in constant contact. This contact has led to the exchange of information, ideas, goods, and services which has transformed the economies of many countries (Haskel *et al*., 2012).

However, there is a concern that economic interactions, at the international arena, are still far below those witnessed within national borders meaning, there is still more domestic than international trade. There is still little international trade, less than what is expected between countries with different relative factor endowments and signatories of trade agreements. The constrained international exchange in goods and services cannot be explained by tariffs and other formal impediments to trade. A number researchers argue that trade is reduced by hidden transaction costs associated with the risk of international exchange (Kagochi & Durmaz, 2018; Hosny, 2013; Coulibaly & Fontagne, 2009; Mayda & Steinberg, 2009; Anderson & Marcouiller, 2002). There are a number of factors which are responsible for this unpleasant state of affairs, and these include: small fragmented economies, distance, physical and technical barriers, and other external factors. Johnson *et al*. (2008) categorise the external factors into political, economic, social, technological, and environmental influences; whilst the WEF (2012) labels the same factors as risks.

However, according to trade literature in the last 20 years, protectionist trade policies (trade barriers) have declined, yet intra-bloc trade still remains low (ECA, 2013; Behar & Criville, 2010; Mayda & Steinberg, 2009; Elva & Behar, 2008; Carrere, 2004; Longo & Sekkat, 2004; Wiemer & Cao, 2004). This implies that, there are other barriers to trade which counter the economic integration model (Sandrey, 2013; ECA, 2013; AGI, 2012; WDR, 2009; Elva & Behar, 2008; Carrere, 2004, Wiemer & Cao, 2004; Anderson & Marcouiller, 2002).

4.2.1 Regional integration

The economic integration paradigm follows a linear integration of goods, labour and capital markets, and eventually monetary and fiscal integration (Hartzenberg, 2011). This paradigm begins with a preferential trade agreement (PTA) which is an agreement that leads to lower trade barriers within the union, and flexibility on external tariff reduction. A Free trade area (FTA) is the next level. It is characterised by zero internal tariffs, and some protection in the form of rules of origin and lower external tariffs.

The customs union has the characteristics of a FTA and a harmonised external trade policy. A common market has the characteristics of a customs union and the free mobility of factors of production. An economic union has the characteristics of a common market and harmonised economic policies. Finally, a political union has complete fiscal policy harmonisation. This model is regarded as a sequencing pattern towards deeper integration, from unilateral trade to multilateralism. The general expectation is that as integration deepens, that is, moving from PTA to a political union (Figure 4.1), intra bloc trade should increase. This is because deeper integration ideally means fewer barriers to trade (Mansfield & Milner, 2014). However, this has not been the case at all. Signatories of trade agreements have continued to trade more with countries outside their trade blocs than with countries within. According to Azis (2016), this is to be expected as integration comes with certain risks.

Figure 4.1 depicts the interplay between the economic integration paradigm; its barriers (both institutional and physical); and external factors (risk). There are a number of institutional barriers which are said to impede trade, and these include tariffs and non-tariff measures. A number of possible explanations for the low trade volumes have been presented in the international trade literature.

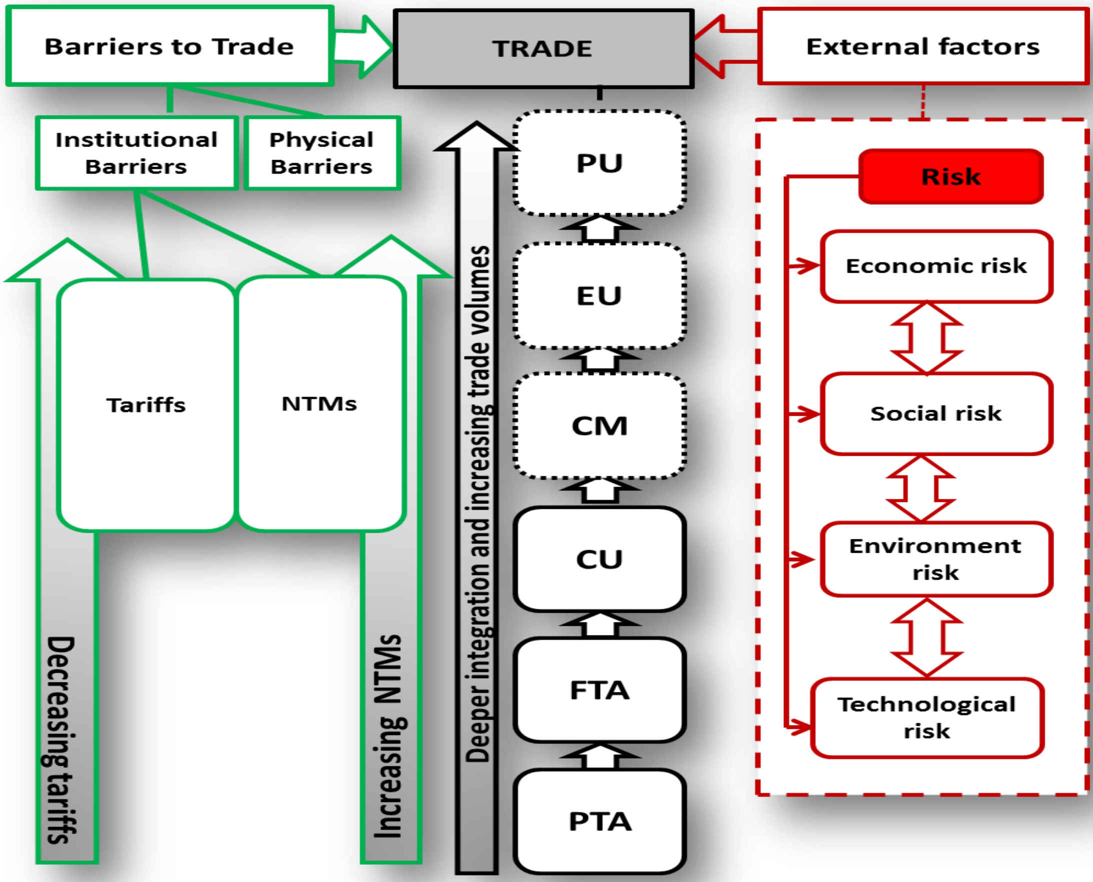


Figure 4. 1: Economic integration and risk as an impediment to international trade

Source: Author's own illustration.

4.2.2 Barriers to Trade

The general objective of regional integration is to provide access to a larger market to trading economies with the aim of achieving increased and sustainable economic welfare. However, the achievement of this objective depends, to a large extent, on the existence of barriers to trade.

4.2.2.1 Institutional barriers

i. Tariff barriers

Tariff barriers, which are defined as taxes or duties imposed on imports, entail government regulation of trade in the form of direct taxes. However, the importance of tariffs has declined in recent times with the success of a number of WTO trade negotiations; accession of a number of countries to the WTO; and other bilateral agreements (Ronen, 2017; Dunn & Mutti, 2004). They are the oldest form of trade policy, and have traditionally been used by governments as a source of income. However, their true purpose is to protect particular domestic sectors, and they generally impede bilateral trade (Krugman & Obstfeld, 2003). Hence, a number of governments now prefer Non-Tariff Measures (NTMs) as a form of trade regulation.

ii. Non-tariff barriers (NTMs)

NTMs take various forms, while they may be less visible and harder to measure than tariffs; they are no less important. They have become more important in recent times as governments look for means of regulating trade without raising tariffs that were reduced in the WTO rounds of negotiations. A NTM is defined as any government trade policy, other than a tariff, which reduces imports, but does not similarly restrict domestic production of import substitutes. Quotas, which are limits on the amount of a product that may be imported at a given time, are the most transparent NTM (Kang & Ramizo, 2017; Dunn & Mutti, 2004). Other NTMs include technical barriers to trade (TBTs); sanitary and phytosanitary measures (SPS); antidumping duties; countervailing duties; and safeguards. TBT and SPS measures are the most common, and they are, principally, a means to protect the health of humans, plants and animals in the domestic economy (Kang & Ramizo, 2017).

4.2.2.2 Physical barriers

Physical barriers, also called geographical barriers, which are said to be unavoidable, include: distance, landlockedness, political borders, and terrain (White, 2010). According to De Benedictis and Taglioni (2011), distance is only a proxy for trade costs. However, the importance of distance as a physical barrier to trade has not decreased with time even with the improvements in the trade landscape.

4.2.2.3 Risk

Risk creates uncertainty in production, consumption, economic returns and transactions (direct effect). It also induces reductions or shifts in investment, demand and supply patterns with serious implications for economic welfare and growth. It is endemic in developing countries, and when it is not properly managed, its negative outcomes can be severe; turning into crises with often unpredictable consequences. Given the level of interdependence in global trade, this risk can impact the economies of trading partners (indirect effect). The relevance, therefore, of analysing the impact of risk on trading patterns, and on the economies of trading countries cannot be overemphasized (WEF, 2013).

Since the early 2000s, risk has been used to augment the gravity model of trade. Risk or risk factors, has been included to estimate the impact of different potentially hazardous events on trade (Keshk *et al*., 2010; Oh & Reuveny, 2010; Abadie & Gardeazabal, 2008; Long, 2008; Mirza & Verdier, 2008; Raddatz, 2007; Bayer & Rupert, 2004; Nitsch & Schumacher, 2004; Li & Sacko, 2000). These studies investigated the impact of these risk factors in isolation, that is, one at a time. This is, however, an over simplification of reality as risk events rarely occur in isolation. They are a result of, and usually result in other risky events. According to Jovanovic *et al*. (2012), there is a need for a more comprehensive approach to modeling risk which will integrate data from different risk sources into a single analytical perspective.

4.3 METHODOLOGY

This study proposes such a comprehensive approach which will integrate risk data from different sources. It seeks to construct a composite risk index using two risk indicators across four risk dimensions. The choice on the number of indicators is purely subjective, and is based on data availability, ease of manipulation, and complexity of index construction (Nardo *et al*., 2005). This index will quantify risk in the economy and will then be used to estimate the impact of risk on bilateral trade flows. This approach will provide a means to aggregate different risk indicators in the economy, and then determine their impact on bilateral trade.

4.3.1 Composite Risk Index

The indicators are quantitative variables which are used to represent a particular characteristic of a system under review. The composition of an indicator may be one dimensional, that is, consists of a single variable (for example, precipitation) or multidimensional (for example, GDP). It is also a common practice to combine an array of indicators to construct a composite indicator or index. The main objective and characteristic of composite indices is to extract the important aspects of the system under review, and represent such with a single number. The composite risk index constructed, in this study, falls into a category of social indices called vulnerability indicators. Such indicators measure the exposure of a population to some hazard, or the ability to cope with the hazard. Prominent examples include the Human Development Index (2010), the Disaster Risk Index (2004), and the Environmental Sustainability Index (2005) (Tate, 2012).

According to Saisana *et al*. (2005), composite indicators have gained popularity in recent times. They are increasingly being used to convey key information on the status of countries in an array of fields. Aggregate, composite index, and composite indicator are used interchangeably and they originate from the process involved in the construction of the index. This process involves the manipulation of individual normalised and weighted indicators, to produce an aggregate ordinal or cardinal measure of country performance in some area of study. The assigned weights may represent the relative importance of each indicator or be derived from the data.

Advancements in social vulnerability conceptual frameworks and the rising interest in the development of quantitative metrics have led to a wide array of approaches employed for constructing indices. The construction of an index involves a multi-stage sequential process, which includes structural design, indicator selection, data transformation, scaling, weighting, and aggregation (Table 4.1). Modellers have the responsibility of making choices between the different legitimate alternatives during the construction process (Tate, 2012). According to OECD (2008), the construction of composite indices, like computational and mathematical models, is more of an art than a science. Its construction relies on the craftsmanship of the modeller. However, in recent times, Tate (2012); OECD (2008); Nardo *et al*. (2005); and Saisana *et al*. (2005) have helped define a framework for the construction of composite indices. Table 4.1 outlines this framework with justification for the different stages and processes.

Table 4. 1: Procedural steps in the construction of composite indices

Step	Justification
i. Theoretical framework **Provides the basis for the selection and combination of different variables.**	Gives a clear understanding and definition of the multidimensional phenomenon to be measured.
ii. Data selection **Based on the analytical soundness, measurability, coverage, and relevance of the indicators to the phenomenon being measured and relationship to each other.**	To check the quality, strength and weakness of each selected indicator against those of other potential indicators.
iii. Multivariate analysis **Used to study the overall structure of the dataset, assess its suitability, and guide subsequent methodological choices (*e.g.*, weighting, aggregation).**	To compare the statistically determined structure of the data set to the theoretical framework and discuss possible differences.
iv. Normalisation **Should be carried out to render the variables comparable on a dimensionless scale.**	To make scale adjustments and deal with outliers in the dataset as they may become unintended benchmarks.
v. Weighting and aggregation **Should be done along the lines of the underlying theoretical framework.**	To select appropriate weighting and aggregation procedures that respect both the theoretical framework and the data properties.
vi. Uncertainty and sensitivity analysis **Should be undertaken to assess the robustness of the composite indicator.**	To identify all possible sources of uncertainty in the development of the composite indicator and accompany the composite scores and ranks with uncertainty bounds.

Source: OECD (2008).

4.3.1.1 Theoretical framework

Dimensions and factors are chosen based on their role as drivers of bilateral trade flows. Such factors are also viewed as sources of potential risk to the trade system. According to the WEF (2013), there are five fundamental sources (dimensions) of risk for an economy: economic, social, environmental, technological and political factors. This study used the first four dimensions to identify risk factors that affect the trade patterns of members of the SACU trade agreement. In the previous chapter, it was argued that, generally, risk has a negative effect on bilateral trade flows as well as the potential individual effect of the different risks. This section presents the theoretical foundations for the risk-trade interplay.

4.3.1.2 Identifying and discussing the relevance of risk indicators

According to the WEF (2013), risk, at the macro-level, can be classified into five principal risk categories: economic, social, technological, environmental, and political. In this study, four risk indicators (economic, social, technological, and environmental) and their respective drivers were chosen through an extensive process of literature review, consultation, and analysis of available data. The decision to exclude political risk was made based on the complexity of the political dimension, that is, it includes indicators which would have been hard to manipulate in this study, e.g. the corruption perceptions index. Other indicators do not show any variation over long periods of time, for example, political stability, conflicts, ideology, and policy (Nardo *et al*., 2005).

i. Economic risk indicators

The correct use and allocation of economic factors is among the most important drivers of an economy. Generally, countries with developed economies tend to have low, stable inflationary trends. Such countries tend to have a high degree of openness as well as a developed financial sector. This gives them a comparative advantage in capital intensive sectors, such that they have a higher export share in manufactured goods (Borodin & Strokov, 2014; Beck, 2002).

A stable macroeconomic framework is necessary and conducive for sustainable economic growth and low inflation levels. It is characterised by low inflation, positive real interest rates, stable and sustainable fiscal policy, competitive and predictable real exchange rates, and a viable balance of payments situation (Ciftcioglu & Begovic, 2008; Bhagwati & Srinivasan, 2002). There is, therefore, a negative correlation between economic growth and inflation. With more countries vying for free trade, which calls for an export promoting trade strategy, the need for a more stable macroeconomic framework has never been greater. *Economic growth* and *inflation* are, therefore, the indicators which represent economic risk in this study.

ii. Social risk indicators

According to the Heckscher-Ohlin/Stolper-Samuelson theorem, an increase in the price of a good that is labour-intensive in production will increase the real wage (and possibly employment), thereby alleviate poverty (FAO, 2012; Dunn & Mutti, 2004; Krugman & Obstfeld, 2003). Winters (2002) argued that in general, free trade leads to low unemployment and poverty levels, even though evidence from the developing world is to the contrary. Developing countries are clearly labour-abundant, and so free trade should lead to low unemployment and poverty. However, it is not clear that the least-skilled poor workers are the most intensively used factor in the production of tradable goods in developing countries.

Poverty and unemployment pose, arguably, the greatest challenge to developing economies around the world, especially in Sub-Saharan Africa (UN, 2019; Ndulu *et al*., 2005). High unemployment rates, coupled with a high proportion of the population living below the poverty line, characterise underdeveloped economies. This does not only compromise their competitiveness and productivity, but also their participation in international trade; hence, *poverty* and *unemployment* represent societal risk in this study.

iii. Environmental risk indicators

Adverse weather and climatic conditions are likely to result in significant economic losses. These losses, in turn, may be more pronounced in developing countries which lack resilience.

It is not hard to see why vulnerable developing countries will be the most affected by drastic climatic changes and unstable weather conditions. Researchers have noted the importance of economic development in reducing vulnerability to adverse environmental factors and their effects. They argued that a critical underlying factor for any economy's response to the effects of a natural disaster is the level of wealth at its disposal (Baudoin *et al*., 2017; Burke *et al*., 2010; Romilly, 2007).

For the most part, the effect of environmental factors on trade has, so far, been neglected in the literature. Drought, floods and other extreme weather patterns are some of the environmental risks facing the SACU countries. Unpredictable rainfall patterns and extreme temperatures affect the agriculture sector and compromise its competitiveness. Extreme rainfall patterns can lead to droughts and floods, and extremely high temperatures lead to high incidents of pests and other diseases which can reduce productivity and profitability in agriculture (UN, 2019). Thus, *rainfall* and *temperature* are the indicators which represent environmental risk in this study.

iv. Technological risk indicators

Good quality infrastructure not only reduces the distance between fragmented regions, but also integrates national markets and connects them at low cost to other economies in the global market (WEF, 2013). According to Ndulu *et al*. (2005), inadequate infrastructure is one of the key impediments to economic growth in Africa. Sub-Saharan Africa ranks at the bottom of all developing regions in terms of infrastructure development; it is no surprise the region has lagged behind in economic growth (Anderson & Felici, 2012; Calderon & Serven, 2008; Limao & Venables, 2001; Bougheas *et al*., 1999).

Some studies have investigated the impact of infrastructure on trade in different sectors. These studies used the quality of roads and telecommunications, amongst others, as the key indicators of infrastructure. They concluded that trade performance was significantly affected by the quality of infrastructure and access to telecommunications (UN, 2019; Nordas & Piermartini, 2004). Therefore, the need for these technologies to be of the required quantity and quality cannot be overemphasized. *Road networks* and *telephone lines* are the indicators chosen to represent technological risk in this study.

4.3.1.3 Multivariate Data Analysis (MDA)

The use of multivariate measurement not only reduces measurement error, but also allowed the researcher to properly measure the concept under review by joining several variables. The idea is meant to avoid the reliance on one variable to represent the concept, but instead to use several indicators. This is ideal as it not only increases the available information, but also increases the chances of understanding the phenomenon under review (Hair *et al*., 2010). Each of these indicators represents a different aspect of the concept, and this serves to provide a more holistic perspective.

Common Factor Analysis (CFA) and Principal Components Analysis (PCA) are MDA techniques which are used extensively in the construction of composite indicators (Hair *et al*., 2010; OECD, 2008; Nardo *et al*., 2005). The main objective of both these techniques is to reveal the correlation between a set of different variables. These techniques are useful for gaining insight into the structure of the dataset before the composite index is constructed. PCA assumes that all the variance in the dataset can be explained, whilst CFA assumes that only the shared variance can be explained. PCA is more robust than CFA in the sense that it is not affected by issues like missing data values and non-normality issues (Hair *et al*., 2010; OECD, 2008; Nardo *et al*., 2005).

i. Factor Analysis (FA)

The FA aims to describe a set of *n* variables (x_1, x_2, x_n) in the dataset in terms of a smaller number of *m* factors, and further highlight the relationship between these variables. It is based on a rather special model as compared to the PCA. The FA model assumes that the data is based on the underlying factors of the model, and that the data variance can be decomposed into that accounted for by common and unique factors (Hair *et al*., 2010; Nardo *et al*., 2005; OECD, 2008).

ii. Principal Components Analysis (PCA)

The objective of the PCA is achieved by transforming a set of correlated variables (factors) into a new set of uncorrelated variables using a covariance matrix, or its standardised form, the correlation matrix. In most empirical work, the correlations among the original set of variables are large enough such that the first few new variables, that is, *principal components*, account for most of the variance in the dataset. The PCA is used to extract the first *m* principal components and to consider them as factors, neglecting those remaining. This analysis, by virtue of its simplicity and the fact that it allows for the construction of weights representing the information content of individual indicators, is the most preferred approach in the development of composite indicators.

The PCA weights are chosen so that the principal components satisfy the following conditions: orthogonality; the first principal component accounts for the maximum possible proportion of the variance; and a squared summation of the weights equal unity (Hair *et al*., 2010; Nardo *et al*., 2005). The correlation coefficients between the principal components and the independent variables are called component loadings. The squared loadings, on the other hand, are the percentage of variance in that variable which is explained by the principal component (OECD, 2008; Nardo *et al*., 2005). The PCA involves finding the eigenvalues of the sample covariance matrix. The eigenvalues are the variances of the principal components, that is, the transformed variables that explain most of the variation.

Eigenvalues add up to the sum of the diagonal elements of the covariance matrix. In order to avoid one variable having an undue influence on the principal components, it is common to standardize the variables to have zero means and unit variances at the start of the analysis. In such situations, the covariance matrix then takes the form of a correlation matrix (Hair *et al*., 2010; Nardo *et al*., 2005).

After the decision has been made on the number of factors to keep, based on the eigenvalues, the next step is to perform a rotation which seeks to enhance the interpretability of the results. It is worth noting that this rotation does not affect the sum of eigenvalues, but changing the axes does change them and factor loadings of particular factors. There are a number of rotation methods in the literature, but the most commonly used one is the *varimax rotation*. The objective of the rotation is to obtain a clear pattern of factor loadings, that is, by maximising loading of individual indicators on individual factors. The factor loadings are then used to construct weights for the composite indicator in the weighting and aggregation stage (Hair *et al*., 2010; OECD, 2008; Nardo *et al*., 2005).

4.3.1.4 Normalisation

During any aggregation exercise, a number of indicators are chosen on the basis of their relevance in explaining the concept under review, and in this case, risk. These indicators convey information of different kinds, and they are expressed in different units, for example, GDP (*US dollars*), Road networks (*kilometres*), rainfall (*millimetres*).

Some of the indicators will be disproportionate with others; for example, GDP may be in the millions whereas economic growth may be a single digit. Thus, according to Nardo *et al*. (2005), before proceeding with the aggregation exercise, it is necessary to bring the indicators to the same standard, by transforming them into purely dimensionless numbers. According to the OECD (2008), normalisation of indicators is an essential step as it renders indicators comparable. Since the SACU members differ considerably in size, some of the indicators used to construct the composite risk indicator will be scaled using population, that is, they will be on per capita terms. This step is also a necessity as it takes care of outliers which tend to become unintended benchmarks (OECD, 2008).

There are a number of normalisation methods, but the most common are: the *min-max re-scaling*, which is used in the construction of the widely used Human Development Index; the *standardisation (z-scores)*, which is used to construct the environmental sustainability index; and the internal market index (Hair *et al*., 2010; OECD, 2008; Nardo *et al*., 2005). The objective is, therefore, to identify the most suitable method for the aggregation exercise, taking into account its properties with respect to the measurement units in which the indicators are expressed, and their robustness to possible outliers in the data.

The standardisation procedure rewards exceptional behaviour, that is, above average performance in a given indicator yields higher scores than consistent average scores across all indicators. This is inappropriate when dealing with multidimensional concepts where no dimension can be neglected in favour of another. It cannot be expected that a low poverty rate will compensate for high temperatures (Aguna & Kovacevic, 2011). Therefore, this study utilises the min-max re-scaling procedure (with the standardisation being a robustness check) since risk is a multidimensional concept where balance in all dimensions should be rewarded.

4.3.1.5 Weighting

A fundamental aspect in the construction of a composite index is the need to combine a number of different indicators, on different scales, in a meaningful way. There are also a number of procedures used in the literature: equal weights, PCA/CFA weights, data envelopment analysis, and the benefit of the doubt approach. Therefore, a decision has to be made on which of the weighting models will be employed in combining the information at hand (Nardo *et al*., 2005).

However, there is no consensus on which of the numerous methods in the literature (equal weighting, PCA weighting, data envelopment analysis, and the benefit of the doubt approach) is the best to weight individual indicators in constructing the composite index. Researchers have taken different approaches in dealing with the weights. Some endeavour to compensate with higher weights, attached to components which they deemed more influential; and some paid more attention to the existence of correlations among factors, and used weights derived from principal components and factor analysis.

Others used weights based on the opinion of experts, who are well versed on policy priorities and theoretical backgrounds (Hair *et al*., 2010; Nardo *et al*., 2005; Nicoletti *et al*., 2000). It is due to these facts that researchers such as Nardo *et al*. (2005) and Nicoletti *et al*. (2000) call for caution. They argue that soundness of the weighting procedure and transparency should guide the entire exercise. However, the equal weighting and PCA/CFA methodologies are the mostly used hence they are used in this study *(*Aguna & Kovacevic, 2011; OECD, 2008; Cherchye *et al*., 2006; Nardo *et al*., 2005).

4.3.1.6 Aggregation

With all the controversy surrounding the abstract nature of composite indices, there is a great need to be as objective and as transparent as possible in constructing one. The controversy is as much along analytical as it is along pragmatic lines. This is one of the reasons why PCA/CFA is so appealing because the aggregation process is data-based (Nardo *et al.*, 2005). The most popular methods of aggregation in the literature are the arithmetic (additive) and geometric (multiplicative) aggregation (Aguna & Kovacevic, 2011; OECD, 2008).

i. Additive aggregation methods

Out of all these techniques, the additive aggregation techniques seem to be the most favoured by the majority of researchers. However, according to OECD (2008), these techniques may require assumptions on and properties of the indicators and weights, which may be difficult to meet or verify. The simplest of the additive aggregation approaches involves calculating the ranking of each country based on each indicator. The second aggregation approach involves setting an arbitrary benchmark and enumerating the number of indicators that are above and below the benchmark. The last approach, in the additive class, is by far the mostly used in the literature. It involves the summation of weighted and normalised sub-indicators (Aguna & Kovacevic, 2011; OECD, 2008).

$$CI_c = \sum_{q=1}^{Q} w_q I_{qc} \qquad (4.1)$$

Where CI_c is the composite index of country c at time t. I_{qc} is sub-indicator q, and w is the respective weight attached to I.

Although additive aggregation approaches are widely used, they have major flaws which are hard to ignore. The most prominent of these flaws is *preference independence*. It allows for the valuation of the marginal contribution of each variable separately. This implies that there are no interactions between variables, and according to Nardo *et al*. (2005), this is an unrealistic assumption.

ii. Multiplicative aggregation methods

The geometric aggregation approach is preferred to its additive counterparts because it avoids the undesirable characteristic of full compensability in additive aggregations (OECD, 2008). This characteristic implies that poor performance in one indicator is compensated by high performance in another indicator. Generally, compensability refers to the possibility of offsetting a disadvantage on some criteria by a sufficiently large advantage on another criterion; whereas smaller advantages would not do the same. This undesirable characteristic is inherent in additive techniques, hence, their unsuitability in composite construction.

The geometric aggregation approach has the following specification

$$CI_c = \prod_{q=1}^{Q} I_{qc}^{w_q} \qquad (4.2)$$

Where CI_c is the composite index of country c at time t. I_{qc} is sub-indicator q, and w is the respective weight attached to I. Originally the arithmetic mean was used to compute the HDI, but Aguna and Kovacevic (2011) used the geometric mean. They argued that the geometric mean was a better alternative as it reflected the trade-offs between the dimensions in the HDI 2010.

4.3.1.7 Uncertainty and Sensitivity Analysis

The exercise of composite index construction involves multiple stages where subjective decisions have to be made. These decisions involve, but are not limited to: the choice of indicators for the composite index; the imputation of missing data; and the choice of normalisation, weighting and aggregation approaches. These are the sources of the never-ending controversy surrounding indices (Tate, 2012; Aguna & Kovacevic, 2011; OECD, 2008).

There are a number of tools outlined in the literature which could be employed to improve the transparency of this exercise, and to improve the robustness of composite indices. Two of these tools that are widely used are: uncertainty analysis (UA) and sensitivity analysis (SA). Given the importance of composite indices in recent times, it goes without saying that the construction of the index has to be transparent and guided by a sound theoretical foundation. Undertaking the UA and SA can, therefore, be seen as an attempt to enhance the transparency of the exercise.

According to Tate (2012), the validation of some social vulnerability indices has been hindered to a large extent because some social vulnerabilities may not be directly observable, for example, risk. This has necessitated researchers to use proxies like human mortality rates, damage to the environment, economic losses, and human displacement, to name a few. The success rate of this option is variable, as it has produced mixed results. The author suggested internal validation as an unexplored alternative approach. This approach is generally an examination of how changes in index construction components affect the modelled output. The importance of this step cannot be over emphasized. According to Tate (2012), the use of methodologically fragile indices in hazard mitigation planning and policy formulation will result in flawed decisions with dire consequences.

Therefore, this study undertook validation in the following stages of the index construction: weighting and aggregation. These are some of the main sources of uncertainty (Aguna & Kovacevic, 2011; OECD, 2008; Nardo *et al*., 2005). The Sensitivity and Uncertainty Analysis was carried out as in Aguna and Kovacevic (2011).

4.3.2 Constructing the Composite Risk Index

The composite risk index is a summary measure of risk affecting the domestic economies of bilateral trade partners.

$$CRI_{ijt} = \varphi_1 Recon_{ijt} + \varphi_2 Rsoc_{ijt} + \varphi_3 Rtech_{ijt} + \varphi_4 Renv_{ijt} \quad (4.3)$$

CRI_{ijt} is the composite risk index for the importer (i) and exporter (j) at time t. It will capture the aggregate effect of risky events on the trade volumes of the trading partners. $Recon_{ijt}$ is the economic risk factor; $Rsoc_{ijt}$ is the societal risk factor; $Rtech_{ijt}$ is the technological risk factor; $Renv_{ijt}$ is the environmental risk factor. The φs are the weights assigned to the different risk categories. The different categories will be assigned equal weights, that is, 0.25. According to Hagerty and Land (2007), the use of equal weighting is justified when survey data, of the respective weights people place on the different components of an index, are not available. There is, however, a need for the weights as they distinguish risk from uncertainty.

4.3.2.1 Normalisation of Dimension indices

As outlined earlier in this section, the normalisation was undertaken using the following equations: The data was normalised using two different methods of normalisation; Min-Max (rescaling) and Standardisation (z-scores).

$$NV_{ijt} = \frac{(x_{ijt} - x_{min})}{x_{max} - x_{min}} \qquad (4.4)$$

Where; *NV* is the normalised value of indicator q (for example, inflation), x_{ijt} is the value of the indicator at time t, x_{min} and x_{max} are the minimum and maximum values of indicator q, for the importer and exporter at time t. With this type of normalisation procedure, the normalised indicators lie between 0 and 1 (OECD, 2008; Nardo *et al.*, 2005). As in Aguna and Kovacevic (2011) the observed actual minimum value will be reduced by 5% to avoid 0 score values on the component index.

The standardisation method of normalisation was used as a robustness check.

$$NV_{ijt} = \frac{x_{ijt} - \bar{x}}{\sigma_{ijt}} \qquad (4.5)$$

Where NV_{ijt} is the normalised value of i (exporter) and j (importer) at time t, x_{ijt} is the value of the importer and exporter indicator at time t. $\bar{x}$ is the mean of an indicator across all the countries under review, and σ is the standard deviation of an indicator across the countries.

4.3.2.2 Weighting

Two weighting methods were employed in this study, that is, the PCA weighting and equal weighting methods. The PCA weights were obtained during the multivariate data analysis. The equal weight is 0.25, and this is because there are four risk dimensions. Equal weighting is the best option when there is no statistical or empirical basis for choosing a particular weighting method. This methodology may also be utilised as a result of inadequate information on the causal relationships governing the phenomenon under review (Hair *et al.*, 2010; OECD, 2008; Nardo *et al.*, 2005).

4.3.2.3 Aggregation

The most popular methods of aggregation in the literature are the arithmetic (additive aggregation) and geometric (multiplicative aggregation) means (Aguna & Kovacevic, 2011). The PCA weighting approach is also attractive as it is data-based. The multiplicative aggregation procedure was used in this study because it does not have the flaw of full compensability (Aguna & Kovacevic, 2011; OECD, 2008). The additive and PCA weighting procedures were used as robustness check (OECD, 2008; Nardo *et al*., 2005; Saisana *et al*., 2005).

a) Additive aggregation technique

i. Aggregation using equal weights (CR_2)

$$CRI_{ijt} = \left[\left(ER_{ijt}\right)^{\frac{1}{4}} + \left(SR_{ijt}\right)^{\frac{1}{4}} + \left(TR_{ijt}\right)^{\frac{1}{4}} + \left(EnR_{ijt}\right)^{\frac{1}{4}}\right] \quad (4.6)$$

Where $CRI_{ijt}$is the composite risk index of country *i* and *j* at time *t*, ER_{ijt} is the economic risk; SR_{ijt} is the social risk; TR_{ijt} is technological risk; and EnR_{ijt} is environmental risk.

ii. Aggregation using PCA weights (CR_pca2)

$$CRI_{ijt} = \left[\left(ER_{ijt}\right)^{\frac{1}{\alpha}} + \left(SR_{ijt}\right)^{\frac{1}{\beta}} + \left(TR_{ijt}\right)^{\frac{1}{\gamma}} + \left(EnR_{ijt}\right)^{\frac{1}{\delta}}\right] \quad (4.7)$$

Where α, β, γ and δ are the PCA weights

b) Multiplicative aggregation technique

i. Aggregation using equal weights (CR_1)

$$CRI_{ijt} = \left[\left(ER_{ijt}\right)^{\frac{1}{4}} * \left(SR_{ijt}\right)^{\frac{1}{4}} * \left(TR_{ijt}\right)^{\frac{1}{4}} * \left(EnR_{ijt}\right)^{\frac{1}{4}}\right] \quad (4.8)$$

ii. Aggregation using PCA weights (CR_pca1)

$$CRI_{ijt} = \left[(ER_{ijt})^{\frac{1}{\alpha}} * (SR_{ijt})^{\frac{1}{\beta}} * (TR_{ijt})^{\frac{1}{\gamma}} * (EnR_{ijt})^{\frac{1}{\delta}}\right] \quad (4.9)$$

1. Sub-indicators

In constructing the sub-indicators, the weighted and normalised variables are aggregated using the equal weighting method. The PCA weights method is used as a robustness check.

a) Economic risk factor

$$Recon_{ijt} = (Ecgr * \omega)_{ijt} + (Infl * \omega)_{ijt} \quad (4.10)$$

Where: *Ecgr* is economic growth of *i* and *j* at time *t*; *Infl* is inflation of *i* and *j* at time *t*; $\omega=0.5$ or is the respective PCA weight.

b) Environmental risk factor

$$Renv_{ijt} = (Rain * \omega)_{ijt} + (Temp * \omega)_{ijt} \quad (4.11)$$

Rain is rainfall of *i* and *j* at time *t*; and *Temp* is the temperature of *i* and *j* at time *t*; $\omega=0.5$ or is the respective PCA weight.

c) Social risk factor

$$Rsoc_{ijt} = (Pov * \omega)_{ijt} + (Unemploy * \omega)_{ijt} \quad (4.12)$$

Pov is poverty in *i and j* at time *t; Unemploy* is unemployment in *i and j at time t*; $\omega=0.5$ or is the respective PCA weight.

d) Technological risk factor

$$Rtech_{ijt} = (Road * \omega)_{ijt} + (Tele * \omega)_{ijt} \quad (4.13)$$

Road is the road network in *i* and *j* at time *t; Tele* is telephone network in *i* and *j* at time *t*; $\omega=0.5$ or is the respective PCA weight.

2. **Composite Index**

$$CRI_{ijt} = ER^{w}_{ijt} + SR^{w}_{ijt} + TR^{w}_{ijt} + EnvR^{w}_{ijt} \qquad (4.14)$$

Where CRI_{ijt} is the composite risk index of country *i* and *j* at time t. w_i is the respective weight of the sub-risk index. ER_{ijt} is the economic risk of country *i* and *j* at time *t*. SR_{ijt} is the social risk of country *i* and *j* at time *t*. $Rtech_{ijt}$ is the technological risk of country *i* and *j* at time *t*. $EnvR_{ijt}$ is the environmental risk of country *i* and *j* at time *t*.

4.3.2.4 Sensitivity and Uncertainty Analysis

The following stages are used in the analysis: Weighting; equal weights, PCA weights and Aggregation; multiplication (geometric mean), addition (arithmetic mean). Table 4.2 below outlines the four input factors and their respective aggregation and weighting procedures.

Table 4. 2: Input factors and the respective aggregation and weighting procedures

Input Factor	Weighting	Aggregation
(X_1)	Equal	Multiplication
(X_2)	PCA	Multiplication
(X_3)	Equal	Addition
(X_4)	PCA	Addition

Given the distribution of the input factors (X_s), 10,000 random draws will be generated and from these draws, the following outputs will be calculated:

i. $CRI_{ij} = ER^{w}_{ij} * SR^{w}_{ij} * TR^{w}_{ij} * ER^{w}_{ij}$ (4.15)

ii. CRI_{ij} ranking

The results of these simulations determined whether the composite risk index (CRI_{ij}) was robust to alternative methodological choices.

4.3.3 Summary of Index Construction

According to trade literature, studies that investigate the impact of risk on bilateral trade have one major flaw, they study the impact of a single risk factor in isolation. This has been flagged as an oversimplification of reality as risky events rarely occur in isolation. There is, therefore, a need for a more comprehensive approach for modelling risk. This approach should integrate data from different risk sources into a single analytical measure (Luckmann, 2015; Jovanovic *et al*., 2012; Oh & Reuveny, 2010). This study set out to address this flaw by constructing a composite risk index which integrated risk data from different risk sources.

An index framework was used as a basis for constructing the risk index (as shown in Appendix Table A1). This was a means to reduce the subjectivity of the process which is described as more of an art than a science. The first step in the index construction process was multivariate data analysis that served the process of reducing measurement error. This step also provides weights used in the weighting stage called PCA weights. The next step was normalisation, which is about bringing the indicators to the same standard, by transforming them into purely dimensionless numbers. Min-Max Re-scaling was the preferred method because it does not reward exceptional behaviour like the standardisation approach.

The constructed composite index showed robustness under different procedures which were altered to determine the appropriateness of the procedure. There were two critical stages that were important for proving the robustness of the index, weighting and aggregation. Weighting entails combining a number of different indicators on different scales, in a meaningful way. Two procedures were used, equal weights and PCA weights. Equal weights were chosen over PCA weights because they produced an index with the least variation. Equal weights are also ideal when there is no *a priori* statistical or empirical basis for choosing a particular method (Hair *et al*., 2010; OECD, 2008; Nardo *et al*., 2005). The aggregation step involved combining different risk dimensions into a single unit; arithmetic and geometric procedures were used. The geometric procedure was chosen to construct the index because it does not have the undesirable characteristic of full compensability in additive aggregations (OECD, 2008). The composite risk index was constructed using min-max re-scaling; equal weights and geometric aggregation.

4.3.4 The Gravity Model of Trade

The gravity model is one of the most successful and widely used models in empirical research in international trade. It has been used to analyse the net effects of trade policy i.e. volume and direction of trade (Bergstrand *et al*., 2013; Baier & Bergstrand, 2009; Anderson & van Wincoop, 2003). Its empirical robustness has made it the model of choice in investigations of the geographic patterns of trade. The gravity model has also been employed in many empirical trade studies to estimate the impact of a variety of policy issues and various trade distortions. There is widespread use of this model despite its earlier criticism of lacking a strong theoretical base (Salvatici, 2013; Tayyab *et al*., 2012; Anderson, 2011; Martinez-Zarzoso *et al*., 2009; Helpman *et al*., 2008; Santos Silva & Tenreyro, 2006). There has also been some controversy around its proper specification. This has led trade researchers to question the validity of some results and conclusions in some of the most influential articles in the trade literature (Gomez, 2013; Anderson & Yotov, 2012; Anderson, 2011; Westerlund & Wilhelmsson, 2011; Anderson, & van Wincoop, 2003). This has also led to an increased interest in the proper specification of the gravity model of trade.

4.3.4.1 Proper Specification of the Gravity Model

In the general form of the model, the volume of trade between two trading countries is proportional, *ceteris paribus*, to the product of the countries' economic size, and diminishes with the distance between them. This specification of the model is called the traditional gravity equation, and it has come under scrutiny in the trade literature. According to Martinez-Zarzoso (2013), the rationale for using the log-linearised approach comes from the need to generate estimates that yield elasticities. Log transformation also improves precision and reduces the influence of outliers on the estimates. This is particularly important when the countries under review are as diverse as the ones in this study (Bacchetta *et al.*, 2012).

However, there are a number of issues that have been raised concerning the traditional specification. Firstly, the gravity model, like other constant-elasticity models, should be estimated in its multiplicative form, as there is potential bias in the elasticities estimated using the log linear model. The source of bias is when some trade observations are zero. It is worth noting that zero values are very common in trade data. The reasons for the occurrence of zero values include: restrictive trade policies; lack of trade between small and distant countries due to high transactional costs; and poor record keeping. Others include: low levels of GDP per capita, especially in developing countries; a lack of historical and cultural relations between some countries; and lastly, the fact that countries do not produce nor demand all available goods (Bacchetta *et al*., 2012; Silva & Tenreyro, 2006). There is, therefore, a problem related with the analogy between Newtonian gravity and trade, as the gravitational force can never be zero. The standard gravity model specification is, therefore, not well suited to deal with zero trade flows as they are discarded (Bacchetta *et al*., 2012). The observed zero observations contain valuable information which should be exploited for efficient estimation and as such should not be discarded *a priori*. This study followed the recommendation of estimating the gravity model in levels i.e. in multiplicative form without log-linearising, since log-linearising drops the zero observations. Therefore, the Poisson estimation technique, which is a log-linear pseudo maximum likelihood estimator (PPML) replaces Ordinary Least squares (Head & Mayer, 2013; Anderson, 2011; Helpman *et al*., 2008). There is, therefore, a need to revisit the model specification to allow for consistent estimation of the parameters of interest when the dependent variable takes on zero values (Head & Mayer, 2013; Westerlund & Wilhelmsson, 2011; Santos Silva & Tenreyro, 2006).

Secondly, the traditional specification ignores that the volume of trade from region i to region j is influenced by trade costs between the two regions relative to those of the rest of the world. These are called the multilateral resistance terms (MRTs) which account for cross-country price variation. This means that, before any bilateral sale materialises, it must have interacted with all possible alternatives and frictions. It is, therefore, imperative that any theory on bilateral trade flows should account for the relative attractiveness of origin-destination pairs. Therefore, the omission of the MRTs is a serious source of bias (Salvatici, 2013; Medvedev, 2010). Another reason for including the MRTs is that, a pair of trading partners surrounded by other open economies tends to trade less than if they were islands or surrounded by deserts or mountains, *ceteris paribus* (Gomez, 2013; Salvatici, 2013; Bacchetta *et al*., 2012; Baier & Bergstrand, 2007; Anderson & van Wincoop, 2003). One solution to this problem is to augment the traditional gravity equation with exporter and importer fixed effects as the MRTs are not observable (Prehn *et al*., 2016; Salvatici, 2013; Bacchetta *et al*., 2012; Medvedev, 2010; Anderson & van Wincoop, 2003).

Thirdly, researchers were using cross sectional data until it was discovered that this type of estimation did not control for heterogeneity among the trading countries in the analysis. This is one of the advantages of using panel data for the analysis, as it allows the researcher to take into consideration country heterogeneity (Westerlund & Wilhelmsson, 2011). According to Gomez-Herrera (2013), results of the analysis may vary substantially depending on the countries in the sample, leading to an estimation bias. Researchers have since turned towards panel data, that is, cross-section data for several consecutive years (Prehn *et al*., 2016; Baltagi *et al*., 2014; Westerlund. & Wilhelmsson, 2011; Helpman *et al*., 2008; Melitz, 2007). Panel data gives more information, more variability, and less collinearity among the variables. It also has more degrees of freedom which may improve the efficiency of econometric estimates; controlling for individual heterogeneity.

It also has a greater capacity of capturing the complexity of human behaviour and dynamics of adjustment, compared to a single cross-section or time series data. This simplifies computation and statistical inference (Baltagi *et al*., 2014; Hsiao, 2007; Gujarati & Porter, 2009). The panel approach makes it possible to disentangle the time invariant country-specific effects. It is important to note that the interpretation of the estimated coefficients in a panel setting is crucially different from that of cross-section analysis; since in a panel framework, one is able to check for cross-section deviations and is, therefore, able to interpret the parameters as elasticities (Hsiao, 2007).

4.3.4.2 Gravity Model Estimation

There is an assortment of estimation techniques in the gravity of trade literature. Each technique has advantages and disadvantages and, as such, it cannot be claimed that any technique absolutely outperforms others. Martinez-Zarzoso (2013) recommends following a model selection approach using a number of tests to select the more appropriate estimator for any application. Therefore, it has become the norm to employ different estimation approaches on the same data set as a robustness check, and as a way of comparing the performance of the different analysis methods (Head & Mayer, 2013). The most used estimation technique, in recent times, is the Poisson estimation technique, which is a log-linear pseudo maximum likelihood estimator (PPML). Westerlund and Wilhelmsson (2011) propose estimating the gravity model directly from its nonlinear form by using the PPML estimator. Since the gravity model can be directly estimated in levels, it removes the need to linearise the model by taking logarithms. Therefore, the problem of dealing with zero trade values disappears. This approach is also ideal since it not only addresses the zero-entry problem, but also provides unbiased estimates in the presence of heteroskedasticity (a common feature in trade data), and takes care of the bias caused by country-specific heterogeneity (Head & Mayer, 2013; Bacchetta *et al.*, 2012; Anderson, 2011; Martinez-Zarzoso, 2013; Westerlund & Wilhelmsson, 2011; Martin & Pham, 2008; Santos Silva & Tenreyro, 2006).

Even though the PPML estimator is mostly used for count data, Santos Silva and Tenreyro (2006) argue that the only thing necessary for this estimator to be efficient is the correct specification of the conditional mean, that is, $E(y_i|x) = exp(x_i\beta)$. They also argue that the data need not be Poisson and the dependant variable need not be an integer for the estimator to be consistent. Another appealing feature of the PPML estimator is that: in the absence of information on the pattern of heteroskedasticity, it assigns the same weight to all observations in the data set. The PPML is not without its flaws. The one flaw, which is flagged every time the PPML is mentioned in gravity model analysis, is that it may present limited dependent variable bias when a significant part of the observations is censored (Gomez-Herrera, 2013; Westerlund & Wilhelmsson, 2011).

Earlier attempts at accounting for multilateral resistance terms (MRTs) by using price indexes data have proven to be ineffective. The problems with this approach include issues of data scarcity, and the failure of existing price indices to accurately reflect the border effect (Salvatici, 2013). These problems prompted researchers to switch to more structural approaches. One of these, and arguably the most effective, is fixed (random to estimate time-invariant terms) effects estimation. This approach accounts for individual unobserved heterogeneity of each economic unit in the data set. This approach has received discipline-wide acclaim, and has been used by a number of researchers (Prehn *et al*., 2016; Head & Mayer, 2013; Anderson, 2011; Greene, 2011; Plumper & Troeger, 2007). However, it is only in cases where the precise modelling structure yields an equation in multiplicative form, when using fixed effects will yield consistent estimates of the components of primary interest (Head & Mayer, 2013).

This approach has one major advantage, the ability to deal with unobserved heterogeneity across units. However, according to Plumper and Troeger (2007), this advantage comes at a heavy price. Since this approach uses the averaging within transformation procedure, it does not work when there are variables that are time invariant, that is, constant over time. Therefore, variables like distance are excluded from the model. This poses a challenge, however, since distance is one of the core explanatory variables. This, according to Martinez-Zarzoso and Nowak-Lehmann (2003), is because the transformation wipes out such variables.

The random effects model makes one important assumption, which is the orthogonality of the individual effects and the regressors. $corr(a_i, x_{ij}) = 0 \; \forall \; i, j$. This means that, there is no correlation between the unobserved heterogeneous component, *a* and the regressors (x_s) for all the bilateral partners (*i*,*j*). In such case, the fixed effects estimator would be inefficient (Baltagi *et al*., 2014). The random effects estimator makes the assumption that the random effects are *orthogonal*, that is, statistically independent to the regressors. If this assumption does not hold, then the random effects estimator is inconsistent, and the fixed effects estimator is not unaffected.

Even though the random effects PPML approach would solve the issue of the time-invariant variables, it has other shortcomings. The most notable of all is that it suffers under a heterogeneity bias, that is, the independence assumption of residuals and covariates is not fulfilled (Prehn *et al*., 2016). An alternative is a random intercept PPML approach, which not only allows for the estimation of time-invariant variables, but it also yields estimates that are identical to those from the fixed effects PPML approach (but only under large samples). This is also true when the scale of the endogenous variable is relatively large as this helps eliminate the contribution of the prior and make the Poisson likelihood more normal. For large samples, the role of the prior vanishes and, therefore, the estimator is robust to the choice of prior. Now, in this framework the posterior mean of the fixed effects should be estimated, but because the posterior is asymptotically normal, the *Laplace* approximation used in the estimation replaces the mean with the mode. This leads to the standard fixed-effects estimation (Prehn *et al*., 2016).

Given the developments in the empirical gravity model literature, it has become very important to pick the correct model specification and estimation approach. Issues like the inherent heteroskedasticity, zero trade values, and accounting for MRTs cannot be ignored. One estimation approach that takes care of all these underlined issues is the Poisson pseudo-maximum likelihood (PPML) approach. It was used with random effects in this study, with fixed effects serving as a robustness check. Even though the fixed effects approach is deemed better than the random effects, it is unable to estimate time-invariant terms e.g. distance. Therefore the random effects model is used instead albeit with a random intercept as it yields similar estimates (to fixed effects) in large samples.

4.4 EMPIRICAL MODEL

For a long time, there was a lot of criticism and controversy concerning the lack of theoretical foundation for the gravity model. However, this has been dealt with extensively in the trade literature (Helpman *et al*., 2008; Bergstrand, 1989; Anderson, 1979). The model now rests on a solid theoretical foundation, and the focus has shifted towards model specification, that is, the log linearisation process in the presence of heteroskedasticity. Since the PPML estimator behaves well in the presence of heteroskedasticity, it is used in this study. There is also the issue of losing information due to the existence of zero trade flows especially in trade blocs where there are low income and low-middle income economies. This study uses the PPML estimator to also account for the multilateral resistance terms (MRTs) (Westerlund & Wilhelmsson, 2011). The log linearised specification has also been shown to generate biased estimates. This is because it does not control for the inherent heterogeneity among the trading countries. There is generally a lot of heterogeneity in SACU due to the different levels of development for the members. The heterogeneity has to be accounted for since a country may export different amounts of a good to two different trading partners, even though they may be equidistant from the exporter, or be members of the same RTA, and have similar economic sizes (GDP). The MRTs have to be accounted for because any trade transaction interacts with all possible destinations and impediments. The log-linearising specification also does not account for MRTs and omits zero-valued trade flows (Westerlund & Wilhelmsson, 2011; Santos Silva & Tenreyro, 2006). Since there are a lot of zero values in SACU trade processes, it is important to retain this information as it will help explain trade patterns between SACU members. The model used in this study also employs panel data to tackle some of the issues highlighted above. Panel data has a number of beneficial characteristics. It generally gives more information and variability. There is also less collinearity among the variables, more degrees of freedom which ultimately improves the efficiency of econometric estimates. This controls for individual heterogeneity and offers greater capacity for capturing the complexity of human behaviour (Baltagi *et al*., 2014; Hsiao, 2007; Gujarati, 2004).

Trade volume has been estimated using the elements under the gravity model; GDP of the importer and exporter; population of the importer and exporter; distance between them; and other trade promoting or impeding factors, for example, whether the countries are contiguous, share a currency, language, and colonizer. This study introduced the element of risk into the gravity model. The risk was aggregated, and captured in the form of an index, across the economies of the bilateral trade partners in SACU. The composite index was then used to augment the gravity model of trade to determine the impact of risk on bilateral trade.

The analysis involved the use of the panel data technique of Random Effects estimation using the PPML estimator and homoskedastic standard errors and a random intercept. The random effects model deals with data non-stationarity, cross-correlation and endogeneity in the data, but most importantly it account for multilateral resistance terms. The Fixed Effects, Ordinary Least Squares, and Generalised Least Squares estimation methods served as robustness checks. The analysis was done in *Excel*, *STATA 12*, *SIMLAB and @Risk*. Equation 4.19, below represents the empirical model used in this study.

$$X_{ijt} = exp\left(\alpha_{ij} + Dist\gamma_t + Z_{ijt}\right)Y_{it}^{\beta_1}Y_{jt}^{\beta_2}P_{it}^{\beta_3}P_{jt}^{\beta_4}R_{it}^{\beta_5}R_{jt}^{\beta_6}\varepsilon_{ijt} \qquad (4.16)$$

Where: X_{ijt} is the total monetary value of agricultural commodity bilateral trade at time *t*. This is usually exports from i to j, but this study uses import data. This is because the BELN countries report their import data more accurately since they receive dividends from the

SACU revenue pool based on the import data (Kirk & Stern, 2005). i and j are the subscripts of the importing and exporting country respectively. α_{ij} *and* γ_t are country-fixed effects of i and j (that is, dummy variables for a country being either the importer or the exporter in a pair). The fixed effects control for unobservable country attributes endogeneity as well as the presence of multilateral trade resistance. ε_{ij} is a white noise disturbance term.

Y_{it} is the Real GDP of the importing country at time t. It is expected to be positive as an increase in GDP of the importer increases consumption and consequently trade. However, since this study deals with agricultural food commodities, there is the possibility that α (the GDP_i coefficient) could be less than zero. The Engel's theorem stipulates that as income increases, the proportion of income spent on food usually decreases. This means as income increases, the proportion spent on food imports decreases. Y_{jt} is the Real GDP of the exporting country at time t. It is a measure of economic size and it is expected to be positive, as large economies trade more. P_{ijt} is population of the importer and exporter at time t.

Population is used as an estimate of the size of the domestic markets of the trading countries. The larger the market, the more each country is expected to trade. Therefore, the population variable is expected to be positive. R_{ijt} is the risk variable for the exporter and importer at time t. It is the variable of interest as it captures the effect of aggregated risk on bilateral trade flows; also an impediment to trade and, as such, is expected to be negative (Oh & Reuveny, 2010).

A number of variables are used to capture trade costs in bilateral trade. These include the distance variable. lnD_{ij} is the natural logarithm of the physical distance between the main economic centres (usually capital cities) of the trade partners i and j. It is a proxy for transport costs, and it is used to reflect the hypotheses that transport costs increase with distance. It is also expected to be negative as countries that are further apart are expected to trade less as compared to contagious countries.

In addition to the distance variable which proxies transport costs, there are a number of additional variables which are also used to capture trade costs (both transport and information costs) in bilateral trade. These variables include: dummies for landlocked countries, contiguity, common language, and common colonial history. They generally reflect the hypotheses that transport costs are expected to be higher for landlocked countries and islands, but are lower for neighbouring countries. They also reflect the hypothesis that search (information) costs are lower for trade between bilateral partners, whose business practices are similar and known to one another. The expectation is that: firms in contiguous countries, countries with a common official language, or countries with common colonial ties are likely to search for suppliers or customers in countries where the business environment is familiar.

$$Z_{ijt} = \delta_1 bord_{ij} + \delta_2 lang_{ijt} + \delta_3 col_{ij} + \delta_4 curr_{ijt} + \delta_5 landlock_{ij} \qquad (4.17)$$

Where: Z_{ijt} is a collection of trade cost observables which are used to capture trade costs. There is empirical evidence from international trade literature that each of these factors can exert a significant impact on bilateral trade flows. This is presumably because they can influence the costs of moving goods.

$Bord_{ij}$ is a dummy variable which takes a value of 1 if i and j are contiguous and 0 otherwise. It reflects the hypotheses that transport costs increase with distance and are higher for landlocked countries, but are relatively lower for contiguous countries. It is expected to be positive as countries that share a border are expected to trade more due to lower transport and administrative costs.

$Lang_{ijt}$ is a dummy variable which takes the value of 1 if i and j share a common official language and 0 otherwise. It is expected to be positive as a common language reduces the transactional costs of trade. Col_{ij} is a dummy variable which takes the value of 1 if i and j were colonized by the same country and 0 otherwise.

It is expected to be positive as colonial ties increase trade. These variables are sometimes referred to as cultural distance variables, and they capture information costs. Trade search costs are said to be lower for countries whose business practices are known to one another.

$Curr_{ijt}$ is a dummy variable which takes the value of 1 if i and j share a common currency or if the currency of i (or j) is an accepted legal tender in j (or i) at time t and 0 otherwise. It is expected to be positive as this reduces the transactional costs of trade. $Landlock_{ij}$ is a dummy variable that takes a value of 1 if both countries are landlocked and 0 otherwise. It is expected to be negative as countries that are landlocked have relatively higher transport costs and, therefore, trade less.

$$E = exp(a) - 1 \qquad (4.18)$$

Continuous exogenous variables are estimated in logarithms. Therefore, such variables are then interpreted as elasticities, while variables estimated in levels (dummy variables) are interpreted as semi-elasticities as specified in equation 4.18 (Prehn *et al*., 2016; Bacchetta *et al*., 2012).

4.5 DATA

4.5.1 Data

The greatest challenge of contemporary research is, arguably, the lack of good quality datasets, especially in the developing countries. Access to good quality data can be the difference between success and failure for a number of governments whose policies are informed by empirical research (IMF, 2014; Scrivens & Iasiello, 2010).

Figure 4.2 presents the trade statistics of the selected agricultural commodities for the period 2000 to 2018. In this period sugar was the most traded of all the commodities with a share of 26 per cent. South Africa and Eswatini are the main sugar producing members in the bloc. The second highest traded commodity was maize (13 per cent) and South Africa was the net maize exporter. Botswana, Namibia and South Africa, as the main beef cattle producers, contributed 11 per cent of traded live animals (cattle) to the SACU market.

South Africa, as the leading producer of grains, contributed about 27 per cent of grain to the SACU market. Namibia, Botswana and South Africa were the major contributors to the beef sector, and they produced about 11 per cent for the market. The least traded commodities in this time period were groundnuts and soybeans, fish, grapes and bananas, cabbages and tomatoes.

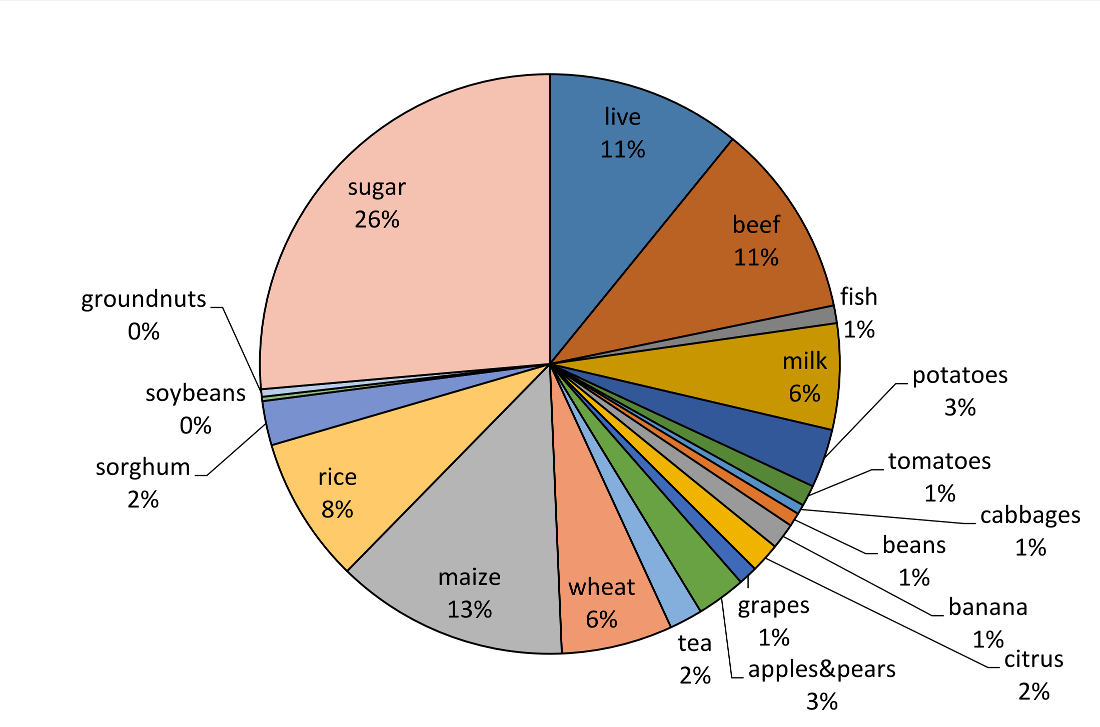


Figure 4. 2: SACU commodity trade, 2000-2018

Source: Author's computation from raw data.

4.5.2 Data Sources

The agricultural trade data used for the analysis in this study was obtained from a number of sources. These sources include the SACU Database, International Trade Centre (ITC), COMTRADE, World Bank, IMF, FAO, and WTO. Data on GDP, GDP per capita, inflation, and infrastructure was sourced from the World Bank and the IMF database. Distance data was sourced the French Research Centre in International Economics (CEPII) database.

Data on RTA membership was sourced from the WTO database. Weather data (rainfall and temperature) was sourced from the Botswana Department of Meteorological Services; Lesotho Meteorological Services; Namibia Meteorological Service; South African Weather Service; Eswatini Meteorological Services; as well as from Harvest Choice. Table 4.3 presents the data sources.

Table 4. 3: Data sources

Variable	Source	Year
GDP growth (%)	International Monetary Fund, World Bank	2018
Inflation (%)	International Monetary Fund, World Bank	2018
Poverty (%)	International Monetary Fund, World Bank	2018
Unemployment (%)	International Monetary Fund, World Bank	2018
Rain (mm)	International Monetary Fund, World Bank	2018
Temperature (℃)	International Monetary Fund, World Bank	2018
Roads (km)	World Bank	2018
Telephone (km)	World Bank	2018
Distance (km)	French Research Centre in International Economics (CEPII)	2018
Commodity trade	UN Comtrade, World Bank, SACU	2018
RTAs	World Trade Organisation	2018

Source: Author's compilation.

4.6 SUMMARY

The log linearised gravity model specification, estimated using ordinary least squares, was earlier deemed ideal in the literature, to investigate the impact of a multitude of policy issues on trade. However, there have been questions on the correct specification of the model. This is primarily because the traditional specification has a number of limiting flaws. It does not address the issues of MRTs, heterogeneity, and zero trade values. In response, a number of specifications have been proposed in the empirical literature, all with their pros and cons. There has been no consensus so far, but one specification has received more endorsement than most: the Fixed Effects Poisson Pseudo-Maximum Likelihood (PPML) specification using panel data. This specification is not without flaws but according to its proponents, the benefits outweigh the costs. For a while, as presented in the conceptual framework, institutional and physical barriers were the only impediments to bilateral trade. Risk has been introduced into the picture to control for the effect of adverse events on bilateral trade flows.

However, there is no consensus on how risk is to be quantified or measured in an economy, and how it ought to be presented in the gravity framework. Some empirical works investigate the effect of a single type of risky event on bilateral trade flows, while others investigate the effect of two or more events. This study argues that attempts to analyse the impact of risk on trade fell short as they over simplified reality and used one risky event to capture the effect of risk. This is due, in part, to the lack of a framework to aggregate risk in the domestic economy. Relying on the recently developed outline for constructing composite indices, a framework was developed and presented in this section. This framework bridges the gap in the literature, that is, provides a way of quantifying and measuring aggregate risk. This framework was used to construct a composite risk index which was used in an augmented gravity model to investigate the impact of aggregate risk on bilateral trade flows in the SACU trade bloc. Eight risk factors were chosen under four risk dimensions, and they were aggregated to come up with a composite risk index. Finally, the empirical model was presented and discussed.

CHAPTER 5

THE IMPACT OF RISK ON SACU BILATERAL TRADE FLOWS

5.1 INTRODUCTION

In a bid to understand the impact of risk on regional integration, trade researchers have augmented the gravity model of trade with a risk variable (Keshk *et al*., 2010; Oh & Reuveny, 2010; Bayer & Rupert, 2004; Anderson & Marcouiller, 2002). However, the introduction of this variable into, and the specification of the gravity framework have raised a few concerns. These concerns include: oversimplification of reality, and failure to address the ripple effect of risk events. This study, therefore, addresses these flaws by aggregating different risk dimensions in the economy into an index. The aggregation of risk achieved by constructing the risk index addresses both the oversimplification and ripple effect concerns. The constructed risk index is then used to estimate the impact of risk on bilateral trade.

In an attempt to avoid the controversy around and the subjective nature of indices (OECD, 2008; Saisana *et al*., 2005), this study followed the index construction framework as outlined in OECD (2008) and Nardo *et al*. (2005). This chapter is divided into two parts; the first part presents results from the index construction phase and the second part presents results from the gravity model analysis phase.

5.2 INDEX CONSTRUCTION

In the preceding chapter, it was highlighted that there is a lot of controversy around the construction and use of composite indices. It was argued that the exercise tends to be more of an art than a science in the sense that a number of subjective decisions have to be made. Such decisions involve the indicators, aggregation, normalisation, and weighting procedures to use. Since composite indices are used to make important decisions which affect a number of people, their construction has to be as precise, transparent, and guided by a sound theoretical foundation as possible. To address this source of controversy, researchers came up with a framework for constructing composite indices (Tate, 2012; OECD, 2008; Saisana *et al*., 2005). This study utilised this framework to construct the composite risk index, and this section presents the results. Table 5.1 illustrates the mean values of the variables used in the construction of the composite risk index. Two drivers were used in quantifying in this study. They are economic growth, inflation, poverty, unemployment, rainfall, temperature, road and telephone networks. The data covers the period from 2000 to 2018. From this table, it can be seen that economic activity decelerated in all the SACU member states during this period. The period was generally characterised by low economic growth and high inflationary pressure. Poverty and unemployment also remained high, owing to failing macroeconomic policies (World Bank, 2018).

Table 5. 1: SACU descriptive statistics of composite risk index variables

	Botswana	Lesotho	Namibia	South Africa	Eswatini	SACU
Economic growth (%)	3.8	3.5	4.1	2.8	2.0	3.2
Inflation (%)	7.3	6.5	6.9	5.7	6.9	6.7
Poverty (%)	21.2	55.8	27.0	16.2	40.6	32.1
Unemployment (%)	19.6	28.8	21.8	25.1	22.8	23.6
Rainfall (mm)	346.1	621.4	336.4	512.5	708.7	505.0
Temperature (^oC)	22.1	13.2	21.5	18.1	20.4	19.1
Road (km)	23040.3	5520.7	51740.3	360362	3223.2	88777.3
Telephone (km)	141733.5	38776.5	139384.1	4863775	44438.9	1045622

Source: Author's calculation from risk dataset (2000 to 2018).

Namibia had the highest economic growth during this time period with an average of 4.1 per cent. Botswana, Lesotho and Namibia had growth rates that were higher than the regional average of 3.2 per cent whereas Eswatini and South Africa's economies grew at 2 and 2.8, per cent respectively. On average, South Africa had the lowest inflation, which was also lower than the regional average. There was inflationary pressure on the rest of the SACU member states, with rates of around 7 per cent. Eswatini and Lesotho were plagued by poverty during this time period as over 40 per cent of their populations were poor. Both countries received the first and second highest average rainfall in the region, respectively. However, with a subdued economy, producers in these countries could not take advantage of the good rains and, as such; their respective economies have continued to suffer. Being the regional powerhouse, South Africa was the most developed of the SACU countries in terms of infrastructure in the period 2000-2018. With a road and telephone network covering 360362 km and 4863775 km, respectively; South Africa exceeded the regional averages of 88777.3 km (road) and 1045622 km (telephone).

5.2.1 Multivariate Data Analysis (MDA)

After having addressed the requirements of the first two steps (laying the theoretical framework and selecting data) in the framework, the MDA was undertaken and this section presents the results. The main idea behind this step was to help the researcher to properly measure the concept under review by joining several variables. This step also avoids measurement error (choosing the wrong indicators and reduce overreliance on any variable) in the construction of the index. Since the index is made up of several variables, this step ensures that there is no over reliance on any particular variable but rather, each aspect is properly represented. The Principal Components Analysis (PCA) procedure was chosen as the best method as it is more robust than Common Factor Analysis (CFA). It is also simpler and allows for the construction of weights which are data-based, as it was outlined and discussed in the preceding chapter.

5.2.1.1 Kaiser-Meyer-Olkin (KMO)

The Kaiser-Meyer-Olkin measure of sampling adequacy is a statistic for comparing the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients. The concept is that the partial correlations should not be very large if one is to expect distinct factors to emerge from the analysis. It is used as a justification for using the PCA method. The KMO measure has to be greater than 0.5, which means the variation between variables is high; hence, its sampling adequacy is *0.7151*. This means that the correlation between the variables is high, and this is one of the requirements for using PCA other than the factor analysis (FA) (Hair *et al*., 2010; Nardo *et al*., 2005).

5.2.1.2 Eigen values

The second step in the composite index construction procedure involves finding a few variables (principal components) from the original set that account for most of the variance, called *Eigen values*. In Table 5.2, the Eigen values of the correlation matrix of the eight sub-indicators (standardised values) that compose the composite index are presented. The sum of the Eigen values is equal to the number of sub-indicators (∑Eigen values = *Q* = 8). Since the PCA employs the correlation matrix rather than the covariance matrix, all eight sub-indicators are assigned equal weights in forming the principal components (OECD, 2008; Nardo *et al*., 2005).

Table 5. 2: Eigen values of the 8 individual Composite Index indicators

Variable	Eigen values	% of variance	Cumulative %
Component 1	***3.68***	***46.1***	***46.1***
Component 2	***1.21***	***15.1***	***61.2***
Component 3	***1.03***	***12.8***	***74.0***
Component 4	0.78	9.8	83.8
Component 5	0.65	8.1	91.9
Component 6	0.35	4.4	96.2
Component 7	0.23	2.9	99.1
Component 8	0.07	0.9	1

Extraction method: Principal Components Analysis (PCA)

Source: Output from risk analysis.

This criteria gives the main factors which are correlated with the eight indicators (those in bold), which jointly account for 74 per cent of the variance. This finding is substantiated by the scree plot (Figure 5.1), which is a plot of the Eigen values. The first Principal Component explains the maximum variance in all the sub-indicators, 46.1 with an Eigen value of 3.68. The second principal component explains the maximum amount of the remaining variance, 15.1 with an Eigen value of 1.21. The third principal component has an Eigen value of 1.03. According to the Kaiser rule, the only components retained (for the construction of the PCA weights) are those with Eigen values above unity. Figure 5.1, is a diagrammatic depiction of Table 5.2. The three principal components are the ones with points above the horizontal line (*y=1*) (Hair *et al*., 2010; OECD, 2008).

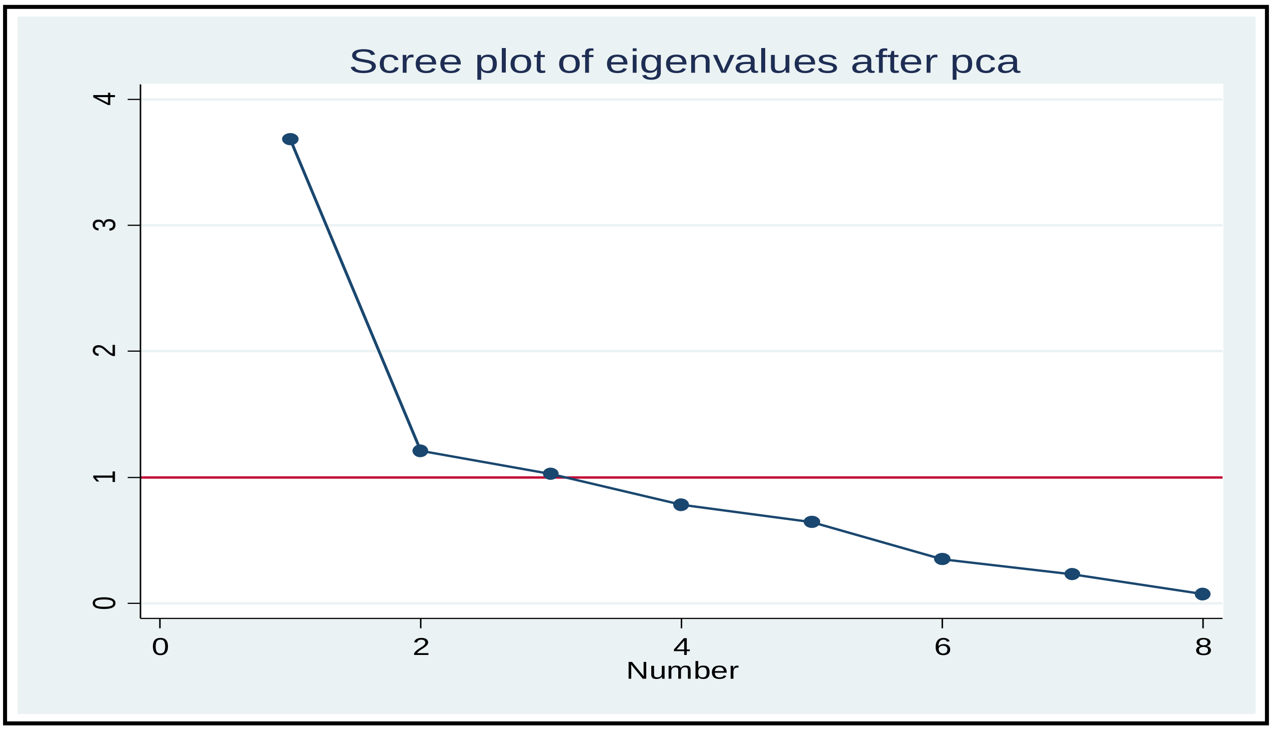


Figure 5. 1: A scree plot of Eigen values from the PCA

Source: Output from risk analysis.

There is a change in slope in the diagram which corresponds to the third Eigen value, since these express the proportion of the total variance in the data explained by each factor. A change in slope is a means of determining the optimal number of factors which explain the highest proportion of the variance. This happens after the third Eigen value. The rest of the principal components are then dropped as they explain very little of the variation (Nardo *et al*., 2005).

5.2.1.3 Eigen vectors

The objective of PCA is to explain the variance of the observed data through a few linear combinations of the original data. Even though there are eight variables, much of the variation in the data can often be accounted for by a small number of variables (three, in this case, as shown in Figure 5.1). These are the principal components, or linear relations of the original data that are uncorrelated (Nardo *et al*., 2005). At this point, there are still 8 principal components, that is, as many as there are variables. Therefore, the third step involves selecting the principal components that preserve a high amount of the cumulative variance of the original data. The principal component values, in bold print, are the ones that are retained as they explain most of the variation in the variables. These principal components have high and moderate loadings (>0.50) and they indicate how the sub-indicators are related to the principal components. Table 5.3 shows the eight components' loadings and the corresponding indicators.

Table 5. 3: Principal component for individual CI indicators (Eigen vectors)

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8
Inflation	0.0028	**-0.5644**	**0.6677**	0.2195	0.4246	0.0815	-0.0213	-0.0038
Econgrowth	0.0937	**0.7424**	0.3152	-0.0911	**0.5230**	0.1271	0.209	-0.0479
Rain	-0.3776	-0.1664	-0.2480	-0.4638	0.2738	**0.6646**	-0.1791	-0.0659
Temp	0.4267	-0.2093	0.0637	-0.3790	-0.1938	0.2380	**0.7031**	0.1949
Poverty	-0.4555	0.1365	0.3303	-0.1651	-0.2342	-0.0600	-0.0564	**0.7589**
Unemploy	-0.3698	0.0640	-0.1435	**0.6809**	-0.0907	0.3910	0.4622	0.0144
Roadcapita	0.3936	0.1787	0.2936	0.1695	-0.4439	**0.5619**	-0.4304	-0.0114
Telecapita	0.4092	-0.0637	-0.4164	0.2552	0.4165	0.0814	-0.1754	**0.6157**

Loadings greater than 0.5 (absolute values) are highlighted, n=5 countries.
Note: Econgrowth- economic growth; Temp- temperature; Unemploy- unemployment; Roadcapita- road network per capita; Telecapita- telephone network per capita.

Source: Output from risk analysis.

Table 5.3 presents the principal components and component loadings for the individual risk indicators. It can be seen that with the exception of *inflation* and *economic growth*, all the other individual risk indicators are entirely accounted for by one principal component. Interestingly, only the first two risk indicators are clearly loading on a single component (Comp 2) as expected. This means that component 2 clearly has pure economic underpinnings and, to some extent, components 3 and 5. Table 5.4 presents the component loadings for the composite index sub-indicators on the three principal components. This is after dropping principal components that explain little variation in the data; only three principal components are retained. The flaw with this procedure is that the identification of the principal components is arbitrary. It is not possible to determine which of the original principal components were retained, only the quantity is known (Nardo *et al*., 2005).

Table 5. 4: Eigen values of the three components with the most loadings

Variable	Comp1	Comp2	Comp3	Unexplained
Inflation	0.0028	**-0.5644**	**0.6677**	0.1566
Econgrowth	0.0937	**0.7424**	0.3152	0.1983
Rain	-0.3776	-0.1664	-0.2480	0.378
Temp	**0.4267**	-0.2093	0.0637	0.2721
Poverty	**-0.4555**	0.1365	0.3303	0.1011
Unemploy	-0.3698	0.0640	-0.1435	0.47
Roadcapita	0.3936	0.1787	0.2936	0.302
Telecapita	**0.4092**	-0.0637	**-0.4164**	0.2003

Extraction method: principal components: Loadings greater than 0.4 (absolute values) are highlighted, n=5 countries

Source: Output from risk analysis.

The values marked in bold represent moderate and high individual loadings. This is an assumed causal effect of a latent variable and the observed indicators. This relationship is determined by the factor loadings and ideally factor loadings should greater than 0.4 to represent a high correlation. From the table, it can be seen that the first two principal components account for the most loadings, five out of eight. All the indicators, with the exception of Inflation and Telecapita, are entirely accounted for by one principal component. Rain and Roadcapita are not accounted for by any of the principal components. An undesirable property of these components is that: two sub-indicators are related strongly to two principal components instead of only one.

Table 5.5 presents the rotated factor loadings of the three principal factors. The extraction method used is the principal factors maximum likelihood. There is a change in the factor loadings; for example, with most of the indicators now loading on factor 1: *poverty*, *unemployment*, *rain*, *temperature*, *road* and *telephone networks*. *Inflation* and *economic growth* still load on the same factor. The importance of the rotation step is to enhance the interpretability of the factor loadings. This is done through maximising loading of individual indicators on individual factors. From this table above, only *factor 2* can be classified as economic, as the indicators that load on it are purely economic. It is hard to put factors 1 and 3 into a single class, as the indicators that load on them are from multiple classes.

Table 5. 5: Factor loadings based on rotated principal components

Variable	Rotated factor loadings			Squared factor loading (scaled to unity)			PCA Weights
	Factor1	*Factor2*	*Factor3*	*Factor1*	*Factor2*	*Factor3*	
Inflation	0.028	**-0.5644**	**0.6677**	0.00	**0.319**	**0.446**	*0.109*
Econgrowth	0.0937	**0.7424**	0.3152	0.01	**0.551**	0.099	*0.270*
Rain	**-0.3776**	-0.1664	-0.248	**0.14**	0.028	0.062	*0.057*
Temperature	**0.4267**	-0.2093	0.0637	**0.18**	0.044	0.004	*0.138*
Poverty	**-0.4555**	0.1365	0.3303	**0.21**	0.019	0.109	*0.119*
Unemployment	**-0.3698**	0.064	-0.1435	**0.14**	0.004	0.021	*0.190*
Roadcapita	**0.3936**	0.1787	0.2936	**0.15**	0.032	0.086	*0.068*
Telecapita	**0.4092**	-0.0637	**-0.4164**	**0.17**	0.004	**0.173**	*0.048*
Explained variance	1.0008	0.9999	1.0000				
Explained variance/total	0.3335	0.3332	0.3333				

Extraction method: principal components

Source: Output from risk analysis.

5.2.2 Normalisation

The following graph, Figure 5.2, shows the basis for using the *Min-Max Rescaling* normalisation procedure. The distribution of the different variables allows for the use of such a procedure. This procedure entails plotting the data across the different variables (for all the countries) to determine their respective distributions. The plotting involves finding the minimum and maximum data values, the second and third quantiles, as well as the median. The idea is to determine the skewness of the distribution, and whether there are outliers in the data.

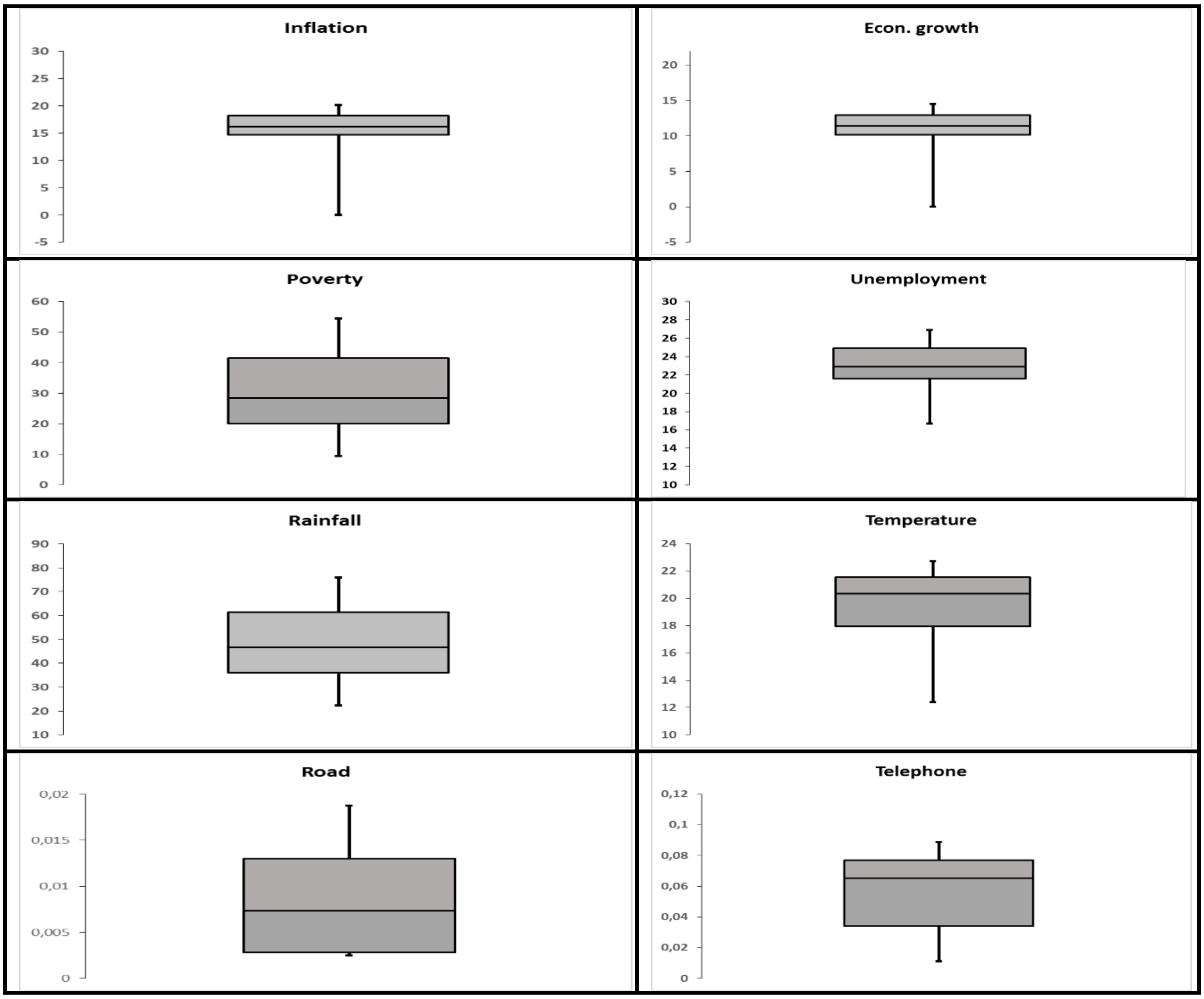


Figure 5. 2: Distributions of risk dimension indicators

Source: Output from risk analysis.

Normalisation is not ideal for data sets with a large proportion of outliers which can distort the normalised indicator (Nardo *et al.*, 2005). To control for this, the first step is to take into consideration the distribution of our data. This graph Figure 5.2 shows the distribution of the eight risk indicators (variables) used in the construction of the composite index, and what can be seen is that: there are no extreme outliers in the data. However, the distributions are skewed for inflation, economic growth, temperature, and road networks.

5.2.3 Aggregation and Weighting Results

Table 5.6 shows the statistics of the composite indices of the SACU member states. The results under the input column are from the raw data. The composite indices were also simulated to determine the robustness of the process used to construct the indices. There is a negligible difference between the statistics from the dimension inputs and the simulated numbers, which proves the robustness of the process.

Table 5. 6: Statistics properties of the Composite Indices

	CI statistics				
Country	**Input**			**Simulation**	
	Mean	*Std. dev.*	*PDF*	*Mean*	*Std. dev.*
Botswana	0.322	0.0525	ExtValMin	0.322	0.0520
Eswatini	0.749	0.0533	Pearson	0.749	0.0533
Lesotho	0.209	0.0345	ExtValMin	0.295	0.0337
Namibia	0.457	0.0956	ExtValMin	0.457	0.0983
South Africa	0.326	0.0678	Beta	0.326	0.0664

Source: *Author's computation from raw data (2010-2018).*

The means are equal for each case at the one decimal place. Eswatini has the highest index, and this equates to the highest risk across the SACU. It is followed by Namibia and South Africa, while Botswana and Lesotho occupy the last two places, respectively.

Table 5.7 presents a summary of the construction of the four different types of indices. The idea behind this process was to validate the index construction framework, and this was done by using different procedures under the weighting and aggregation processes. According to Nardo et al. (2005) a structurally sound index framework is one that produces similar results when the different sources of uncertainty are explored. The indices are CR1, CR2, CRpca1 and CRpca2. CR1 and CR2 were constructed using equal weighting combined with geometric and arithmetic aggregation, respectively. CRpca1 and CRpca2 were constructed using PCA weights combined with geometric and arithmetic aggregation, respectively.

Table 5. 7: Summary of weighting, aggregation and normalisation

	Weighting	Aggregation	Normalisation
CR1	Equal	Geometric	Min-Max Rescaling
CR2	Equal	Arithmetic	Min-Max Rescaling
CRpca1	PCA	Geometric	Min-Max Rescaling
CRpca2	PCA	Arithmetic	Min-Max Rescaling

Source: Output from risk analysis.

The results of the different indices across the SACU member states are presented in Figure 5.3. Two of the most important steps in the composite index construction process are aggregation and weighting, that is, the need to combine different dimensions of the index using specific proportions. According to Nardo *et al*. (2005), a decision has to be made on which of the weighting and aggregation models will be employed in aggregating the information at hand. Figure 5.3 illustrates the differences between the four composite indices: *CR1*, *CRpca1*, *CR2* and *CRpca2* for the respective SACU states. This stage tests the robustness of the constructed index, and further validates the methodology used. The idea is to use different aggregation and weighting procedures and note any changes in the resultant indices (Nardo *et al*., 2005).

The composite index results for South Africa are more robust. As shown in Figure 5.4, there is the least difference between the four constructed composite risk indices for the country. All the indices have almost equal values between 2000 and 2005. The low variation between the constructed composite indices for the same country is an indication of the reliability of the dataset (Nardo *et al*., 2005).

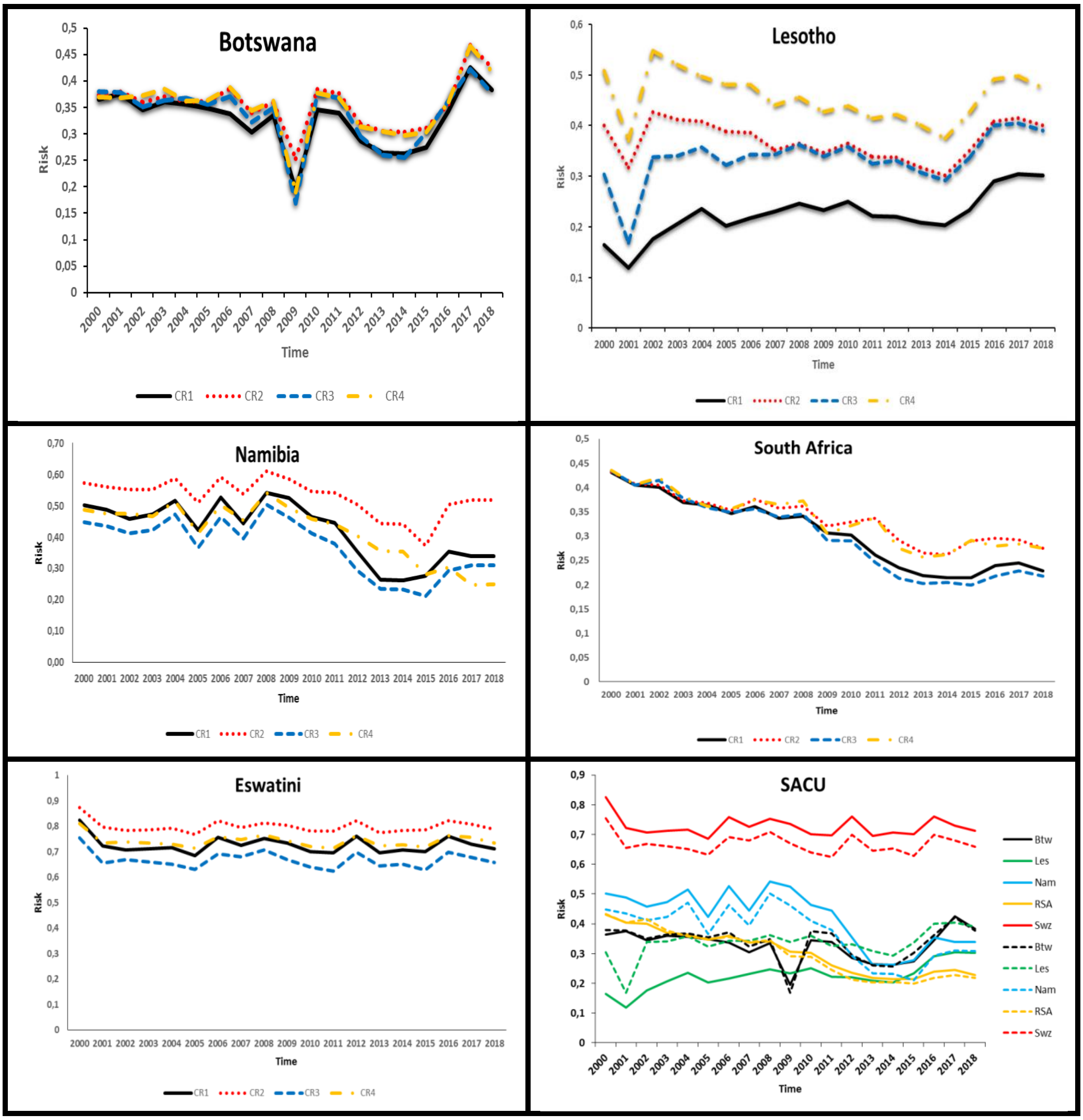


Figure 5. 3: Differences between indices in the SACU member states

Source: Output from risk analysis.

The Botswana case also presents a composite risk index with minimal variation across time. There is, however, a sharp decrease and increase for Botswana's risk index around 2009. According to ADB (2019), Botswana's economy has been relatively vibrant since the beginning of the 21st century, driven by mining, energy generation, and current account surpluses. This led to the observed decrease in risk as the resilience of the country increased.

This resilience was, however, put to the test by the global financial crisis of 2008. Namibia and Eswatini also have low variation between the constructed indices. Lesotho has by far the highest variation of all the SACU member states and, as indicated before, this is a sign of the lack of reliability for the country's data set (Nardo *et al*., 2005). The shape of the index plots indicates the appropriateness of the methodology (Hair *et al*., 2010). This would, therefore, mean that the methodology used for constructing the index is appropriate.

Interestingly, the risk indices of the more developed countries in the bloc, South, Botswana and Namibia, show a downward trend over time (Figure 5.3). This means that risk decreases with time in these countries, and it is particularly more pronounced in the South African case. The steady decrease in risk over time is to be expected, as more advanced economies are better placed to deal with the effects of domestic risk, that is, resilience. This means that such economies have the resources needed to return to a past and/or settle on a new equilibrium after a shock (WEF, 2013). The risk index plots of the relatively less developed countries (Lesotho and Eswatini) show a much more constant risk index over time, with even an increase for Lesotho from 2004-2010 (as shown by the trendline in Appendix Figure A1). These results were expected because the relatively less developed countries lack resources and are, therefore, not expected to cope with the risk in the short to medium term (WEF, 2013). Lesotho's risk index also has a higher degree of variation over time, and this attests to the lack of data reliability in developing countries (World Bank, 2018).

These results show that risk is a constant feature in the economies of the two least developed SACU member states. It also shows that the relatively less developed economies in the bloc are less resilient and are, therefore, unable to deal with the adverse effects of risk in their economies; hence, the risk does not decrease with time as is the case with South Africa, Botswana and Namibia. Figure 5.4 presents a comparison between the four classes of indices across the SACU. All the presented results are robust as they have the same shape across all the different weighting and aggregation procedures.

Eswatini has the highest values across all the different types of composite risk indices. This result was expected as poor countries are inherently risky due to a low resource base (WEF, 2013). South Africa and Botswana had relatively the lowest risk throughout the period under review. The composite risks values of Eswatini and Lesotho remain constant across time, while those for South Africa, Botswana and Namibia decrease. The decrease in the risk of the bigger economies proves that they are more resilient. This means that they are able to deal with the risk in their domestic economies timeously (WEF, 2013).

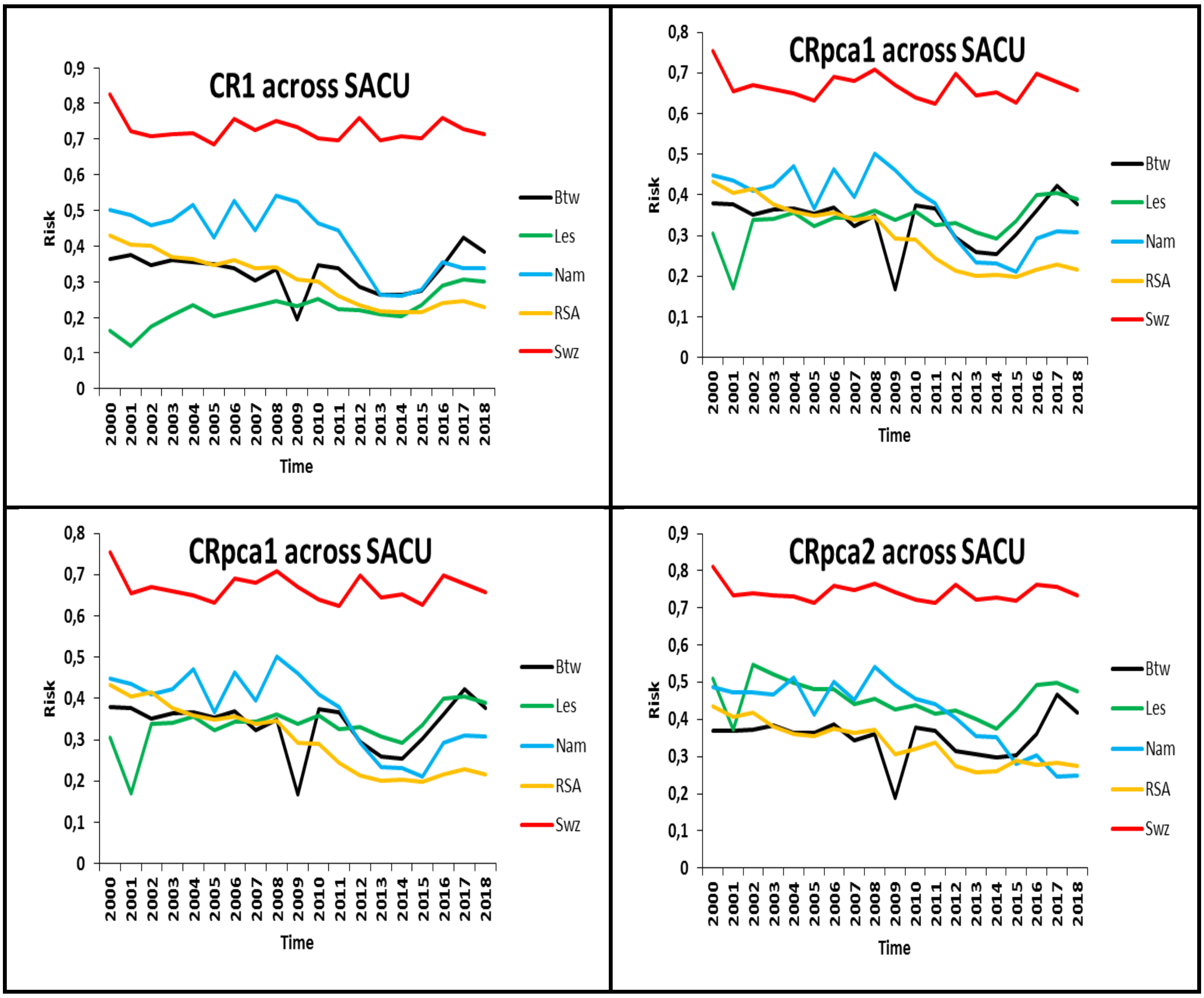


Figure 5. 4: Differences between indices across the SACU countries

Source: Output from risk analysis.

Lesotho had the highest variation in the constructed risk indices with a range of 0.45. This means that the composite index for the country is less robust, that is, different procedures give different values. This could be due to unreliable data for the Lesotho case. The composite indices of the other SACU states are more robust. Namibia has the second highest range, followed by Eswatini, Botswana, and South Africa having the lowest (0.25). The composite indices for South Africa are the most robust, and this may be due to the more reliable dataset.

5.3 THE LEVEL OF RISK IN SACU MEMBER STATES

Ultimately a choice had to be made between the different procedures and come up with one that produces the best results. The geometric aggregation with equal weights procedure (used to construct composite risk index *CR1*), was the preferred methodology due to its robust results. It is also the most utilised aggregation and weighting methodology in the literature (Aguna & Kovacevic, 2011; OECD, 2008; Nardo *et al*., 2005). Table 5.8 presents the descriptive statistics of the aggregate risk across the SACU member states.

Table 5. 8: Descriptive statistics of aggregate risk across SACU

	Mean	Minimum	Maximum
Botswana	0.33	0.19	0.43
Eswatini	0,73	0.68	0.82
Lesotho	0.22	0.12	0.31
Namibia	0.42	0.26	0.54
South Africa	0.31	0.21	0.43

Source: Output from risk analysis.

Eswatini had the highest aggregate risk in the time period under review which averaged 0.73 with a minimum of 0.68 and a maximum of 0.82. This means that the country's economy was characterised by very high risk. This means the Eswatini economy is very fragile such that it lacks the capacity to recover from external shocks. This calls for programmes that will improve the resilience of the Eswatini macroeconomic landscape. This entails programmes to help different sectors of the economy recover timeously from external shocks. Namibia had the second highest composite values ranging between 0.3 and 0.5. The Namibian government needs to invest in key industries e.g. beef production, fishing (where they have a comparative advantage) in order to improve the resilience of the domestic economy. Botswana and South Africa had the lowest aggregate risk values when Lesotho is excluded (due to results not being reliable). Botswana and South Africa have average aggregate risk means of 0.3, and their minimum and maximum values are in the range of 0.2 and 0.4, respectively. The composite indices of Eswatini and Lesotho show the familiar trend of being almost constant across time, as shown in Figure 5.5.

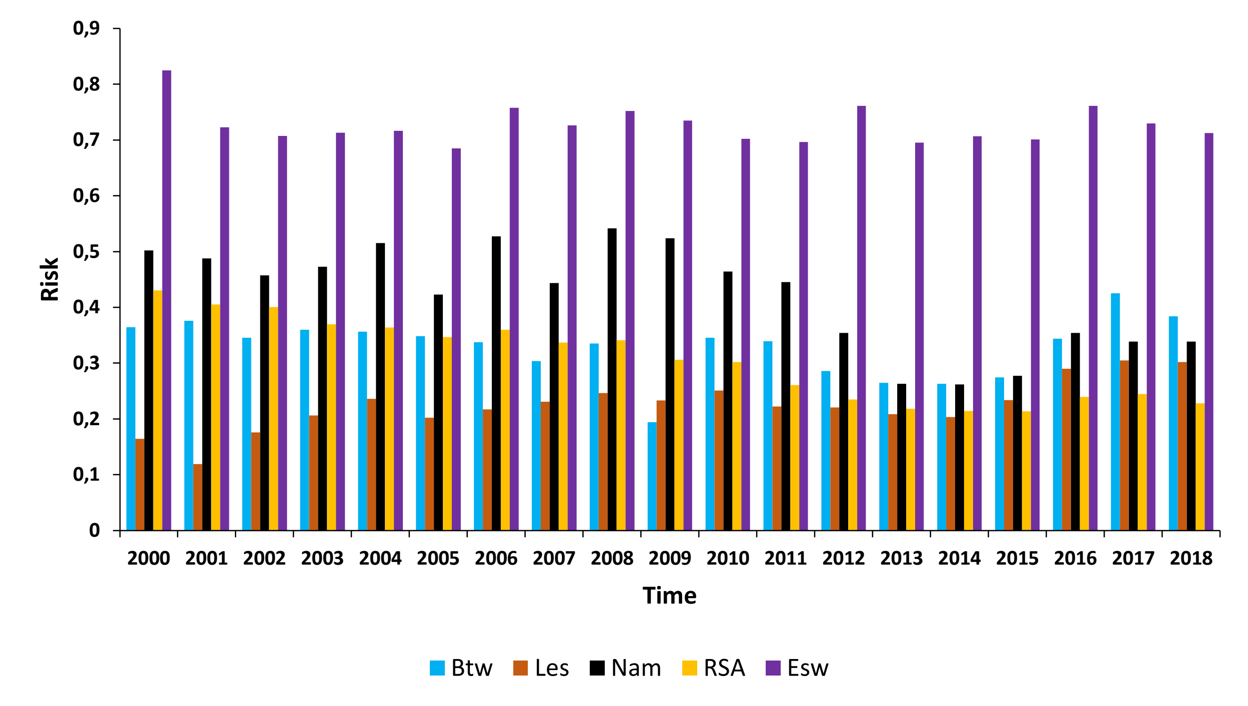


Figure 5. 5: The levels of aggregate risk in the SACU member states, 2000-2018

Source: Output from risk analysis.

From this graph, it can be seen that the aggregate risk for South Africa shows a steady decline over time, from 4.3 in 2000 to 0.2 in 2018. This is to be expected for big economies which have the resources to address and minimise the effects of risky events in the domestic economy. The indices for Botswana and Namibia also show a declining trend over time, albeit, with a lot more noise. This decline in the risk over time means the ability of the macro economy to cope with risk in the long run. There is however a need to improve the resilience of key sectors in the economy. The risk index for Lesotho shows an increase overtime from 2001 to 2010, while the index for Eswatini is generally constant over time.

Generally, the risk in the economies of the more developed SACU states decrease with time, while the smaller SACU members, on the other hand, as expected, have a somewhat increasing risk trend over time. From the graph, Lesotho has the lowest aggregate risk. This is depicted by a low average composite index of 0.23. South Africa has the largest index range; this is depicted by the wide base of the PDF (as shown by Appendix Figure A8). It has the second lowest composite index (average 0.33). Botswana and Namibia follow with average values of 0.35 and 0.48, respectively. Eswatini has the highest average 0.75. These results are in line with the results shown on Table 5.9, which highlight the robustness of the *CR1* composite risk index. According to risk literature, risk that is constant or increasing over time is an indication of a lack of resilience as the system under review is unable to find a new equilibrium. The more developed countries in the bloc on the other had had a more pleasant scenario. They might have had periods where the risk was around average, but it generally had a decreasing trend through time. This is an encouraging situation because it outlines the system's ability to manage the risk it is facing.

Table 5. 9: Risk dimension statistics of the SACU states

Dimension Statistics												
	Economic			Social			Environmental			Technological		
Country	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Botswana	0.474	0.09	0.61	0.337	0.10	0.34	0.319	0.14	0.53	0.449	0.39	0.54
Eswatini	0.428	0.35	0.56	0.451	0.43	0.57	0.578	0.44	0.84	0.0591	0.034	0.19
Lesotho	0.445	0.081	0.64	0.774	0.60	0.99	0.208	0.14	0.33	0.0324	0.0086	0.057
Namibia	0.474	0.37	0.71	0.283	0.091	0.59	0.299	0.079	0.44	0.636	0.55	0.76
RSA	0.432	0.34	0.52	0.219	0.02	0.42	0.380	0.27	0.47	0.388	0.30	0.43

Source: *Author's computation from raw data (2010-2018).*

This table presents the statistics of the different risk dimensions used to construct the composite risk indices for the respective SACU states. Botswana and Namibia have the highest mean (0.47) under the economic dimension, while South Africa and Eswatini had the lowest (0.43). This means that Botswana and Namibia had low economic growth and higher inflation rates during this time period. Lesotho and Eswatini take first and second spot in the social dimension with values of 0.78 and 0.45, respectively. This means the economies of Lesotho and Eswatini were characterised by high unemployment and poverty. Under the environmental dimension, Eswatini had the highest mean of 0.58, followed by RSA with

0.38. These results mean that Eswatini and RSA had the lowest rainfall and highest temperatures during the time under review. Lastly, under the technological dimension, Namibia had the highest mean in (0.64). This means that the Namibian economy had the poorest quality road and telephone networks between 2000 and 2018.

5.3.1 Level of Economic Risk in SACU

The world economy is said to have recovered steadily since the 2008 global financial crisis. The global economic growth had been rising steadily since 2010 before falling to a six-year low of 3.2 per cent in 2016. However, the economic growth is projected to continue an upward trend to reach 3.9 per cent in 2019 (UN, 2018). Interestingly, even in Southern Africa, economic growth is said to have been increasing steadily after the financial crisis of 2008. However, the quoted global economic growth low of 2016 (3.2 per cent) happens to have been the regional average in the SACU for the past eight years (ADB, 2019). This means the SACU economies have been unable to match the rest of the world in terms of economic growth. This compromised economic situation renders the SACU countries vulnerable to the global shocks (price and demand fluctuations) that are a result of international trade.

Inflation in SACU has been a constant menace; the average was around 6.9 per cent in the time period under review, and weak economic growth was cited among the major drivers (World Bank, 2018). Inflationary pressure in SACU member states that are part of the Common Monetary Area (CMA) with South Africa (Lesotho, Namibia and Eswatini) was cushioned by a lower inflation rate in South Africa (5.7 per cent, see Table 5.1). This is because inflation in these countries tracks movements in South Africa’s inflation patterns due to linked monetary policy through the CMA. Botswana’s monetary policy is independent of South Africa; hence, her inflation was much higher between 2000 and 2018 (ADB, 2019).

The economic situation discussed above is presented in Figure 5.6. The figure is a graphic representation of the situation in SACU bloc over the time period under review with regards economic risk. The trade bloc experienced low economic growth (averaging 3.2) and high inflation (around 6.9) and, as such, the economic risk was around 0.5 on average. The economic risk was the highest of all the risk classes across the SACU. Generally, SACU had moderate economic risk; however, there was relatively high inflation in the time period under review such that there is still a need to cushion consumers in the bloc against the high prices of goods and services.

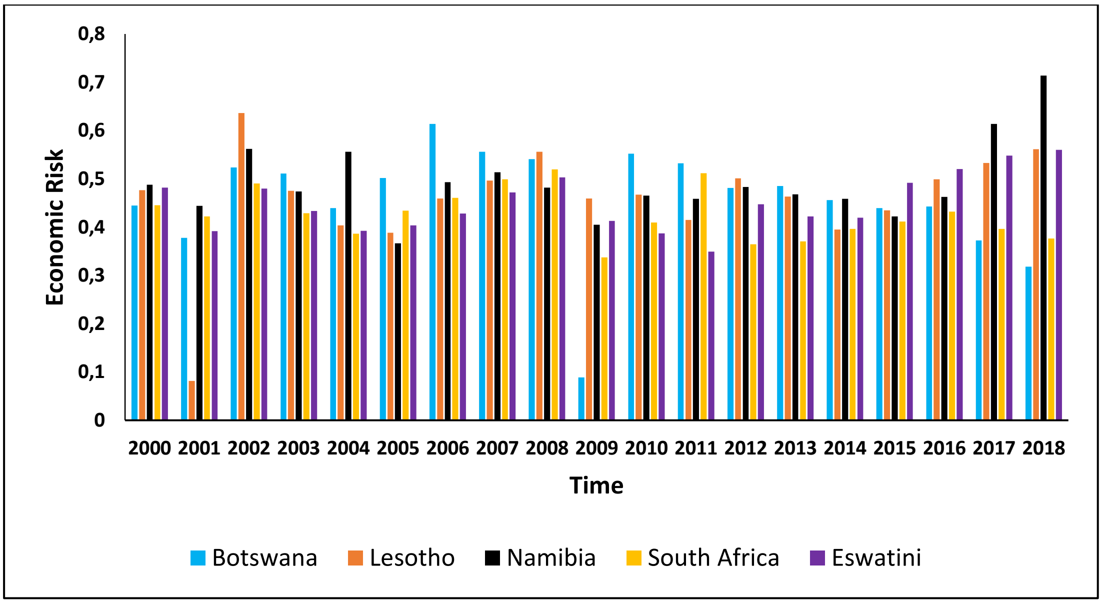


Figure 5. 6: Economic risk across SACU, 2000-2018

Source: Output from risk analysis.

5.3.2 Level of Social Risk in SACU

The upper middle-income countries in the SACU: Botswana, Namibia, and South Africa have, over the years, made significant progress in reducing poverty compared to Eswatini and Lesotho. The regional average of 32.1 from 2000 to 2018 is a reflection of the successful socio-economic policies of the bigger economies in the trade bloc. Lesotho and Eswatini registered average poverty rates of 55.8 per cent and 40.6 per cent, respectively, over the same time period (ADB, 2019). Therefore, solving the poverty puzzle in SACU, generally, requires policy intervention that addresses issues of unemployment and income redistribution (ADB, 2019; World Bank, 2018).

The SACU member states have done well in addressing unemployment issues across their economies (with the regional average of 23.6 per cent, see Table 5.1). However, the prevalent high unemployment rates limit the distributional power of economic growth to lift families out of poverty. The region needs to prioritise addressing socioeconomic inequalities in its poverty-reduction agenda (ADB, 2019). Figure 5.7 presents the social risk from 2000 to 2018 across the SACU.

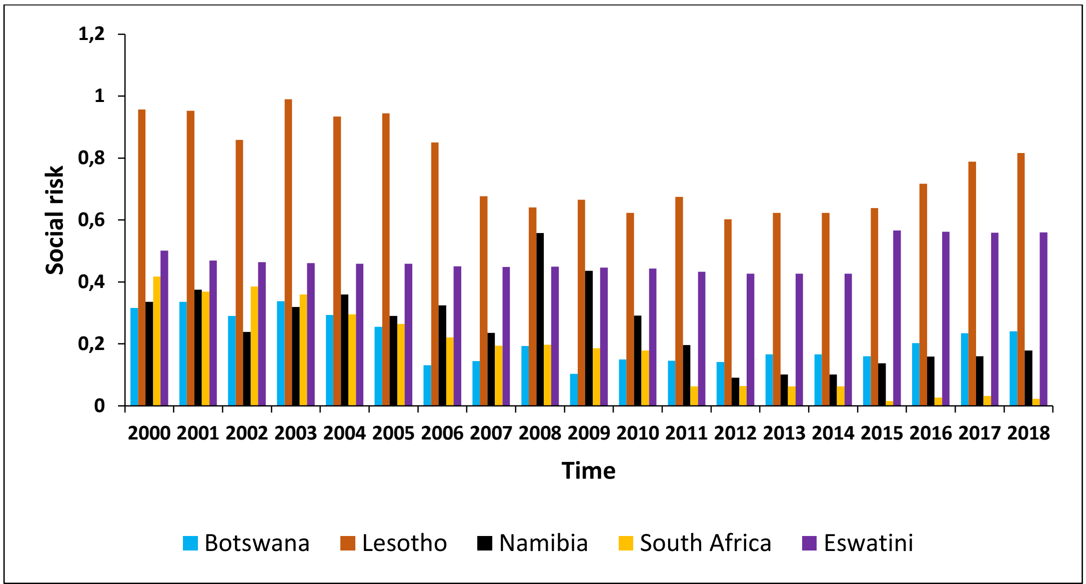


Figure 5. 7: Social risk across SACU, 2000-2018

Source: Output from risk analysis.

Lesotho has the highest social risk of the SACU members. It has an average of 0.6 and a maximum value of 0.99. Eswatini has the second highest social risk in SACU, 0.45. The relatively less developed SACU members (Eswatini and Lesotho), have struggled to keep poverty and unemployment rates low. The ADB (2019) lists a number of complex macroeconomic challenges: overreliance on the dwindling SACU receipts to fund the national budgets. Other challenges include fiscal strain and low domestic revenues, and inflationary pressures. There is an urgent need to ensure sufficient revenue for development, spending to stimulate growth, and generate employment. However, with low projected income growth, this remains a very tall order. Botswana and Namibia have enjoyed relatively low social risk values in this time period, 0.34 and 0.28 respectively. Based on the data, South Africa had the lowest social risk of all the SACU states. With an average of 0.22, the SACU powerhouse has made real strides in curbing unemployment and poverty. The low social risk in the more developed SACU states has been attributed, in part, to domestic resource mobilisation and social development policies, which have triggered steady domestic growth and finance development (ADB, 2019).

5.3.3 Level of Environmental Risk in SACU

SACU's recovery from the El Nino-induced drought of 2015 has been modest at best. This recovery has been driven by favourable weather conditions, which led to higher agricultural output. However, SACU did not fully benefit from these favourable conditions because of the slow economic growth in the South Africa economy, which left aggregate demand and supply unchanged. Given the dependence of the other SACU states on South Africa, even favourable weather conditions in their domestic economies could not translate into tangible economic benefits (ADB, 2019). A high percentage of Botswana's landmass is occupied by the Kalahari Desert, leaving the country with a limited supply of fresh water. Botswana‘s arid and semi-arid climate leads to low rainfall and high rates of evapotranspiration.

Drought is the most frequent natural hazard, with one in four years being a drought year. Climate change may exacerbate this rainfall variability and increase temperatures, and this would further put pressure on the Botswana economy (World Bank, 2018). One would have expected Botswana to have a much higher environmental risk (compared to the 0.32 average, see Table 5.10) based on the assessment above. Figure 5.8 shows moderate environmental risk for Botswana between 2000 and 2015, with a close to 50% increase in 2016 after the drought. Lesotho's mountainous topography and socio-economic conditions renders it highly vulnerable to adverse impacts of climate change. The country has a continental temperate climate characterised by average temperature ranges between -10°C in winter and 30°C in summer. It receives an average of 700 mm per annum which tends to be highly variable; temporally and spatially; thus, droughts and floods are common occurrences. Snowfall and strong winds are also common, causing destruction to infrastructure. Floods and droughts have resulted in severe loss to agricultural crops and livestock, resulting in food insecurity implications (World Bank, 2018). From Figure 5.8, it can be seen that Lesotho had the lowest environmental risk of all the SACU member states. Since 2015, Namibia has experienced one of the worst dry spells in its history. This has seriously affected agricultural productivity, which dropped by an estimated 42%. At the beginning of 2019, a state of emergency was declared due to poor rainfall, high temperatures, and the prevalent drought. Word Bank (2019) and ADB (2019) highlighted that 500,000 Namibians face food insecurity and water shortages, and within six months an estimated 60,000 head of cattle have starved due to inadequate grazing. However, Figure 5.8 presents a different picture of the Namibian environmental risk; with an average of 0.3; Namibia had the lowest environmental risk since the year 2000.

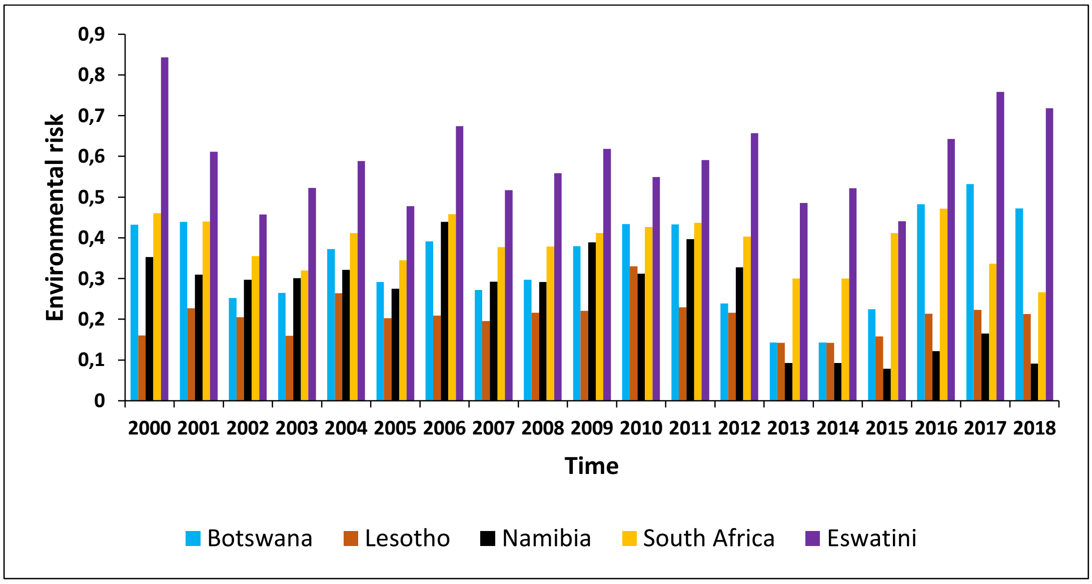


Figure 5. 8: Environmental risk across SACU, 2000-2018

Source: Output from risk analysis.

South Africa is a relatively dry country with an average annual rainfall of about 464 mm. The country is, generally, a summer-rainfall region except for the Cape, which is a winter-rainfall region. Temperatures in South Africa tend to be lower compared to other countries at similar latitudes, owing mainly to greater elevation above sea level. The altitude keeps the average summer temperatures below 30°C and below freezing point, in some places. There is a striking contrast between temperatures on the country’s east and west coasts due to the different currents that sweep the coastlines (World Bank, 2018). Figure 5.8 depicts a mild environmental risk for the country with an average of 0.4. Eswatini, like a number of developing countries in Sub-Saharan Africa, relies heavily on the physical environment. Rainfall is the major driver of agricultural productivity and economic growth. Therefore, droughts and unpredictable weather conditions disrupt economic activities and sever lifelines for many rural communities in the country whose livelihoods depend on rain-fed agriculture. The country has a continental temperate climate characterised by average temperatures of around 25°C. It receives an average of 600 mm per annum with occasional heavy downpours (World Bank, 2018). The environmental risk depicted by Figure 5.8 for Eswatini is a stark contrast to what is happening on the ground. With such favourable weather conditions, one would have expected a lower environmental risk value.

5.3.4 Level of Technological Risk in SACU

Infrastructure is one of the main drivers of the exchange in goods between different countries worldwide. It makes a vital contribution to effective productive and trade processes in the economy (ADB, 2019). Infrastructure contributed over 2 per cent to Botswana's improved per capita growth performance in the last ten years. Raising the country's infrastructure endowment to that of the region's infrastructural leader (South Africa) could boost economic growth exponentially (ADB, 2019). Botswana made significant progress toward improving its infrastructure in recent years with a strong investment record in the road and telecommunication sectors, and has successfully increased rural access to power. However in 2019, the country still faces a number of challenges; segments of international road corridors are at a basic level. The country has also not yet achieved full national connectivity of road and telecommunication networks (World Bank, 2018). There is however still a lot of ground of cover if the country wants to reduce the technological risk (0.46), which is the second highest in the bloc, as shown in Figure 5.9.

Road infrastructure dominates Lesotho's transport networks, making up more than 70 per cent of domestic transport needs. The country's rocky topography has made the development of roads and telephone networks a challenge. This has had significant implications for accessibility and trade. Although the lowlands and foothills are relatively well served, they constitute just a quarter of the country's total area. Relatively few roads connect villages and towns in the highland districts that constitute 75 per cent of the country. Isolated rural populations still struggle to access agricultural markets and business opportunities due to limited road and telephone connections (World Bank, 2018).

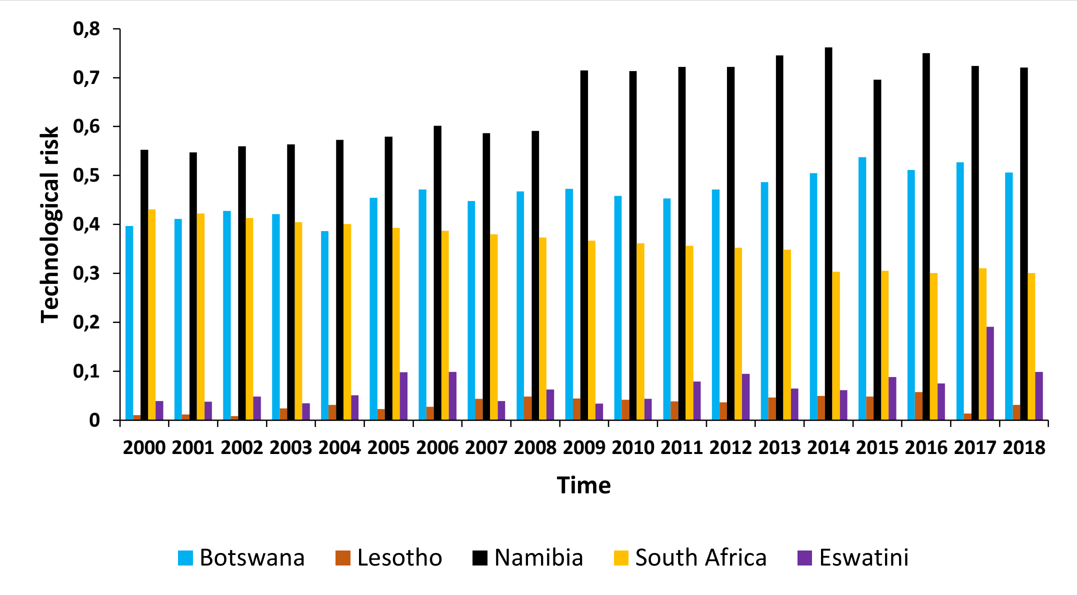


Figure 5. 9: Technological risk across SACU, 2000-2018

Source: Output from risk analysis.

Namibia has a well-established road network of about 46,376 km, some of which need urgent rehabilitation. The majority of towns and communities can be reached, and this extensive road network facilitates trade between Namibia and its neighbouring states. However, most of the country's road and telecommunications infrastructure has been in existence prior to independence, and are in urgent need of rehabilitation and maintenance (World Bank, 2018). This could be the reason why Namibia has the highest technological risk in the SACU trade bloc, with an average of 0.65 (as shown in Figure 5.9).

South Africa's road network is the longest of any African state, let alone the SACU member states. The transport sector is a key contributor to South Africa's competitiveness in global markets. The transport infrastructure is modern and among the most developed in the world. While 90 per cent of the national road network is in good to excellent condition, there is a need for maintenance and rehabilitation. Telecommunication infrastructure, on the other hand, needs attention, especially in the rural and informal settlements (Wold Bank, 2009; ADB, 2019). The high population in the bloc's powerhouse may be due to the third highest technological risk (0.34) in the bloc.

Eswatini still faces many infrastructure bottlenecks in transport and telecommunications, which increase the cost of doing business. The country has a 1 500 kilometre road network, 75 per cent of which is paved. District roads, which account for 2 055 km, are unpaved and in poor condition (World Bank, 2018). The telecommunications sector is characterised by monopolies in both the mobile and fixed telephone networks and, as such, the country lags behind its neighbours in telecommunications services (ADB, 2019). Lesotho and Eswatini have the lowest technological risks, 0.033 and 0.070 respectively. This result may be due to the fact that the analysis involved controlling for population (per capita) and Lesotho and Eswatini have relatively low populations compared to Botswana, Namibia and South Africa.

5.3.5 Summary and Policy Implications

The economies of the less developed countries in SACU (Eswatini and Lesotho) were characterised by very high aggregate risk between 2000 and 2018. This situation was further exacerbated by the fact that the risk was constant or increasing over time. This means that the countries had high risk and low resilience. According to risk literature, risk that is constant or increasing over time is an indication of a lack of resilience as the system under review is unable to recover from the shock or find a new equilibrium. The more developed countries in the bloc on the other hand had a more pleasant scenario. They might have had periods where the risk was around average, but it generally had a decreasing trend through time. This is an encouraging situation because it outlines the system's ability to manage the risk it is facing.
The economic situation of the SACU bloc was dire in the period 2000 to 2018. The inflationary pressure and low economic growth in the SACU bloc meant the members were

unable to realise the predicted steady economic growth after the 2008 financial crisis. The average economic growth was 3.2 per cent and the consequent inflation pressure was around 6.9 per cent. The average economic risk in the bloc was 0.5. The high economic risk, which was the highest of all the risk dimensions across SACU, compromised the resilience of the bloc.

Lesotho and Eswatini had the first and second highest social risk between 2000 and 2018, 0.65 and 0.45. This means that the relatively less developed SACU members had high poverty and unemployment rates. The more developed members, Botswana, Namibia and South Africa had lower poverty and unemployment rates meaning they have made real strides in curbing unemployment and poverty in their economies.

SACU member states, like a number of developing countries in Sub-Saharan Africa, rely heavily on the physical environment. Rainfall is the major driver of agricultural productivity and economic growth. Drought is the most frequent natural hazard, with one in four years being a drought year such that droughts and unpredictable weather conditions disrupt economic activities which depend on rain-fed agriculture.

Given the dependence of the other SACU states on South Africa, even favourable weather conditions in their domestic economies could not translate into tangible economic benefits (ADB, 2019). A high percentage of Botswana’s landmass is occupied by the Kalahari Desert, leaving the country with a limited supply of fresh water. Botswana‘s arid and semi-arid climate leads to low rainfall and high rates of evapotranspiration. There is an urgent need to firm up on the resilience of key sectors of the SACU economy with a view to reduce the high dependence on the physical environment.

Infrastructure is one of the main drivers of the exchange in goods between different countries worldwide. The Namibian road and telephone networks are in need of urgent attention as the country has the highest technological risk in the bloc (0.64). Botswana has made significant progress toward improving its infrastructure in recent years however it still has the second highest technological risk (0.45). The country has still not achieved full national connectivity of road and telecommunication networks. Even though South Africa has the longest road network of any African state, it still has the third highest technological risk in the SACU bloc.

5.4 THE IMPACT OF RISK ON SACU BILATERAL TRADE

None of the reviewed studies followed the methodology used in this study i.e. aggregating the risk into a single measure and augmenting the gravity model to control for the effect of aggregate risk. The reviewed empirical studies looked at the impact of different types of risk in isolation as argued in previous chapters (Oh & Reuveny, 2010; Long, 2008; Mirza & Verdier, 2008; Abadie & Gardeazabal, 2008; Raddatz, 2007; Bayer & Rupert, 2004; Nitsch & Schumacher, 2004).

This section presents the results of the gravity model of trade which was augmented with the composite risk index. As outlined in the previous chapter, the Poisson Pseudo-Maximum Likelihood (PPML) estimator is used with panel data in the analysis. Three other estimators are used as a robustness check i.e. Ordinary Least Squares (OLS), Generalized Least Squares (GLS), Maximum Likelihood. The Fixed and Random models are used with the PPML estimator to determine efficiency.

5.4.1 Descriptive Statistics and Signage

Table 5.10 presents a description of the variables used in the empirical gravity model and their expected signs. The theoretical relationship between trade and the GDP is expected to be positive. This means a higher GDP in the exporting country would mean higher production capacity, that is, higher exports (supply side). On the import side, a higher GDP means a higher consumption capacity in the importing country, that is, higher imports (demand side).

However, when dealing with agricultural goods (as in this study), the Engels's Law allows for the GDP in the destination country to have a negative influence on demand for imports. Therefore, it is also possible that the coefficient of the importer GDP variable will be less than zero. Since the distance variable is a proxy for transportation costs, it is expected to have a negative sign. This essentially means that: the greater the physical distance between the economic centres of trading countries, the lower the expected trade volume is between them due to higher trade costs.

Just like other trade costs, the risk variables (individual risk dimension and composite risk index) are expected to have a negative sign. The higher the incidence of risky events on the economy, the higher the probability that normal business activities (input procurement, production, marketing and commerce) will be disrupted leading to lower trade. The population coefficient can be negative or positive. This ambiguity depends primarily on whether the particular country exports less when it is big (absorption effect), or whether a big country exports more than a small country (economies of scale effect) (Martinez- Zarzoso, 2013).

Table 5. 10: Description of variables and expected signs

Variable	Description	Expected sign	Reference
X_{ij}	Bilateral trade	Positive (+ve)	(Anderson (2012)
GDP_j	Economic size of importer	Negative (-ve) or positive (+ve)	Baier and Bergstrand (2009)
GDP_i	Economic size of exporter	Positive (+ve)	Baier and Bergstrand (2009)
$Distance_{ij}$	Distance between economic centres of *i* and *j*	Negative (-ve)	Anderson and van Wincoop (2003)
$Risk_j$	Aggregate risk of importer *j*	Negative (-ve)	Oh and Reuveny (2010)
$Risk_i$	Aggregate risk of exporter *i*	Negative (-ve)	Oh and Reuveny (2010)
$EconRisk_j$	Economic risk of importer	Negative (-ve)	Oh and Reuveny (2010)
$SocRisk_j$	Social risk of importer	Negative (-ve)	Oh and Reuveny (2010)
$EnvRisk_j$	Environmental risk of importer	Negative (-ve)	Oh and Reuveny (2010)
$TechRisk_j$	Technological risk of importer	Negative (-ve)	Oh and Reuveny (2010)
$EconRisk_i$	Economic risk of exporter	Negative (-ve)	Oh and Reuveny (2010)
$SocRisk_i$	Social risk of exporter	Negative (-ve)	Oh and Reuveny (2010)
$EnvRisk_i$	Environmental risk of exporter	Negative (-ve)	Oh and Reuveny (2010)
$TechRisk_i$	Technological risk of exporter	Negative (-ve)	Oh and Reuveny (2010)
$Border_{ij}$	Contiguity	Negative (-ve)	Feenstra (2002)
$Language_{ij}$	Shared official language	positive (+ve)	Anderson and Yotov (2012)
$Colony_{ij}$	Shared colonial ties	positive (+ve)	De Benedictis and Taglioni (2011)
$Landlocked_{ij}$	Landlockedness	negative (-ve)	Carrere (2004)
$Currency_{ij}$	Shared currency, Common Monetary Area (CMA)	positive (+ve)	De Sousa (2012)

Source: Trade literature.

Table 5.11 presents the descriptive statistics of the data. There are 7600 observations in total, and these are made up of 20 bilateral trade combinations; across 20 agricultural commodities; over a 19-year period. There are eight *risk dimension variables* from the four risk sub-indices for each trader. There are, two *risk indices* (a composite risk index for each trader), and five *dummy variables; Contiguity, Language, Colony, Landlockedness,* and *Currency* (which capture trade costs). The other variables are: the traditional gravity model specification variables; GDP_{ij} for the importer and exporter (these control for the economic size); and $Distance_{ij}$ (controls for transport costs). The table presents the mean, standard deviation, minimum and maximum values of the data.

Table 5. 11: Description of exogenous variables of the SACU bilateral trade, 2000-2018

Variable	Mean	Std. Dev.	Min	Max
GDP_{ij}	23.0	1.81	20.9	26.5
$Distance_{ij}$	6.71	0.488	5.82	7.30
Pop_{ij}	15.0	1.36	13.9	17.8
$Risk_{ij}$	-1.21	0.274	-2.12	-0.754
EconRisk	-0.828	0.299	-2.51	-0.452
$SocRisk_{ij}$	-1.16	0.701	-2.78	-0.00983
$EnvRisk_{ij}$	-1.74	1.29	-4.76	-0.272
$TechRisk_{ij}$	-1.12	0.452	-2.38	-0.171
$Border_{ij}$	0.500	0.500	0	1
$Language_{ij}$	0.400	0.490	0	1
$Colony_{ij}$	0.400	0.490	0	1
$Landlocked_{ij}$	0.300	0.458	0	1
$Currency_{ij}$	0.603	0.490	0	1

Source: Output from trade analysis.

5.4.2 The impact of the risk dimensions on the SACU bilateral trade flows

Even though the main objective of the study was to determine the impact of aggregate risk on bilateral trade, it is still a worthy exercise to determine the impact of the individual risk dimensions. As argued earlier, the impact of risky events may have a ripple effect, but the different risky events still have a distinct effect on everyday activities, and possibly bilateral trade. Therefore, this methodology, that is, isolating the impact of individual risk dimensions, is in line with what researchers have done in the reviewed literature (Oh & Reuveny, 2010; Raddatz, 2007).

This section, therefore presents the results of the impact of the individual risk dimensions (economic, social, technological, and environmental) on bilateral trade. This will, potentially, help identify areas (risk dimensions) where the SACU states need to build resilience to restrict the negative effects of risk on bilateral trade within the trade bloc. The dependent variable in the five equations (excluding PPML) was the log of the monetary value of bilateral agricultural commodity trade for all 21 bilateral combinations over a period of 19 years (2000-2018). Under the PPML model, the dependent variable was the monetary value of bilateral agricultural commodity trade in levels (Westerlund & Wilhelmsson, 2011; Santos Silva & Tenreyro, 2006).

5.4.2.1 The Impact of Economic Risk

Economic development is one of the key issues in risk management. The economically developed countries are resilient, that is, better placed to manage and mitigate risks (Kellenberg & Mobarak, 2008; Toya & Skidmore, 2007). Therefore, it is intuitive that economic risk should be one of the most important risk dimensions. It deprives a country of a key building block in risk management – *capital*. This section investigates the impact of economic risk on bilateral trade between the SACU member states.

Table 5.12 presents the gravity model of trade which has been augmented with the economic risk variable. The dependent variable is bilateral trade (under the PPML), and the log of bilateral trade volume (under the other estimators). The independent variables include: the *log of economic risk*$_{ij}$ (variable of interest); *log of distance*$_{ij}$; and dummy variables (*language*, *currency*, *contiguity*, *landlockedness* and *colonial ties*). The economic risk variable for the importer is positive and significant with a coefficient is 0.0119. This means a 10 per cent increase in economic risk (due to slow economic growth and or high inflation) leads to a 0.12 per cent increase in bilateral trade. This is a negligible impact but an important one since the incidence of risky events in the importer's domestic economy increases trade, in this case.

According to this result, an increase in risky events leads to an increase in bilateral trade volume. The probability of this result rests on the premise that economic downturn on the importing country will lead to the importation of cheaper substitutes.

Table 5. 12: Impact of economic risk on bilateral trade

	Estimators					
Variables	**PPML X_{ij}**	**OLS Ln(X_{ij})**	**GLS Ln(X_{ij})**	**Fixed Ln(X_{ij})**	**Random Ln(X_{ij})**	**MLE Ln(X_{ij})**
$lnGDP_j$	**-0.00111*** (0.000217)	-0.216 (0.366)	-1.79 (1.32)	-1.52 (1.15)	-0.565 (0.459)	-0.565 (0.407)
$lnGDP_i$	**1.39*** (0.000292)	-0.210 (0.344)	**3.44**** (1.41)	**2.79***** (1.54)	0.180 (0.446)	0.186 (0.354)
$lnPop_j$	**6.43*** (0.000924)	0.345 (1.05)	0.184 (4.62)	-0.302 (4.14)	-0.181 (1.38)	-0.185 (1.10)
$lnPop_i$	**2.88*** (0.00102)	1.49 (1.02)	-4.66 (4.87)	-4.86 (5.39)	0.222 (1.33)	0.212 (1.02)
$lnDistance_{ij}$	**-1.52***** (0.886)	**-1.82*** (0.688)	**-2.19*** (0.762)		**-1.62***** (0.944)	**-1.61**** (0.808)
$lnEconRisk_j$	**0.0119*** (0.0000425)	-0.0607 (0.198)	-0.00417 (2.44)	-0.0255 (0.0988)	-0.0342 (0.975)	-0.0343 (0.151)
$lnEconRisk_i$	**-0.169*** (0.000648)	0.265 (0.239)	0.0533 (0.236)	-0.0128 (0.167)	0.0911 (0.156)	0.0908 (0.146)
$Border_{ij}$	**3.32***** (1.80)	-0.661 (1.25)	-0.892 (1.49)		-0.368 (1.64)	-0.3607 (1.57)
$Language_{ij}$	**4.08**** (1.52)	**3.54***** (2.29)	9.66 (14.6)		**6.31**** (2.85)	**6.33*** (2.14)
$Colony_{ij}$	**2.80**** (1.11)	**2.13*** (0.704)	2.58 (3.07)		**2.13**** (0.961)	**2.13*** (0.854)
$Currency_{ij}$	**-5.86*** (1.54)	**-2.06**** (0.883)	0.0539 (2.87)		**-2.14**** (1.11)	**-2.14**** (0.992)
$Landlocked_{ij}$	-3.60 (3.09)	-3.20 (2.54)	-4.18 (6.72)		-2.36 (3.16)	-2.35 (2.73)
R^2		46		59	45	
No. of obs.	6300	2299	2299	2299	2299	2299

*, **, and *** are confidence levels at the 1, 5 and 10 per cent respectively.

Source: Output from trade analysis.

On the other hand, the economic risk variable for the exporter is negative and significant. It has a coefficient of -0.169. This means a 10 per cent increase in economic risk in the exporting country, will decrease bilateral trade by 1.7 per cent. This could be because risky events in the domestic economy of the exporter could compromise the production endeavours of domestic producers. This will decrease the amount of goods produced, which will, in turn, decrease the amount of goods offered for export in the event the commodity is also consumed locally. According to the economic theory, a decrease in supply of a commodity will push the market price up, in the event there is no accompanying decrease in demand. This means that the commodity will be more expensive in the market, such that poorer consumers may find more affordable substitutes. This would further decrease bilateral trade of the commodity in the bloc. The economic risk results, however, are only significant under the PPML estimator.

The distance variable is robust, and significant under all the estimation procedures with a coefficient of -1.52. This means a 1 per cent increase in distance reduces bilateral trade by 1.52 per cent. This would explain the low trade volumes between more distant partners; for example, Lesotho-Botswana; and Namibia-Eswatini. This result is most probable when dealing with food commodities due to their perishability and need for refrigeration facilities, which in turn increases transportation costs for the importer.

The economic size (proxied by the GDP) of the trade partners was also found to be an important determinant of bilateral trade. Both variables were significant, the coefficient of the importer GDP is -0.00111. This means a 10 per cent increase in economic size for the importer leads to a 0.01 per cent decrease in bilateral trade. According to the economic theory, an increase in income is supposed to lead to an increase in demand for all normal goods; however, according to Engel' law, there are exceptions. The law stipulates that an increase in the GDP leads to a decrease in the proportion of income spent on food commodities. An increase in the GDP could also stimulate investments in domestic production, which would decrease the amount of goods sourced from the regional markets. The coefficient of the exporter GDP is 1.39, which means a 1 per cent increase in economic size of the exporter leads to a 1.4 per cent increase in bilateral trade volume.

Investments in production, triggered by growth of the exporter's economy, means more goods are produced for the export market. The population variables for both the importer and exporter are significant and positive; meaning, they are important determinants of bilateral trade flows in the SACU. Their coefficients are 6.43 and 2.88, meaning a 1 per cent increase in population would lead to a 6.4 and 2.9 per cent increases in bilateral trade respectively. This result was expected as population is one of the determinants of demand.

According to economic literature, countries that share a border are expected to trade more than countries that are far apart, regardless of any trade agreements. The contiguity variable is significant and positive, and this means a high impact on bilateral trade flows within the SACU. With a coefficient of 3.32, this result suggests that the trade between contiguous SACU member states is on average 26 per cent higher than countries that do not share a border (Anderson, 2011).

All the dummy variables were also found to have an impact on bilateral trade flows in the SACU trade bloc, except Landlockedness. Currency had the largest impact in terms of level of significance, and in absolute terms, with a coefficient of -5.86. This means that countries that use the same currency in business transactions trade, on average, 1 per cent less than countries that do not use the same currency; implying that membership in the Common Monetary Agreement (CMA) decreases bilateral trade. This result was not expected as using the same currency helps firms avoid some of the difficulties of cross-border business transactions (Rose, 2000). The language dummy is the only one which is robust out of all the dummy variables. It has a coefficient of 4.08, and also significant with the expected sign. Countries that share an official language are expected to trade 58 per cent more on average; whilst countries that were colonized by the same country, on the other hand, are expected to trade 15 per cent more than countries without colonial ties.

5.4.2.2 The Impact of Social Risk

Least developed countries are typically more vulnerable to a multitude of risks. This is because they lack the instruments needed to deal with such risks. These instruments include: safety nets, insurance and social welfare policies and programs (WEF, 20112).

The lack of these instruments means that poor countries do not have the capacity to build the resilience necessary to withstand the social risks. This exposure to risk and the subsequent vulnerability to such makes poor countries relatively risk averse and, thus, unwilling to engage in higher-risk, higher-return activities. There is an argument in the economic literature that trade promotes development and, in turn, development reduces poverty and unemployment (Bhagwati & Srinivasan, 2002). However, the impact of poverty and unemployment on trade is not well documented. This section seeks to determine the impact of aggregate social risk on bilateral trade.

Table 5.13 presents the results of the gravity model augmented with a social risk index. The index captures the effects of risky events under the social dimension. The variables of interest under this section are the log of social risk for both trade partners. From the results, the importer social risk variable has a marginal effect on bilateral trade; it has a coefficient of -0.082. The coefficient is negative and significant. It means that a 10 per cent increase in the incidence of social risky events in the importing economy (increase in unemployment and poverty) leads to a 0.8 per cent decrease in bilateral trade.

Table 5. 13: Impact of social risk on bilateral trade

	Estimators					
Variables	**PPML X_{ij}**	**OLS $Ln(X_{ij})$**	**GLS $Ln(X_{ij})$**	**Fixed $Ln(X_{ij})$**	**Random $Ln(X_{ij})$**	**MLE $Ln(X_{ij})$**
$lnGDP_j$	**-0.772*** (0.000227)	-0.184 (0.489)	**-2.40***** (1.33)	**-2.37**** (1.06)	0.422 (0.492)	0.424 (0.425)
$lnGDP_i$	**1.84*** (0.000288)	-0.270 (0.455)	**4.17*** (1.41)	**3.72*** (1.58)	0.219 (0.476)	0.226 (0.380)
$lnPop_j$	**6.85*** (0.000930)	-0.121 (1.16)	1.13 (4.76)	2.27 (3.86)	-0.0727 (1.37)	-0.0693 (1.15)
$lnPop_i$	**3.61*** (0.00103)	1.35 (1.10)	**-7.46***** (5.03)	-7.54 (5.95)	0.518 (1.30)	0.505 (1.08)
$lnDistance_{ij}$	**-1.53***** (0.885)	**-1.74*** (0.705)	**-2.09*** (0.767)		**-1.77**** (0.917)	**-1.77**** (0.820)
$lnSocRisk_j$	**-0.082*** (0.000036)	0.0760 (0.201)	0.174 (0.197)	**0.364**** (0.154)	**0.295**** (0.158)	**0.295*** (0.120)
$lnSocRisk_i$	**0.275*** (0.000034)	-0.946 (0.202)	**-0.313***** (0.196)	**-0.305***** (0.181)	-0.123 (0.154)	-0.123 (0.118)
$Border_{ij}$	**3.33***** (1.80)	-0.509 (1.25)	-0.741 (1.49)		-0.552 (1.58)	-0.545 (1.58)
$Language_{ij}$	**3.43**** (1.52)	4.14 (3.32)	15.8 (15.1)		**5.21***** (3.21)	**5.23**** (2.72)
$Colony_{ij}$	**3.04*** (1.11)	**0.759*** (0.719)	3.17 (3.10)		**2.12**** (0.950)	**2.12*** (0.858)
$Currency_{ij}$	**-6.38*** (1.53)	**-2.27*** (0.929)	0.0551 (2.89)		**-2.15**** (1.09)	**-2.14**** (0.990)
$Landlocked_{ij}$	-3.13 (2.57)	-3.68 (2.55)	-5.17 (6.76)		-2.43 (3.07)	-2.41 (2.72)
R^2		46		33	45	
No. of obs.	6300	2299	2299	2299	2299	2299

*, **, and *** are confidence levels at the 1, 5 and 10 per cent respectively.

Source: Output from trade analysis.

This result was expected as loss of gainful employment and increase in poverty may lead to a decrease in the demand for imports by domestic consumers.

For the exporting country, the impact of risk is higher in absolute terms; a 10 per cent increase in risky events leads to a 2.8 per cent increase in bilateral trade. This means that: as poverty and unemployment increase in the domestic economy, the amount of goods demanded decrease per unit time. This decrease in domestic demand means that more goods are then available for export, assuming domestic production is not affected. Also, the more goods are left over from domestic consumption, the more trade increases. These results are, however, not robust across the respective estimation procedures.

As was the case in the previous section, the distance variable has the expected sign and is significant at the same level of significance (10 per cent). A 1 per cent increase in distance leads to a 1.53 per cent decrease in trade volume, that is, countries which are further apart from each other are expected to trade less. The variables which capture economic size; the GDP and population are found to affect bilateral trade as they are significant. The *log of importer GDP* has a coefficient of -0.772, meaning a 1 per cent increase in importer GDP, decreases trade by 0.8 per cent.

On the other hand, a 1 per cent increase in the GDP in the exporting country, increases bilateral trade by 1.8 per cent. Due to the lucrative nature of foreign markets, it makes sense that an increase in the GDP in the exporting country would lead to double the increase in trade. The increase in the GDP might lead to an increase in investments in production such that the goods available for export increase. The coefficients of the importer and exporter population variables are 6.85 and 3.61, respectively. This means a 6.9 per cent and 3.6 per cent increase in trade due to a 1 per cent increase in the population of the importing and exporting countries, respectively. The other proxy for economic size, population, is also an important determinant of bilateral trade flows in the SACU. The variable is significant and positive for both the importer and exporter. With coefficients of 6.85 and 3.61, this means a 1 per cent increase in population would lead to a 6.9 per cent and 3.6 per cent increase in bilateral trade for the importer and exporter, respectively.

The dummy variables are significant except *landlockedness*. The common currency variable has the largest impact in terms of level of significance and in absolute terms even under the social risk dimension. The variable has a coefficient of -6.38, meaning that countries in the CMA trade 1 per cent less on average than countries outside the agreement. The language variable has the second highest effect of the dummy variables. It has a coefficient of 3.43 and it is significant with the expected sign. This means that countries that share an official language are expected to trade 30 per cent more on average compared to countries that do not. The border dummy is next in line in terms of importance. It is also significant and has the expected positive sign. With a coefficient of 3.33, this result suggests that the SACU member states that share a border trade on average 27 per cent more than countries that are not contiguous. Colonial times are also an important determinant of bilateral trade under the social dimension. The common colony variable is significant and has the expected sign. With a coefficient of 3.04; and this means that countries that have colonial similarities are expected to trade 20 per cent more on average than countries with different colonial origins.

5.4.2.3 The Impact of Technological Risk

Technology plays a very important role in the economic development of countries. Advancement in technology enables both developed and developing countries to grow their domestic economies and become more competitive in the global market. This is particularly important in international trade where development in technology helps countries to fully exploit their competitive advantage and strengthen their trading positions in the competitive global market (Sabir & Sabir, 2010).

Recent trends in the evolution of technology have generated great potential for improvements in welfare around the globe. New and improved technology, coupled with the globalization of trade in goods, services, and factors of production, has the world community poised to reap the fruits of global comparative advantages. Technology is also helping to speed innovation and holds the potential to remove the major constraints to development for many people in developing countries (Holzmann & Jorgensen, 2001). Its importance can be seen in the economies of innovative countries. Such countries have been able develop their economies relatively quicker, strengthened their competitive advantage, and became more competitive in the global trade arena.

With the development of new advanced technologies, trade has become easier, cheaper and faster. Consumers are now able to source goods from distant places at minimum cost, and this has increased economic welfare. Lack of innovation and late adoption of advanced technologies is the reason that developing countries continue to lag behind their more developed counterparts in world trade. Furthermore, technology affects different sectors differently. Sectors like agriculture are relatively more negatively affected by late adoption of improved technologies, and this threatens the competitive advantage of developing countries (Nordas & Piermartini, 2004).

Table 5. 14: Impact of technological risk on bilateral trade

	Estimators					
Variables	**PPML X_{ij}**	**OLS Ln(X_{ij})**	**GLS Ln(X_{ij})**	**Fixed Ln(X_{ij})**	**Random Ln(X_{ij})**	**MLE Ln(X_{ij})**
lnGDP$_j$	**-0.293***	-0.206	**-1.86****	**-1.64*****	-0.515	-0.520
	(0.000223)	(0.414)	(1.31)	(1.05)	(0.443)	(0.437)
lnGDP$_i$	**1.72***	-0.117	**3.97***	**3.31***	0.785	**0.800****
	(0.000285)	(0.418)	(1.39)	(1.50)	(0.517)	(0.406)
lnPop$_j$	**6.66***	-0.359	-1.29	0.763	-0.606	-0.615
	(0.000913)	(1.09)	(4.80)	(4.18)	(1.31)	(1.09)
lnPop$_i$	**2.95***	1.12	-6.76	-6.50	-0.785	0.816
	(0.00100)	(1.10)	(5.08)	(5.88)	(1.37)	(1.04)
lnDistance$_{ij}$	**-1.51*****	**-1.64***	**-1.79***		**-1.40****	**-1.39*****
	(0.886)	(0.693)	(0.759)		(0.918)	(0.801)
lnTechRisk$_j$	**-0.208***	-0.440	-0.131	-0.230	**-0.284***	**-0.283*****
	(0.0000594)	(0.207)	(0.275)	(0.220)	(0.189)	(0.162)
lnTechRisk$_i$	**0.105***	-0.210	**-0.627****	**-0.725***	**-0.618***	**-0.621***
	(0.0000725)	(0.241)	(0.315)	(2.61)	(0.220)	(0.189)
Border$_{ij}$	**3.34*****	-0.0452	-0.186		-0.184	-0.170
	(1.80)	(1.26)	(1.53)		(1.56)	(1.57)
Language$_{ij}$	**5.07***	**4.07****	13.9		**7.13***	**7.17***
	(1.52)	(2.30)	(15.3)		(2.80)	(2.10)
Colony$_{ij}$	**2.85****	**2.75***	4.26		**3.01***	**3.00**
	(1.11)	(0.811)	(3.27)		(1.02)	(0.913)
Currency$_{ij}$	**-6.06***	**-2.40***	-1.04		**-2.69***	**-1.85***
	(1.53)	(0.919)	(2.99)		(1.14)	(0.899)
Landlocked$_{ij}$	-3.69	-3.94	-7.08		-4.11	-4.08
	(3.09)	(2.66)	(7.05)		(3.18)	(2.77)
R^2		46		36	45	
No. of obs.	6300	2299	2299	2299	2299	2299

*, **, and *** are confidence levels at the 1, 5 and 10 per cent respectively

Source: Output from trade analysis.

However, the lack of innovation and adoption of improved technology in the developing world mean that, developing countries will not reap the benefits anytime soon. Table 5.14 presents the results of the impact of technological risk on the SACU bilateral trade.

The log of importer GDP is again negative and significant, with a coefficient of -0.29. This means that a 10 per cent increase in the GDP in the importing country, decreases bilateral trade by 3 per cent. Again, this is to be expected as an increase in the GDP can lead to a decrease in the trade of food commodities (Engel's law). The log of exporter GDP is positive and significant; meaning that, there is positive correlation between exporter GDP and bilateral trade. The coefficient on the GDP variable is 1.72. This means a 1 per cent increase in the GDP would lead to an almost double increase in bilateral trade; and this result is probable as an increase in income might lead the domestic economy to invest in the production of goods and services, which are then exported. However, this is probably the case in South Africa and, to a lesser extent, in Botswana and Namibia where the level of income is higher. The log of distance variable is negative and significant; and the result is also robust across the respective estimation procedures. The magnitude is higher than the unity presented in the gravity literature. The coefficient on the distance variable is -1.5; meaning an increase in distance by a kilometre would lead to a 1.5 per cent decrease in bilateral trade.

The variables of interest are, however, the *log of importer technological risk* and log of *exporter technological risk* with coefficients of -0.21 and 0.11, respectively. Both variables are significant with different signs. A 10 per cent increase in the incidence of technological risks on the importing economy (a decrease in the quality of roads and telephone networks for the importer) would decrease bilateral trade between the trading partners by 2 per cent. On the other hand, a 10 per cent increase in technological risk on the exporting side, would increase bilateral trade by 1 per cent. What is worth noting is that the magnitude of the decrease in bilateral trade is higher (twice the volume) than the increase. This could be due to the fact that the exporter has a multitude of competing destinations for their goods and, as such, they will choose the route with the higher returns or low risk.

The population of the trading countries is another important determinant of bilateral trade in the SACU territory. The coefficients on the log of population variables for the importer and exporter are 6.66 and 2.95, respectively. They are both significant and have the expected positive signs. A 1 per cent increase in population in the importing country increases imports by close to 7 per cent, and the same increment in population on the importing side, increases exports by 3 per cent.

All the dummy variables are robust, except the ones that control for contiguity; and they are all significant, except the one that controls for landlockedness. The currency dummy has the highest impact, yet again. With a coefficient of -6.06, this means that countries that use the same official currency are expected to trade 1 per cent less on average compared to countries that use different currencies. The language variable is again an important determinant of the SACU bilateral trade. It is highly significant with the expected sign. According to the economic theory, communication is an important component in business transactions; hence, countries that share an official language are expected to trade more. This is proven by the language dummy; with a coefficient of 5.07, countries that share an official language are expected to trade 159 per cent more. As expected, contiguity is important in bilateral trade. *Border*, the dummy variable that control for countries being close to each other, is significant and has the expected positive sign. The coefficient on the border dummy is 3.34, meaning that countries that share a border are expected to trade 28 per cent more on average.

5.4.2.4 The Impact of Environmental Risk

In recent times, the appreciation of the importance of climatic conditions in relation to trade has increased among trade researchers. This follows the exponential increase in climate-related disasters and their destructive impact thereof. Since the industrial revolution, the world has had to cope with serious environmental issues stemming from the pursuit of economic development endeavours in agriculture. These activities have seen countries pursue intense production schemes to increase their agricultural exports. The increased production has taken its toll on the environment in recent times, with an increase in environmental risks due to global warming. This has been, arguably, one of the most difficult problems facing humanity (Oh & Reuveny, 2008).

A broader view of the global science suggests that: there will be more frequent and stronger climatic disasters in the future as climate change progresses (Oh & Reuveny, 2008). According to the same authors, environmental risk has a negative effect on trade and, as such, this impact may spill into the domestic economies of many countries due to the influential role of international trade in the global economic system. Economic gains from international trade allow the world economy to build resilience in order to better withstand adverse shocks, such as risky environmental events. Therefore, the expected decline in bilateral trade, due to climate-related events, may reduce the resilience of the world economy in the long run.

Table 5.15 presents the results from the estimation of the impact of environmental risk on bilateral trade flows within the SACU trade bloc. In the case of the environmental risk, the coefficient of the log of importer environmental risk is negative and significant. With a coefficient of -0.035, a 10 per cent increase in environmental risk (extremely high or low rainfall and temperature) in the importing country, decreases bilateral trade by 0.3 per cent. This result is probable as unfavourable weather conditions might compromise the production endeavours of domestic producers. Since the BELN, like other developing countries, have an agriculture-dependent economy, poor weather conditions compromise income generation endeavours of domestic producers, which reduces disposable income and, consequently, the demand for exports. The log of exporter environmental risk, on the other hand, is highly significant and positive. With a coefficient of 0.706, this means a 10 per cent increase in the incident of extremely high or low climatic conditions would lead to a 7 per cent increase in bilateral trade within the SACU bloc. The probability of this result rests on the fact that a majority of exports come from South Africa, where the economy is more resilient. However, these results are not robust across the different estimation procedures.

Table 5. 15: Impact of environmental risk on bilateral trade

	Estimators					
Variables	**PPML** X_{ij}	**OLS** Ln(X_{ij})	**GLS** Ln(X_{ij})	**Fixed** Ln(X_{ij})	**Random** Ln(X_{ij})	**MLE** Ln(X_{ij})
lnGDP$_j$	**-0.454*** (0.000264)	-0.222 (0.368)	-0.802 (1.45)	-0.880 (1.21)	-0.438 (0.460)	-0.437 (0.406)
lnGDP$_i$	**-0.652*** (0.000316)	-0.234 (0.356)	**2.85**** (1.50)	**2.49***** (1.56)	0.310 (0.453)	0.317 (0.355)
lnPop$_j$	**5.13*** (0.000978)	0.428 (1.05)	2.04 (4.72)	1.24 (4.12)	-0.342 (1.37)	-0.353 (1.08)
lnPop$_i$	**4.57*** (0.00109)	**1.59***** (1.03)	**-7.37***** (5.03)	-6.92 (5.59)	0.0748 (1.31)	0.0563 (1.00)
lnDistance$_{ij}$	**-1.52***** (0.887)	**-1.79*** (0.705)	**-2.15*** (0.763)		**-1.32**** (0.938)	**-1.31***** (0.805)
lnEnvRisk$_j$	**-0.0345*** (0.000554)	0.0137 (0.197)	**0.533***** (0.311)	**0.418**** (0.219)	0.426 (0.197)	**0.427*** (0.159)
lnEnvRisk$_i$	**0.706*** (0.000063)	0.236 (0.226)	-0.223 (0.329)	-0.0208 (0.210)	-0.100 (0.173)	-0.100 (0.173)
Border$_{ij}$	**3.32***** (1.81)	-0.700 (1.30)	-0.805 (1.49)		-0.393 (1.66)	0.408 (1.58)
Language$_{ij}$	**-4.08*** (1.52)	3.25 (2.29)	20.3 (15.9)		**6.18**** (2.80)	**6.21*** (2.11)
Colony$_{ij}$	1.46 (1.11)	**2.13*** (0.695)	4.61 (3.30)		**1.80**** (0.960)	**1.79**** (0.859)
Currency$_{ij}$	**-4.37*** (1.54)	**-2.36*** (0.722)	-1.93 (3.15)		**-1.74***** (1.11)	**-1.73***** (0.996)
Landlocked$_{ij}$	-0.929 (3.09)	-3.25 (2.64)	-8.13 (7.11)		-1.03 (3.18)	-0.998 (2.76)
R^2		46		34	45	
No. of obs.	6300	2299	2299	2299	2299	2299

*, **, and *** are confidence levels at the 1, 5 and 10 per cent respectively.

Source: Output from trade analysis.

The log of the GDP for both the importer and exporter are negative and highly significant. The coefficients are -0.45 and -0.65 respectively. This means an increase in environmental risk decreases bilateral trade for both trading partners. Importers from smaller countries, who depend on the physical environment for their livelihood, might realise lower disposable incomes due to poor weather conditions. This would mean they have less money to spend on foreign goods, hence, a decrease in agriculture imports. On the export side, poor climatic conditions may compromise the production endeavours of domestic producers and reduce their foreign exchange earnings through trade.

The *log of distance* variable is again negative and significant, and like it has been the case with the other three risk dimensions, the coefficient is -1.5. This result is again robust across the respective estimation procedures under the environmental risk. An increase in distance by a kilometre would lead to a 1.5 per cent decrease in bilateral trade. When you control for environmental risk, the decrease in bilateral trade is 20 times greater for the exporter than it is for the importer.

5.4.2.5 The Combined Impact of Individual Risk Dimensions

According to Kahan (2008), producers in developing countries rely on the external environment more than does their counterparts in developed countries. Therefore, such farmers are frequently exposed to the uncertainties that come with this overreliance. Many farmers from the developing world live on the edge of extreme uncertainty with respect to weather, prices, and policies; and this affects their daily business decisions and, ultimately, their livelihood. For the most part, farmers have no control over these risks and, as such, may or may not have the ability to develop effective coping strategies. One of the ways to help them and their governments formulate sustainable coping and mitigation strategies is to interrogate the problem and come up with tangible empirical facts. Risks are generally a complex phenomenon and, as such, farmers have difficulties in making informed decisions due to the lack of adequate information. To retrieve this information, researchers need to fully interrogate the risk dynamics with the view of helping farmers find effective ways of protecting their enterprises from future uncertainties.

This study seeks to determine the impact of risk on bilateral trade flows; whereas, the previous four sections presented the results of this when only the effect of one risk dimension was controlled for. This section presents the results when the influence of all the risk dimensions is simultaneously controlled for, and the results are presented in Table 5.16. The variables of interest in this analysis are: the log of economic risk, log of social risk, log of technological risk, and log of environmental risk for both the importer and exporter.

Table 5. 16: Impact of the risk dimensions on bilateral trade

	Estimators					
Variables	**PPML** X_{ij}	**OLS** **Ln**(X_{ij})	**GLS** **Ln**(X_{ij})	**Fixed** **Ln**(X_{ij})	**Random** **Ln**(X_{ij})	**MLE** **Ln**(X_{ij})
$lnGDP_j$	**-0.221*** (0.000284)	0.343 (0.517)	**-1.21** (1.48)	-1.40 (1.10)	-1.45 (1.10)	**-1.44**** (0.929)
$lnGDP_i$	**-0.812*** (0.000333)	0.408 (0.543)	**3.70*** (1.55)	**3.65**** (1.68)	**3.66**** (1.65)	**3.66*** (0.981)
$lnPop_j$	**4.61*** (0.00101)	-0.101 (1.26)	3.32 (5.23)	2.99 (4.29)	3.05 (4.28)	3.04 (3.27)
$lnPop_i$	**4.60*** (0.00113)	-1.80 (1.30)	**-10.3***** (5.48)	**-9.55***** (6.57)	**-9.38***** (6.47)	**-9.39*** (3.45)
$lnDistance_{ij}$	**-1.51***** (0.886)	**-1.80**** (0.757)	**-1.72**** (0.761)		**-1.87***** (1.01)	**-1.87***** (0.993)
$lnEconRisk_j$	**0.0754*** (0.000042)	-0.0354 (0.202)	-0.00953 (0.247)	-0.0279 (0.106)	-0.0302 (0.106)	-0.0302 (0.153)
$lnSocRisk_j$	**-0.125*** (0.0000394)	**0.127**** (0.203)	0.175 (0.206)	**0.369*** (0.155)	**0.360**** (1.55)	**0.361*** (0.129)
$lnTechRisk_j$	**-0.166*** (0.0000637)	**-0.517*** (0.209)	-0.326 (0.292)	**-0.500*** (0.211)	**-0.470**** (0.212)	**-0.472*** (1.81)
$lnEnvRisk_j$	**0.00466*** (0.0000561)	0.111 (0.204)	**0.597**** (0.314)	**0.506**** (0.216)	**0.523**** (0.215)	**0.522*** (0.196)
$lnEconRisk_i$	**-0.160*** (0.000064)	0.316 (0.248)	0.105 (0.239)	0.0714 (0.165)	0.0764 (0.163)	0.0761 (0.151)
$lnSocRisk_i$	**0.209*** (0.0000361)	-0.136 (0.203)	-0.284 (0.207)	**-0.313***** (0.184)	**-0.313***** (0.163)	**-0.313*** (0.131)
$lnTechRisk_i$	**-0.169*** (0.0000637)	-0.165 (0.235)	**-0.531***** (0.336)	**-0.531***** (0.288)	**-0.515***** (0.285)	**-0.516*** (0.214)
$lnEnvRisk_i$	**0.669*** (0.0000638)	**0.464***** (0.251)	-0.217 (0.332)	-0.0545 (0.208)	0.0661 (0.205)	-0.0650 (0.208)
$Border_{ij}$	**3.34***** (1.80)	0.510 (1.65)	-0.0309 (1.54)		-0.655 (1.88)	-0.656 (1.93)
$Language_{ij}$	**3.63*** (1.52)	**5.30***** (3.35)	26.2 (17.0)		23.9 (18.2)	**23.9**** (108)
$Colony_{ij}$	**2.16**** (1.11)	**2.80*** (1.02)	**6.01***** (3.57)		**5.45***** (3.71)	**5.46**** (2.53)
Currency	**-5.11*** (1.53)	**-2.41**** (1.13)	-2.53 (3.33)		-2.69 (3.23)	-2.70 (2.39)
$Landlocked_{ij}$	-2.32 (3.09)	-3.00 (1.13)	-10.3 (7.57)		-9.34 (8.04)	-9.34 (5.84)
No. of obs.	6300	2299	2299	2299	2299	2299
R^2		45		31	47	

*, **, and *** are confidence levels at the 1, 5 and 10 per cent respectively.

Source: Output from trade analysis.

The economic risk variable for the importer is positive and highly significant. The coefficient is 0.075, which means a 10 per cent increase in economic risk (low economic growth and high inflation) leads to a 0.8 per cent increase in bilateral trade. This result is logical as the increase in inflation coupled with a stagnant or negative economic growth could increase the volume of goods bought by the importing country in the global market arena. This is especially true when the domestic consumers cannot afford certain food commodities due to a poorly performing economy; they could increase their imports of cheaper food alternatives, thereby, increasing bilateral trade.

The log of exporter economic risk is also highly significant and negative, with a coefficient of -0.160. This means a 10 per cent increase in risky economic events in the exporting economy will decrease bilateral trade by close to 2 per cent. This result is also expected as an increase in economic risk in the exporting country is expected to compromise the production endeavours of domestic producers. Low GDP growth and inflation decrease disposable income which could decrease investments in production. This might decrease the amount of goods produced to meet domestic demand; hence, even less would be available for the export market. This result is also a negligible impact but an important one since the incidence of risky events in the importer's domestic economy decreases trade in this case. The log of social risk variable for the importing country is negative and highly significant. With a coefficient of -0.125, a 10 per cent increase in socially risky events (poverty and unemployment) would decrease bilateral trade by 1.3 per cent.

The coefficient from the exporting side is 0.209, which means a 10 per cent increase in social risks in the exporting economy would lead to a 2 per cent increase in bilateral trade. High incidents of poverty and unemployment are expected to decrease the demand for imports; while the same conditions could increase exports of cheaper substitute food commodities.

The log of technological risk variables for the importer and exporter are both negative and highly significant. The coefficients are -0.166 and -0.169, respectively. Interestingly, this means a 10 per cent increase in technological risk will decrease imports and exports by the same percentage, (1.7). This result is probable, given the fact that the exporting country has a number of potential export destinations and would, therefore, choose the one with the least risk in the event the incidence of technological risk increases in one bilateral partner. However, for the importer, this situation would mean a decrease in imports. These results are also robust across the different estimation methods.

The logs of environmental risk variables, on the other hand, are positive for the importer and exporter. Both coefficients are highly significant, with the value for the importing country being a negligible -0.00466. This means a 10 per cent increase in environmental risks would decrease bilateral trade by 0.05 per cent. Given the over reliance of developing countries on the environment, this result was unexpected. An increase in environmental risks was expected to increase bilateral trade to domestic consumption. The coefficient for the exporting country is -0.67, indicating a more negative impact on exports. This means a 10 per cent increase in environmental risks would decrease exports by 7 per cent. Like has been the case under all the other risk dimensions, the log of distance variable is significant and negative and the coefficient is -1.5.

The currency dummy, again, has the highest impact in on bilateral trade within the SACU and is significant. It has a coefficient of -5.11; and this means membership in the CMA decreases bilateral trade by 1 per cent. This result is unexpected as the CMA was formed solely to aid trade in the region. This result is also robust across the different estimators. The results from this analysis, again, highlight the importance of language in bilateral trade. The language dummy is highly significant, and it has the expected sign. Countries that share an official language are expected to trade 38 per cent more on average. The contiguity variable has the third highest impact on bilateral trade within the SACU. Its importance is underlined by significance, the expected sign and a coefficient of 3.34. This result means that countries that share a border are expected to trade 27 per cent more than distant countries. Colonial ties are still an important determinant of bilateral trade in the SACU. This is evident from the significant variable. A coefficient of 2.16 means countries with a similar colonial history are expected to trade 8 per cent more on average.

5.4.3 The impact of aggregated risk on the SACU bilateral trade flows

It is plausible to expect that different risky events will have a negative impact on international trade, and on bilateral trade volumes. An increase in risk, generally, acts as an impediment to trade, as it raises the transactional costs of doing business and, thus, lowers the volume of international trade flows (Nitsch & Schumacher, 2004). Due to their inherently low resilience, it is now increasingly accepted that governments have a duty to assist individuals, households, and communities in developing countries deal with diverse risks. This is particularly necessary to expedite the fight against poverty, inequality, unemployment and to achieve sustained economic and human development.

However, for this to be a realistic exercise in a developing country context, there is a need to be pragmatic in assessing the risks and instruments used to deal with them. International trade has been identified as a possible vehicle for economic transformation in the developing world; however, risk has also been flagged as an impediment to sustainable trade relations. Relying on risk-trade studies done in a developed country context will not provide the necessary answers for developing countries. There is a need for a more comprehensive approach in the developing world which will draw attention to diverse risks. This approach should also propose instruments of dealing with these diverse risks (Holzmann *et al*., 2003).

However, in spite of its growing importance in world trade, risk has still not been fully integrated in decision making when it comes to trade (Baas, 2010). This is partly due to the lack of a framework that quantifies and measures aggregate risk in an economy. This section presents the results from the gravity model augmented with a composite risk index. The index measures aggregate risk and Table 5.17 presents the impact of such risk on bilateral agricultural-commodity trade volume between the SACU member states.

The variables of interest in the analysis are the log of risk for the importer and exporter (lnR_{ij}). They are presented and interpreted under the RE (PPML) column. They are both significant (at 1 per cent level of significance), indicating a substantial effect of risk on bilateral trade, albeit, with different signs indicating opposite effects. The coefficient of the log of risk on the importing country is 0.0567 and positive. Though not overly substantial, it still means a 0.6 per cent increase in imports for a 10 per cent increase in risk in the domestic economies of the SACU members. This result was expected because an increase in risk in the domestic economy could potentially disrupt the production of goods and services by domestic producers (Oh & Reuveny, 2010). In such a scenario, domestic producers would be unable to meet domestic demand. This would push up the price of locally produced goods such that cheaper goods would have to be sourced from foreign producers leading to an increase in imports.

Table 5. 17: Impact of aggregate risk on bilateral trade in SACU

Model Estimators: Dependent variable:	RE (PPML) X_{ij}	Pooled (OLS) Ln(X_{ij})	FE Ln(X_{ij})	RE (GLS) Ln(X_{ij})	FGLS Ln(X_{ij})	RE (MLE) Ln(X_{ij})
lnGDP$_j$	**0.627*** (0.000223)	**-0.124***** (0.378)	**-1.94***** (1.08)	**-2.01**** (1.07)	**-2.04***** (1.30)	**-2.01*** (0.825)
lnGDP$_i$	**-1.78*** (0.000290)	-0.267 (0.356)	**3.20**** (1.52)	**3.25**** (1.50)	**3.84*** (1.39)	**3.24*** (0.887)
lnDistance$_{ij}$	**-1.54***** (0.886)	**-1.91*** (0.712)		**-2.16**** (0.100)	**-2.05*** (0.772)	**-2.16**** (0.986)
lnPop$_j$	**7.46*** (0.000954)	0.512 (1.18)	-3.35 (4.05)	-3.35 (4.04)	2.72 (4.93)	3.35 (3.10)
lnPop$_i$	**4.60*** (0.00102)	1.83 (1.21)	-8.49 (6.02)	-8.16 (5.97)	**-7.93***** (4.84)	**-8.16*** (3.07)
lnR$_j$	**0.0567*** (0.0000769)	0.173 (0.355)	**0.701**** (0.319)	**-0.712**** (0.319)	0.527 (0.413)	**0.712*** (0.258)
lnR$_i$	**-0.994*** (0.0000852)	-0.440 (0.463)	-0.575 (0.411)	-0.559 (0.405)	-0.515 (0.427)	**-0.559**** (0.271)
Border$_{ij}$	**-3.33***** (1.80)	-0.729 (1.26)		-1.28 (1.85)	-0.652 (1.50)	-1.28 (1.92)
Language$_{ij}$	0.212 (1.52)	2.68 (3.06)		21.8 (16.5)	18.4 (15.2)	**21.8**** (9.65)
Colony$_{ij}$	**1.96***** (1.11)	**2.05*** (0.95)		4.75 (3.73)	4.08 (3.16)	**4.75**** (2.31)
Currency	**5.45*** (1.53)	**-1.99**** (0.918)		-2.41 (2.88)	-0.927 (2.91)	2.41 (2.17)
Landlocked$_{ij}$	**-1.91***** (3.09)	-3.07 (2.60)		-8.41 (7.40)	-6.96 (6.86)	**-8.41** (5.49)
R^2		46	31	63		
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
N	6300	2299	2299	2299	2299	2299
Log likelihood	-2.414e+09				-5658.47	-4864.4
Wald chi2	9.35e+08		925.3	925.3	2052.1	271.5

*, **, and *** are confidence levels at the 1, 5 and 10 per cent respectively.

Source: Output from trade analysis.

The exporter risk variable on the other hand is negative and highly significant **(-0.994**). This means that a 1 per cent increase in the incidence of risky events in the exporting economy would decrease bilateral trade by the same percentage. This result was expected because according to the trade theory, risk is an impediment to trade (Oh & Reuveny, 2010; Long, 2008; Mirza & Verdier, 2008; Nitsch & Schumacher, 2004). The logic behind this result is that as risk increases in the exporting country, it compromises the production endeavours of domestic producers. This would mean that fewer goods are produced and available for export (decreasing exports). According to the results, aggregate risk on the importing economy leads to an increase in bilateral trade, whereas it decreases bilateral trade on the exporting end.

As expected, the distance variable was significant and negative. This means the greater the distance between trading partners, the less will be commodity trade. This result implies that distance discourages bilateral trade within the SACU member states. A per cent increase in distance reduces commodity trade by 1.54 per cent. This value is higher than the unity reported in the empirical literature (Baier & Bergstrand, 2009; Anderson & van Wincoop, 2003; Martinez- Zarzoso, 2013).

The results show that the importer and exporter GDPs are both important factors in bilateral trade; they both have significant coefficient, albeit, with different signs. The sign of the importer GDP variable is positive. This means that an increase in the GDP (growth in the domestic economy) increases imports as domestic consumers increase their consumption of food commodities. This is, however, contrary to Engel's law which stipulates that when dealing with agricultural commodities, the GDP of the importing country should be negative.

This is because as the GDP increases, the proportion spent on food commodities decreases (Foellmi & Zweimuller, 2008). However, this result is probable in the case of developing countries where the growth in the GDP might not translate into an equitable distribution of real income. The logs of the GDP variables, which are proxies for economic size, are also important determinants of bilateral trade. The coefficients for both the importer and exporter are significant with values of 0.627 and -1.78, respectively. This means a 10 per cent increase in economic size for the importer leads to a 6.3 per cent increase in bilateral trade. This result was expected as an increase in economic size could increase disposable income and, therefore, the demand for normal goods. This increase in goods could be through the extensive margin of trade (which is the entry of new goods), or intensive margin (increased trade of existing goods in the market). This could also lead to an increase in imports to meet domestic demand. The elasticity of the importer GDP is lower than unity and has been described as evidence of home market effects (Feenstra, 2002). However, the log of the GDP variable for the exporter is negative. This means a 1 per cent increase in economic size would lead to a 1.8 per cent decrease in bilateral trade. An increase in disposable income in the domestic economy might increase the demand for locally produced goods and, thereby, decrease the amount of goods available for export.

The population variables for both the importer and exporter were also found to be important determinants of bilateral trade flows in the SACU. They are both significant and they have the expected signs. A 1 per cent increase in population leads to a 7.46 per cent and 4.60 per cent increase in bilateral trade for the importer and exporter, respectively. This result was expected as according to the economic theory, population is one of the key determinants of demand. For the importer, an increase in population means more mouths to feed for domestic producers. The inability of domestic producers to meet this increased demand could lead to an increase in imports as foreign suppliers enter the market. On the export side, an increase in population could lead to an increase in domestic investments as producers gear up for the increased demand. This could lead to an increase in the volume of goods produced in the domestic economy and, consequently, the volume available for export.

According to Bacchetta *et al*. (2012), the dummy variable coefficients are interpreted as semi-elasticities. All the dummy variables were also found to have an impact on bilateral trade flows in the SACU, except *language*. Currency had the largest impact on bilateral trade in absolute terms, with a coefficient of 5.45. This means that membership in the CMA, where the Rand is used as a common currency, leads to a one per cent increase in bilateral trade, on average. This result was expected because according to Rose (2000), currency unions are supposed to increase trade by substituting a single currency for several different national currencies. This offers greater predictability of commodity prices, eliminates exchange rate volatility, and transactions costs of trade which essentially make doing business relatively easier. However, in recent times, there has been some controversy around this finding with a number of researchers arriving at different conclusions (Head & Mayer, 2010; Rose, 2015; Santos Silva & Tenreyro, 2010). However, it would seem that currency unions could potentially decrease bilateral trade in the long term, according to Yeyati (2003) and De Sousa (2012). The former documented differences in effect on trade between multilateral and unilateral currency unions and found that the effect was stronger for unilateral currency unions. However, the latter found a general downtrend for both currency arrangements.

An interesting finding is that even after controlling for distance and membership in the trade agreement, contiguity still has an important impact on bilateral trade between the SACU member states. The border dummy is significant and positive with a coefficient of 3.33, and this means that sharing a border increases bilateral trade by 28 per cent on average. This means that countries that are close to each other trade more than countries which are distant. This is an important result as it outlines the impact of geographical distance as a source of trade costs even with trade agreements.

The language variable has a coefficient of 0.212; it has the expected positive sign but is not significant. Countries that share common colonial ties; for example, South Africa and Namibia; Botswana, Lesotho, and Eswatini, are expected to trade 7.1 per cent more than countries without such ties. This is deduced from a positive and significant colony dummy variable with a coefficient of 1.96.

The language and colony linkages are used as proxies for cultural or historical proximity (Head & Mayer, 2013). As expected from the literature, landlocked countries are expected to trade less than countries which have access to the sea. The coefficient for the landlocked variable is -1.91 and it is significant. Botswana, Lesotho and Eswatini as the landlocked members in the SACU bloc are expected to trade 0.85 per cent less than South Africa and Namibia.

5.5 SUMMARY

This study had two outputs, a framework and a composite risk index for quantifying and measuring aggregate risk in an economy. Since there has been a lot of controversy in the construction of composite indices, this study followed a framework outlined in the literature to come up with the former, and took procedural lessons from the human development index (2010) to construct the latter. The composite risk index was then used to augment the gravity model of trade to determine the impact of risk on bilateral trade flows in the SACU trade bloc.

After having addressed the requirements of the first two steps; providing a sound theoretical framework and data selection, MDA was undertaken. The main idea behind this analysis is to avoid measurement error in the construction of the index. The PCA procedure was chosen as the best method. This choice was based on the KMO measure of sampling adequacy which had a value of *0.7151* (>*0.5*), meaning high correlation between the variables. As one of the pre-requisites of the PCA method, correlation has to be ascertained between the variables.

The variables were found to be moderately correlated which raised no collinearity concerns (*average bivariate correlation was found to be 0.25*). Three Eigen values were identified and they accounted for 74% of the total variance. This step produced PCA weights which were used during the weighting stage. The Min-Max rescaling normalisation procedure was chosen on the basis that there were small proportions of outliers in the dataset. Since different indicators are used for the composite risk index, it is necessary to bring the indicators to the same standard, that is, a dimensionless number.

Two aggregation and weighting procedures were used to construct the composite risk index: Equal weighting and geometric aggregation (*CR1*); Equal weighting and additive aggregation (*CR2*); PCA weighting and geometric aggregation (*CRpca1*); and the PCA weighting and additive aggregation (*CRpca2*). From the results, it was clear that the equal weighting and geometric aggregation was the ideal procedure. It produced results that were robust; hence, the *CR1* was the chosen composite risk index.

This study followed the long list of empirical studies which have used the gravity model. However, following the recent controversy surrounding the correct specification of the model, this study looked to circumvent this. This was done by following Santos Silva and Tenreyro (2006) who argued that the log linear model was not correct as there was potential bias in the estimated elasticities. They proposed that the gravity equation of trade, like other constant-elasticity models, should be estimated in multiplicative form using the PPML estimator with panel data. The analysis was undertaken in three distinct steps: the first of which was to augment the gravity model with one risk dimension at a time and determine its impact on bilateral trade. The second and third steps involved augmenting the gravity model with all risk dimensions at once and the composite risk index, respectively.

All the risk dimension variables were significant at different levels of significance, albeit, with differing signs. The variables of interest in the first two steps of the analysis were: the *log of economic risk*, *log of social risk*, *log of technological risk* and the *log of environmental* risk for both the importer and exporter. The economic and social risk variables had robust results for both trading partners under the individual and combined stages of the analysis.

The economic risk increased imports and decreased exports. The social risk reduced imports and increased exports during the time under review. For the technological and environmental risks, only one side of the trading pair had robust results. The technological risk decreased imports while the environmental risk increased exports.

An important result from the final stage of the analysis of the study was the fact that the aggregate risk variables were both highly significant, indicating a substantial impact on bilateral trade flows within the SACU. An increase in the incidence of risky events in the domestic economy of the importer increases bilateral trade, while the opposite is true for the exporter. This means that risk increases imports and decreases exports in the SACU trade bloc. It is also worth mentioning that the impact of the risk was substantially higher for the exporter than for the importer. The risk was found to decrease exports by up to 18 times more than it did imports.

Another important result was the robustness of the coefficient on the distance variable. It was found to be -1.5, across all the different analysis when the PPML was used. This means that when controlling for all the different types of risks and transport costs, distance had a higher impact on bilateral trade. Interestingly, this is higher from the unitary elasticity reported in the trade literature.

CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 INTRODUCTION

The main objective of regional economic integration is to provide a larger market for bilateral trade partners, so as to increase bilateral trade. For a while now, intra-bloc trade has remained low in regional trade blocs around the world, especially those involving developing economies (SS RTAs). The SACU, a regional trade agreement between Botswana, Eswatini, Lesotho, Namibia, South Africa, is a classic example. The SACU member states have over the years conducted more trade with external partners than with fellow SACU members. A bulk of the SACU exports has gone to Africa, Asia and Europe, with the SACU market being a distant fourth destination. Asia, Europe and Africa have been the principal sources of the SACU imports.

A number of possible explanations for this state of affairs have been forwarded in the literature. These include: a lack of administrative capacity and infrastructure; the presence of protectionist trade policies; politically immaturity and instability. However, according to a number of researchers (ECA, 2013; Behar & Criville, 2010; Elva & Behar, 2008; Carrere, 2004, Wiemer & Cao, 2004), these issues have been addressed yet intra-bloc trade remains low. Risk was flagged as a possible solution to this mystery. However, there were concerns over the manner in which risk had been quantified in the trade-risk studies. Therefore, this study set out to determine whether the observed low intra-bloc trade in the RTAs can potentially be attributed to risk. The second was to use the risk measure to determine the impact of risk on bilateral trade flows. Accordingly, this study pursued three main objectives. The first one was to determine whether SS regional trade blocs had lower intra-bloc trade compared to NN and NS regional trade blocs. The second objective was to construct and validate a risk measure which accurately quantifies risk in a trading economy. The third objective was to determine the impact of risk on the SACU bilateral trade flows.

The motivation to undertake such an analysis emanates from the realisation that much against theory, trade volumes within SS RTAs have remained low, despite efforts to make the trade arena more conducive (Coulibaly & Fontagne, 2009). The need for this analysis also emanates from the lack of studies analysing the impact of aggregated risk in a SS RTA setting. This is because risks are said to have a spill over effect and SS RTAs are said to be inherently risky and less resilient to the adverse effects of risky events (WEF, 2012). Studies that have been done tend to focus on NN and NS RTAs. This setting may yield misleading predictions for SS trade agreements due to differences in the level of economic development and macroeconomic policies (Mayda & Steinberg, 2009). Risk has also been flagged as an important impediment to bilateral trade (Oh & Reuveny, 2010).

Arguably, the greatest motivation for the study came from the fact that there is no framework for quantifying and measuring aggregate risk in an economy. This is besides the fact that risk has been identified as one of the principal external factors that impede bilateral trade flows (Oh & Reuveny, 2010; Long, 2008; Mirza & Verdier, 2008; Nitscha & Schumacher, 2004; Anderson & Marcouiller, 2002; Fosu, 2001; Li and Sacko, 2000). Such a framework would help shed light on how to determine the level of risk in an economy, and how to determine its overall impact on regional economic integration. The decision to use the SACU as the subject of the analysis was made purely because it is an old trade bloc. It has gone through a number of reforms which were made to improve the trade landscape for the member states. It also has a good mixture of developing countries across the different income classifications: low, middle, and upper income.

SACU is, arguably, the only trade bloc that has an explicit financial risk mitigation strategy in the form of the common revenue pool. Agricultural commodity trade was chosen because it represents the livelihood for the SACU member states, especially Botswana, Lesotho, Namibia and Eswatini. With a majority of people in most of these countries being poor and unemployed, agriculture represents a survival alternative. However, there is an over reliance on the physical environment, which is characterised by erratic weather and poor infrastructure. This means the majority of the population is not able to reap the benefits from agriculture and trade.

The next section of this chapter draws conclusions from the key processes and findings of the index construction and gravity model sections. It also summarises the main findings of the study; followed by key conclusions. The last section recommends possible policy interventions given the findings.

6.2 SUMMARY

This study combined trade and risk principles to investigate the impact of risk on bilateral trade flows between the SACU member states. The external factor considered in this study is risk. This builds on empirical findings and conclusions of the negative correlation between risky events and bilateral trade. However, since a number of studies considered the influence of one type of risky event in isolation, this study considered the impact of a number of risky events at the same time. This is a consequence of the spill over effect of risky events as well as their snowballing effect (Jovanovic *et al*., 2012).

6.2.1 Composite Index Construction

The analysis began with the need to come up with a logical methodology of aggregating the risk elements into a meaningful risk measure. This involved setting up a framework for quantifying and measuring the different risks in the economies of the SACU member states. After reviewing the literature on the best methodology to follow in aggregating risk, it was decided that a composite index would be the best approach. As Saisana *et al*. (2005) alluded; composite indicators have gained popularity in recent times. They are increasingly being used to convey key information on the status of countries in an array of fields. Since risk is a multi-dimensional concept, the composite index approach was deemed best. This is because the process involves the manipulation of individual normalised and weighted indicators, to produce an aggregate ordinal or cardinal measure of a country's performance in some area of study. The process of constructing the composite risk relied heavily on processes used to construct other social indices, for example, the Human Development Index (2010), the Disaster Risk Index (2004), and the Environmental Sustainability Index (2005).

The composite risk index construction process followed a framework outlined in OECD (2008) and Nardo *et al*. (2005).

The first step in the process involved identifying risk dimensions to be included in the aggregation. The choice of dimensions was based on their role in affecting bilateral trade. Four risk dimensions were chosen from the five fundamental sources of risk as classified by the WEF (2013). The chosen dimensions were: economic, social, environmental, and technological factors. From these risks dimensions, two risk factors were chosen based on analytical soundness, measurability, coverage, and relevance. The chosen risk factors were economic growth and inflation (economic); poverty and unemployment (social); rainfall and temperature (environmental); and road and telephone networks (technological).

The next step in the process was multivariate data analysis. This step reduces measurement error and allows the proper measurement of the concept under review. It also reveals the association (that is, correlation) between a set of different variables, and how these variables change in relation to one another (Hair *et al*., 2010; OECD, 2008; Nardo *et al*., 2005). The Kaiser-Meyer-Olkin measure of sampling adequacy was *0.7151* (requirement is for the measure to be greater than 0.5 in order to use principal components analysis). This exercise produced the *PCA* weights which were used during the weighting stage.

An aggregation exercise generally involves combining a number of indicators which are chosen on the basis of their relevance in explaining some phenomena of interest. The next step involved bringing the indicators to the same standard, by transforming them into purely dimensionless numbers, this is called normalisation. The *Min-Max Re-scaling* and *Standardisation (z-scores)* techniques were used in the study.

The next step in the process was the aggregation and weighting procedures. This involved coming up with a logical way of combining the different indicators. *Equal weighting* and *PCA weighting* (from the multivariate data analysis stage) were used as weighting procedures. The most popular aggregation methods in the literature are the *arithmetic* and *geometric* means (Aguna & Kovacevic, 2011). Four different risk indices were constructed using the two aggregations and weighting procedures: multiplicative aggregation with equal weights (*CR1*); additive aggregation with equal weights (*CR2*); multiplicative aggregation with PCA weights (*CRpca1*); and finally additive aggregation with PCA weights (*CRpca2*).

The construction of a composite index involves multiple stages where subjective decisions have to be made and these are a source of the never-ending controversy surrounding indices (Tate, 2012; Aguna & Kovacevic, 2011; OECD, 2008). Uncertainty and sensitivity analysis were undertaken to enhance the transparency of the composite risk construction exercise. The *CR1* risk index proved its robustness under different test scenarios and was, therefore, used as the composite risk index in the analysis.

6.2.2 Empirical Model Specification

The first part of the analysis involved producing a single value which quantified the level of risk in the economies of the SACU member states. The second part was about using that value in a gravity framework to control for the influence of aggregate risk in bilateral trade flows. This sections outlines the specification of the gravity model used for the empirical analysis as well as arguments for the choice made.

To address recent criticism of the gravity model, this study adopted numerous measures which trade researchers have recommended. To address the criticism, that it does not account for the cost of sourcing goods from alternative sources, this study used a specification proposed by Feenstra (2002). This specification consists of using importer and exporter fixed (random) effects to control for the specific MRTs, instead of estimating it (Prehn *et al*., 2016; Bacchetta *et al*., 2012; Feenstra, 2002). To address issues of non-stationarity, cross-correlation, heteroskedasticity and endogeneity in the data, this study used the random effects specification with panel data (Zwinkels & Beugelsdijk, 2010; Baier & Bergstrand, 2007). The use of panel data also aids in accounting for the wide variety of country heterogeneity in the SACU trade bloc (Westerlund & Wilhelmsson, 2011). The use of the PPML estimator allows for the direct estimation of the gravity model. This circumvents the need to drop zero trade values. This approach works well even in the presence of heteroskedasticity (as is always the case with trade data); the PPML is a robust approach (Head & Mayer, 2013; Martinez-Zarzoso, 2013; Bacchetta *et al*., 2012; Anderson, 2011; Westerlund & Wilhelmsson, 2011).

6.2.3 Gravity Model Analysis

The main objective of this study was to determine the impact of aggregate risk on the bilateral trade between the SACU member states. This involved the construction of a risk measure and the augmentation of the gravity model of trade. The analysis was undertaken in four distinct parts; the first stage involved comparing the level of risk in the SACU member states. The results showed that South Africa had low levels of risk and Eswatini had the highest. This was expected as risk is said to be inherent in the less developed countries due to an array of reasons: including primarily poorly developed economies and a low asset base which compromise resilience.

The second stage of the analysis involved determining the impact of the individual risk dimensions on bilateral trade within the SACU trade bloc. This means that the four respective risk dimensions (economic, social, environmental and technological) had their own indices which quantified the respective risk type. These were used to control for the effect of the respective risks in the bilateral trade flows. From the results of the analysis, three of the individual risk dimensions (social, technological and environmental) decreased imports, except economic risk. The economic risk decreased exports, while all the other risks increased exports. The economic risk had the highest impact on bilateral trade in absolute terms, while environmental risk had the lowest impact.

The third part of the analysis involved analysing the impact of the risk dimensions simultaneously. From the results, when viewed from the importer’s side, the technological risk had the highest impact on bilateral trade, whilst environmental risk had the lowest impact. From the exporter’s side of things, the environmental risk had the highest impact on bilateral trade, whilst economic risk had the lowest impact. The economic and environmental risks increased imports, while the other two decreased them. The economic risk, also, had a negative effect on exports as did technological risk, while social and environmental risks increased exports.

The last part of the analysis, and the key part of the study, was the aggregation of the risks found in the respective economies into a single measure, the composite risk index. The gravity model of trade was augmented with two domestic risk variables (for each of the bilateral partners) in this analysis. The risk variables control for the risk in the domestic economies of the importing and exporting countries. From the results, the importer and exporter risk variables were found to be significant, albeit, with different signs.

The risk variables of the importer and exporter were found to be positively and negatively correlated with bilateral trade, respectively. This means risk increased imports and decreased exports. The exporter risk had a higher impact on bilateral trade than importer risk in absolute terms.

6.3 CONCLUSIONS

As far as it could be determined, this study is the first attempt at analysing the impact of aggregated risk on bilateral trade flows in the SACU trade bloc. A number of studies analysed the impact of some form of risky event on bilateral trade (Oh & Reuveny, 2010; Long, 2008; Mirza & Verdier, 2008; Nitscha & Schumacher, 2004; Fosu, 2001; Li and Sacko, 2000). Such studies were useful in that they provided insights on the interaction of risk and bilateral trade. However, since these studies controlled for a single type of risk, they provided limited information on the interaction dynamics between different types of risk and consequently between risk and trade.

Even though the gravity model of trade is generally regarded as the workhorse of empirical trade studies, there are still a number of contentious issues around it. These include: the natural specification of the gravity model, that is, log linear version. This specification leads to zero bilateral trade flows being dropped (which introduce selection bias). Another issue is the bias in empirical trade studies which emanates from the omission of MRTs in the gravity model. Theory on bilateral trade flows should account for the relative attractiveness of origin-destination pairs. To circumvent some of these shortcomings, this study used the Poisson Pseudo-Maximum Likelihood (PPML) estimator with panel data. Besides being consistent in the presence of heteroskedasticity, this approach accounts for MRTs, it also provides a natural way of dealing with zero values of the dependent variable and increases the efficiency of the model estimates (Bacchetta *et al*., 2012; Martinez- Zarzoso, 2009; Westerlund & Wilhelmsson, 2011; Santos Silva & Tenreyro, 2006; Anderson & van Wincoop, 2003).

This study used an index constructing framework (OECD, 2008; Nardo *et al*., 2005) to quantify and measure risk in the domestic economies of the SACU member states. The aggregated risk measure was used to augment the gravity model of trade for the empirical analysis. There are two major findings of the study: the first one is that risk is an impediment to trade as proven by Oh and Reuveny (2010). However, risk only impedes the flow of goods from the producing country to the consuming country (exports). This study found this result to be probable because risk disrupts production and render fewer goods available for export. Another finding of the study is that risk could potentially increase trade. Producers who are risk averse in the domestic economy may reduce their production activities due to some perceived threat. This would mean fewer goods are available for domestic consumption, and imports would have to cover the deficit.

Another important result and policy implication from this study is the significance and robustness of distance. The distance variable was significant and with the expected sign which was also robust throughout the relative estimation procedures. The coefficient was also -1.5 throughout the empirical analysis. This result calls for investments into transport infrastructure which will ideally reduce long distance costs of transporting goods. These high transportation costs, which are a consequence of poor transport infrastructure, act as a barrier to intra-SACU trade.

6.4 RECOMMENDATIONS

The recommendations of this study are in two parts; the first part addresses recommendations pertaining to the results from this study. The second part deals with recommendations for future research.

6.4.1 Policy Recommendations

Developing countries cannot afford to dismiss studies on risk as speculative and expensive as has been the case over the years (WEF, 2013). From the results of this research, it has been shown that risk does have an impact on bilateral trade flows. The individual and aggregated risk variables showed a significant effect (albeit, negative and positive). This means that risk mitigation programmes have to be part of every developing country's development agenda because risk is a significant trade shifter. They have to be put in place, implemented or re-visited, as a matter of urgency, to help countries improve their resilience to risk. This would also help countries exploit their comparative and competitive advantage in international trade. Each country needs risk mitigation strategies at every stage of the economy to assist economic players compete internationally.

By definition, risks are unfavourable events that may happen through chance as a consequence of other events. The fact that they are uncertain should not cloud the fact that they have to be planned for. The low resilience of developing countries is not always because they do not have resources. Instead, they decide to allocate resources to more pressing matters that are already occurring; for example, poverty, unemployment, drought and diseases (WEF, 2013). They neglect the events that might happen, only to suffer unrepairable damage when disaster strikes. Conceptually, risk mitigation needs to reduce the economic vulnerability of business units in the domestic economy by building their resilience. This may be done through planning and strategies aimed at helping these units anticipate shocks from the physical environment, from within and outside each country.

Governments need to come up with policies that will keep inflation low while pushing for a robust and sustainable economic growth. Such policies should thrive to reduce poverty and unemployment; reduce the dependency on the external environment; and improve the quality of infrastructure so as to help domestic producers and consumers with smooth production and consumption patterns.

Risk need to be addressed by improving the resilience of the domestic economy to potential crises through contingency planning. However, the starting point of the implementation of an effective and proper risk management policy is a thorough understanding of the type and dynamics of the risks involved, and vulnerabilities thereof. Understanding the nature and impact of risk in the domestic economy would greatly help developing countries set up and implement risk mitigation strategies. Such strategies should be geared towards decreasing the effect of risky events on the domestic economy. It is, therefore, imperative that a thorough risk assessment is done by the respective countries with the aim of determining which types of risks pose the greatest threat to each country. Such studies should inform the choice of mitigation strategy for the identified risk and related risks thereof.

The SACU needs to help member states in building their resilience through collective risk mitigation policies and strategies. This can be done by increasing the developmental component of the SACU receipts, and making sure they are used for their intended purpose. Since the results reveal that risk increases imports and decreases exports between bilateral partners, it can be deduced that risk increases the dependency of the BELN countries on South Africa. There is a need for these countries to increase their exports into the South African market. This will not only improve their terms of trade, but also their share from the CRP. This also has the potential of increasing trade volumes within the trade bloc, and this would help the bloc remain relevant.

6.4.2 Future Research Recommendations

This study is valuable in the sense that it gives a glimpse into previously unexplored territory; however, it can be extended and refined in a number of ways. Although the methodology that was utilised passed a number of vetting tests on appropriateness on being a valid risk measuring tool for trading countries, it was not possible to subject it to a more rigorous empirical validation. This was due, primarily, to the problem of data paucity in developing countries. This led to a situation where the analysis relied on a small sample size, and the data set that was utilised spanned 19 years. Even though the data was presented and analysed as panel data of 20 agricultural commodities between two trading partners, which amounted to 6300 observations, a larger data set would greatly aid the validation. Due to the paucity of data and lack of adequate information, for instance, the probability of the risk dimensions used in the construction of the index had to be equalised.

While this study used aggregated agricultural commodity trade, for future research, the risk-trade nexus may be investigated in the context of individual commodities in the agricultural sector, to determine whether some traded goods are affected more by risk than others. Furthermore, this study may be extended to explore the effect of risk on traded commodities in other sectors of the economy.

6.4.3 Limitations of the study

This study was affected by, probably the oldest problem that plagues empirical studies in the developing economies: lack of large and reliable data sets. The dataset utilised in the study spans 19 years, and a longer dataset would have definitely offered more insights.

After discussions with experts in the trade and risk disciplines, it was apparent that some of them were not satisfied with the construction and composition of the risk trade index. Others had suggestions on how it could be expanded to cover more dimensions, ranging from politics to activities at border posts. While many of these concerns are valid, this should not take anything away from the primary objective of this study, which was to construct a composite risk measure to address the spill over effects of risk. It has managed to shed light on the importance of aggregating risk in the economy through the composite risk index and using it to determine the impact of risk on bilateral trade.

At first attempt, it is not possible to construct a flawless index which captures all the important dimensions of risk. This would be attained after discussions and debates on the need for an aggregated index which lumps together different aspects of production, trade, and consumption risks. However, in this study, all attempts were made to present the best possible risk indices. In further research, there would be a need to decide what other dimensions need to be added, how much importance to attach to respective categories, and how to obtain more data.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

REFERENCES

Abadie, A. and Gardeazabal, J. (2008). Terrorism and the World Economy. *European Economic Review*. 52:1-27.

Adams, J. (2002). *Risk*. London: Taylor and Francis Group.

African Development Bank (ADB), (2019). Southern African Economic Outlook. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/2019AEO/REO_2019_-_Southern_africa.pdf. [Accessed 12/10/2019].

Africa Growth Initiative (AGI), (2012). Accelerating Growth through improved Intra-African Trade. https://www.brookings.edu/wp-content/uploads/2016/07/01_intra_african_trade_full_report.pdf. [Accessed 20/03/2014].

Aguna, C.G. and Kovacevic, M. (2011). Uncertainty and Sensitivity Analysis of the Human Development Index. http://hdr.undp.org/sites/default/files/hdrp_2010_47.pdf. [Accessed 04/10/2016].

Aimin, H. (2010). Uncertainty, Risk Aversion and Risk Management in Agriculture. *Agriculture and Agricultural Science Procedia*. 1:152-156.

Anderson, J. E. (2011). The Gravity Model. *Annual Review of Economics*. 3:133-60.

Anderson, S. and Felici, M. (2012). *Emerging Technological Risk: Underpinning the Risk of Technological Innovation*. Springer-Verlag London Limited. London.

Anderson, J. E. and Marcouiller, D. (2002). Insecurity and the Pattern of Trade: An Empirical Investigation. The Review of Economics and Statistics. 84(2):342-352.

Anderson, J. E. and van Wincoop, E. (2003). Gravity with Gravitas: A Solution to the Border Puzzle. American Economic Review. 93(1):170-192.

Anderson, J. E. and Yotov, Y. V. (2012). Gold Standard Gravity. NBER Working Paper.

Anderson, J. E. (1979). A Theoretical Foundation for the Gravity Equation. *American Economic Review*. 69(1):106-116.

Azis, I. J. (2016). The risks of regional integration. What Asia can learn from European economic integration? https://www.policyforum.net/risks-regional-integration/. [Accessed 22-01-2019].

Baas, D. (2010). Approaches and challenges to political risk assessment: The view from Export Development Canada. *Risk Management*. 12(2):135-162.

Bacchetta, M., Beverelli, C., Cadot, O., Fugazza, M., Grether, J. M., Helble, M., Nicita, A. and Piermartini, R. (2012). A practical Guide to Trade Policy Analysis. http://vi.unctad.org/tpa/web/docs/book.pdf. [Accessed 30/09/2014].

Baharumshah, A. Z., Onwuka, K. O. and Habibullah, M. S. (2007). Is a regional Trade Bloc a Prelude to Multilateral Trade liberalization? Empirical Evidence from the ASEAN-5 Economies. *Journal of Asian Economics*. 18:384-402.

Baier, S. L. and Bergstrand, J. H. (2007). Do Free Trade Agreements actually increase members' International Trade? *Journal of International Economics*. 71(1):72-95.

Baier, S. L. and Bergstrand, J. H. (2009). Bonus vetus OLS: A simple Method for approximating International Trade-Cost Effects using the Gravity Equation. *Journal of International Economics*. 77:77–85.

Baldwin, R. and Seghezza, E. (2010). Are Trade Blocs Building or Stumbling Blocks? *Journal of Economic Integration*. 25(2):276-297.

Baltagi, B. H., Egger, P. and Pfaffermayr, M. (2014). Panel Data Gravity Models of International Trade. CESIFO Working Paper NO. 4616. https://ideas.repec.org/p/ces/ceswps/_4616.html. [Accessed 17/08/2016].

Baudoin, M. C., Vogel, K. Nortje, and M. Naik. (2017). Living with drought in South Africa: lessons learnt from the recent El Niño drought period. *International Journal of Disaster Risk Reduction*. 23:128-137.

Bayer, R. and Rupert, M. C. (2004). Effects of Civil Wars on International Trade, 1950-92. *Journal of Peace Research*. 41(6):699-713.

Beck, T. (2002). Financial Development and International Trade. Is there a Link? *Journal of International Economics*. 57(1):107-131.

Behar, A. and Criville, L. C. (2010). The Impact of North-South and South-South Trade Agreements on Bilateral Trade. F.R.E.I.T Working Paper. http://www.freit.org/WorkingPapers/Papers/TradePolicyRegional/FREIT220.pdf. [Accessed 13/08/2014].

Bergstrand, J. H. (1985). The gravity equation in international trade: Some microeconomic foundations and empirical evidence. *The Review of Economics and Statistics*. 67(3):474-481.

Bergstrand, J. H., Larch, M. and Yotov, Y. V. (2013). Economic Integration Agreements, Border Effects, and Distance Elasticities in the Gravity Equation. Drexel University School of Economics. Working Paper Series. WP 2013-7.

Bhagwati, J. (2008). *Termites in the Trading System. How Preferential Agreements are undermining Free Trade*. Oxford University Press. New York.

Bhagwati, J. and Srinivasan, T. N. (2002). Trade and Poverty in the Poor Countries. *The American Economic Review*. 92(2):180-183.

Borodin, K. and Strokov, A. (2014). Inflation and the Pattern of Trade: General Conclusions and Evidence for Russia. http://ageconsearch.umn.edu/bitstream/195708/2/Borodin_Strokov_Inflation_and_the_pattern_of_trade_2014_IAMO.pdf. [Accessed 29/10/2015].

Bougheas, S., Demetriades, P. O. and Morgenroth, E. L. W. (1999). Infrastructure, Transport Costs and Trade. *Journal of International Economics*. 47.169-189.

Brink, C. H. (2004). *Measuring political risk*: Risks to foreign investment. Ashgate Publishing Limited. Aldershot.

Burke, M., de Janvry, A. and Quintero, J. (2010). Providing Index based agricultural Insurance to Smallholders: Recent Progress and Future promise. Available at: http://siteresources.worldbank.org/EXTABCDE/Resources/7455676-1292528456380/7626791-1303141641402/7878676-1306270833789/Parallel-Session-5-Alain_de_Janvry.pdf. [Accessed 18/11/2015].

Calderon, C., and Serven, L. (2008). Infrastructure and Economic Development in Sub-Saharan Africa. World Bank Policy Research Working Paper Series. No. 4712. Washington, DC: World Bank.

Carrere, C. (2004). African Regional Agreements: Impact on Trade with or without Currency Unions. *Journal of African Economies*. 13(2):199-239.

Cernat, L. (2001). Assessing Regional Trade Arrangements: Are South-South RTAs more Trade diverting? United Nations Conference on Trade and Development. http://unctad.org/en/docs/psitcdtab17.en.pdf. [Accessed 21/04/2014].

Chavas, J. P. (2004). *Risk analysis in theory and practice*. London: Elsevier Academic Press.

Cherchye, L., Moesen, W., Rogge, N., Van Puyenbroeck, T., Saisana, M., Saltelli, A., Liska, R., and Tarantola, S. (2006). Creating Composite Indicators with DEA and Robustness Analysis: The Case of the Technology Achievement Index. *Journal of the Operational Research Society*. 59(2):239-251.

Chingono, M. and Nakana, S. (2008). The Challenges of Regional Integration in Southern Africa. *African Journal of Political Science and International Relations*. 3(10):396-408.

Cieslik, A. and Hagemejer, J. (2009). Assessing the Impact of the EU-sponsored Trade Liberalization in the MENA Countries. *Journal of Economic Integration*. 24(2):343-368.

Ciftcioglu, S. and Begovic, N. (2008). The Relationship between economic Growth and selected macroeconomic Indicators in a Group of Central and East European countries: A Panel Data Approach. *Problems and Perspectives in Management*. 6(3):24-30.

Coulibaly, S. and Fontagne, L. (2009). South-South Trade: Geography Matters. *Journal of African Economies*. 15(2):313-341.

Department of Environmental Affairs and Tourism (DEAT), (2005). Risk Management. www.environment.gov.za/sites/default/files/docs/series23_risk_management.pdf. [Accessed 03/09/2014].

De Benedictis, L, and Taglioni, D. (2011). The Gravity Model in International Trade. The Trade Impact of European Union Preferential Policies. Springer. https://ssrn.com/abstract=2384045. [Accessed 11/02/2015].

De Sousa, J. (2012). The Currency Union Effect on Trade is decreasing over Time. *Economics Letters*. 117(3):917-920.

Dirar, L. G. (2009). Multilateralism or Regionalism: What can be done about the Proliferation of Regional Trading Agreements? Cornell Law School Inter-University Graduate Student Conference Papers. Paper No. 20. http://scholarship.law.cornell.edu/lps_clacp/20. [Accessed 18/04/2014].

Dlamini, T., Mlipha, S.S.B., Mohammed, M. and Sacolo T. (2018). Path to economic recovery and sustainable growth in the Kingdom of Eswatini. *African Review of Economics*. 10(2):1-7.

Dunn, R. M. and Mutti, J. H. (2004). *International Economics*. 6th Ed. London: Routledge.

Dutt, P., Mihov, I. and Van Zandt, T. (2013). The Effect of WTO on the extensive and the intensive Margins of Trade. *Journal of International Economics*. 91(2):204-219.

Economic Commission for Africa (ECA), (2013). Making the most of Africa's Commodities: Industrializing for Growth, Jobs and Economic Transformation. Economic Report on Africa. https://www.uneca.org/sites/default/files/PublicationFiles/unera_report_eng_final_web.pdf. [Accessed 15/04/2014].

EconomyWatch, (2010). Risks in International Trade. http://www.economywatch.com/international-trade/risks.html. [Accessed 03/09/2014].

Egger, P. and Larch, M. (2008). Interdependent preferential trade Agreement Memberships: An empirical analysis. *Journal of International Economics*. 76(2):384-399.

Elva, M. and Behar, A. (2008). Factors that contribute to (or detract from) successful Outcomes in African Regional Agreements. World Development Report.

https://openknowledge.worldbank.org/bitstream/handle/10986/9101/WDR2009_0001.pdf?sequence=1. [Accessed 16/04/2014].

Erasmus, G. (2014). Namibia and the Southern African Customs Union. http://www.kas.de/upload/Publikationen/2014/namibias_foreign_relations/Namibias_Foreign_Relations_erasmus.pdf. [Accessed 16/09/2014].

Facchini, G., Silva, P. and Willmann, G. (2012). The customs union issue: Why do we observe so few of them? *Journal of International Economics*. 90:136-147.

Feenstra, R. C. (2002). Border Effects and the Gravity Equation: Consistent Methods for Estimation. *Scottish Journal of Political Economy*. 49(5):491-506.

Fischhoff, B. Watson, S.R. and Hope, C. (1984). Defining Risk. *Policy Sciences*. 17:123-139.

Foa, R. (2014). Household Risk Preparation Indices. Construction and Diagnostics. World Development Report 2014 background paper.

Foellmi, R. and Zweimuller, J. (2008). Structural change, Engel's consumption cycles and Kaldor's facts of economic growth. *Journal of Monetary Economics*. 55(7):1317-1328.

Food and Agriculture Organization of the United Nations (FAO), (2012). Why has Africa become a net Food Importer? Explaining Africa agricultural and Food Trade Deficits. Rome.

Fosu, A. K. (2001). Political Instability and economic Growth in developing Economies: Some Specification Empirics. *Economics Letters*. 70:289-294.

French Research Centre in International Economics (CEPII). (2018). GeoDist. http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6. [Accessed 18/09/2018].

Freund, C. (2000). Different Paths to Free Trade: The Gains from Regionalism. *The Quarterly Journal of Economics*. 115(4):1317-1341.

Freund, C. and Ornelas, E. (2010). Regional Trade Agreements. *Annual Review Economics*. 2:39-66.

Gassebner, M., Keck, A. and Teh, R. (2010). Shaken, Not Stirred: The Impact of Disasters on International Trade. *Review of International Economics*, 18(2): 351-368.

Gomez-Herrera, E. (2013). Comparing Alternative Methods to estimate Gravity Models of bilateral Trade. *Empirical Economics*. 44(3):1087-1111.

Greene, W. (2011). Fixed Effects Vector Decomposition: A Magical Solution to the Problem of Time-Invariant Variables in Fixed Effects Models? *Political Analysis*. 19:135-146.

Gujarati, D. N. and Porter, D. C. (2009). *Basic econometrics* (5th Ed.) New York: McGraw−Hill.

Gunning, J. W. (2008). Shocks, Risk, and African Growth: The Political Economy of Economic Growth in Africa, 1960–2000. Cambridge University Press. New York.

Gupta, A. (2014). *Risk Management and Simulation*. Florida: Taylor and Francis Group.

Hagerty, M. R. and Land, K. C. (2007). Constructing Summary Indices of Quality of Life: A Model for the Effect of Heterogeneous Importance Weights. *Sociological Methods and Research*. 35(4):455-496.

Hair, J. F., Black, W. C., Babin, B. J., and Anderson R. E. (2010). *Multivariate Data Analysis* (7th Ed.). New Jersey: Pearson Prentice Hall.

Hansohm, D. (2011). Structural Policies to counter Marginalization in Southern African Integration. *Monitoring Regional Integration in Southern Africa*. Trade Law Centre of Southern Africa (tralac). Stellenbosch.

Hardaker, J. B., Huirne, R. B. M., Anderson, J. R. and Lien, G. (2004). *Coping with Risk in Agriculture* (2nd Ed.). Washington D.C. Cabi.

Hartzenberg, T. (2011). Regional Integration in Africa. WTO Staff Working Paper ERSD-2011-14. http://www.wto.org/english/res_e/reser_e/ersd201114_e.pdf. [Accessed 02/05/2014].

Haskel, J., Lawrence R. Z., Learner E. E. and Slaughter, M. J. (2012). Globalization and U.S. Wages: Modifying Classic Theory to Explain Recent Facts. *Journal of Economic Perspectives*. 26(2):119-140.

Head, K. and Mayer, T. (2013). Gravity Equations: Workhorse, Toolkit, and Cookbook. Centre for Economic Policy Research. Discussion Paper No: 9322. http://strategy.sauder.ubc.ca/head/papers/headmayer_revised.pdf. Accessed 06/06/2014.

Helpman, E., Melitz, M. and Rubinstein, Y. (2008). Estimating Trade Flows: Trading Partners and Trading Volumes. *Quarterly Journal of Economics*. 123(2):441-487.

Holzmann, R. and Jorgensen, S. (2001). Social Risk Management: A New Conceptual Framework for Social Protection, and Beyond. *International Tax and Public Finance*. 8:529–556.

Holzmann, R., Sherburne-Benz, L., and Tesliuc, L. (2003). Social Risk Management: The World Bank's approach to social protection in a globalizing world. http://siteresources.worldbank.org/SOCIALPROTECTION/Publications/20847129/SRMWBApproachtoSP.pdf. [Accessed 12/09/2015].

Hosny, A. S. (2013). Theories of Economic Integration: A Survey of the Economic and Political Literature. *International Journal of Economy, Management and Social Sciences*. 2(5):133-155.

Hsiao, C. (2007). Panel data analysis. Advantages and Challenges. *Test*. 16:1-22.

International Monetary Fund (IMF), (2018). Macroeconomic and Financial Data. https://data.imf.org/. [Accessed 19/09/2018].

International Monetary Fund (IMF), (2014). Regional Economic Outlook. Sub-Saharan Africa.

International Trade Centre. (2018). International Trade Statistics 2001-2018. https://www.intracen.org/itc/market-info-tools/trade-statistics/. [Accessed 20/09/2018].

Irwin, D. A. (2008). International Trade Agreements. http://www.econlib.org/library/Enc/InternationalTradeAgreements.html. [Accessed 17/04/2014].

Johnson, G., Scholes, K. and Whittington, R. (2008). *Exploring Corporate Strategy* (8th Ed.). London: Prentice Hall.

Jovanovic, A., Renn, O. and Schroter, R. (2012). Social Unrest. OECD Reviews of Risk Management Policies. OECD Publishing. Paris. http://dx.doi.org/10.1787/9789264173460-en. [Accessed 07/05/2014].

Kagochi, J. and Durmaz, N. (2018). Assessing RTAs Inter-regional Trade Enhancement in Sub-Saharan Africa. *Cogent Economics & Finance*. 6:1-14.

Kahan, D. (2008). *Managing Risk in Farming*. Rome: Food and Agriculture Organization.

Kang, J. W. and Ramizo D. (2017). Impact of Sanitary and Phytosanitary Measures and Technical Barriers on International Trade. https://mpra.ub.uni-muenchen.de/82352/1/MPRA_paper_82352.pdf. [Accessed 29 January 2019].

Kaplan, R. S. and Mikes, A. (2012). Managing Risks: A new Framework. https://hbr.org/2012/06/managing-risks-a-new-framework. [Accessed 20/11/2014].

Kay, R. D., Edwards, W. M. and Duffy, P. A. (2011). *Farm management* (7th Ed.). New York: McGraw-Hill.

Keillor, B. D., Wilkinson, T. J. and Owens, D. (2005). Threats to International Operations: Dealing with Political Risk at the Firm Level. *Journal of Business Research*. 58:629- 635.

Kellenberg, D. K. and Mobarak, A. M. (2008). Does Rising Income increase or decrease Damage Risk from natural Disasters? *Journal of Urban Economics*. 63:788-802.

Keshk, O. M. G., Reuveny, R. and Pollins, B. M. (2010). Trade and Conflict: Proximity, Country Size, and Measures. *Conflict Management and Peace Science*, 27(1):3-27.

Kirk, R. and Stern, M. (2005). The New Southern African Customs Union Agreement. *The World Economy*. 28(2):169-190.

Konishi, H., Kowalczyk, C. and Sjostrom, T. (2003). Free Trade, Customs Unions, and Transfers. http://fmwww.bc.edu/ec-p/wp568.pdf. [Accessed 24/09/2014].

Krishna, K. (2005). Understanding rules of origin. National Bureau of Economic Research. Working Paper 11150. http://www.nber.org/papers/w11150. [Accessed 22/05/2014].

Krueger, A. O. (1999). Are Preferential Trading Arrangements Trade-liberalizing or Protectionist? *The Journal of Economic Perspectives*. 13(4):105-124.

Krugman, P. and Obstfeld, M. (2003). *International Economics: Theory and Policy*.6th Ed. Pearson Education. Boston.

Kucheryavyy, K. (2014). Comparative Advantage and International Risk Sharing. http://www.freit.org/WorkingPapers/Papers/TradePatterns/FREIT804.pdf. [Accessed 22/06/2015].

Levinson, A. (2009). Technology, international trade, and pollution from US manufacturing. *The American Economic Review*. 99(5):2177-2192.

Li, Q. and Sacko, D. (2000). The (Ir)Relevance of militarized Interstate Disputes for International Trade. *International Studies Quarterly*, 46(1):11-43.

Limao, N. and Venables, A. (2001). Infrastructure, geographical disadvantage, transport costs, and trade. *The World Bank Economic Review*. 15(3):451-479.

Long, A. G. (2008). Bilateral Trade in the Shadow of armed Conflict. *International Studies Quarterly*. 52:81-101.

Longo, R. and Sekkat, K. (2004). Economic obstacles to expanding intra-African trade. *World Development*. 32(8):1309-1321.

Luckmann, J.A. (2015). Positive Risk Management: Hidden Wealth in Surface Mining. *The Journal of the Southern African Institute of Mining and Metallurgy*. 115:1027-1034.

Lwanda, G. C. (2011). Can EPAs strengthen Regional Integration in Southern Africa? A Qualitative Analysis. Development Planning Division Working Paper Series No. 27

Mansfield, E.D. and Milner, H.V. (2014). The Domestic Politics of Preferential Trade Agreements in hard times. https://www.princeton.edu/~hmilner/working%20papers/Mansfield%20and%20Milner%20PTAhard%20times%2003112014.pdf. [Accessed 11/04/2014].

Manyena, B., O'Brien, G., O'Keefe, P. and Rose, J. (2011). Disaster Resilience: A Bounce Back or Bounce Forward Ability? *Local Environment: The International Journal of Justice and Sustainability*. 16:(5)417-424.

Martin, W., and Pham, C. S. (2008). Estimating the Gravity Model when Zero Trade Flows are Frequent. Economics Series; MPRA Paper No. 9453. https://openknowledge.worldbank.org/handle/10986/22182. [Accessed 13/08/2016].

Martinez- Zarzoso, I. (2013). The log of gravity revisited. *Applied Economics*. 45:311-327.

Martinez- Zarzoso, I., Felicitas, N. L. D. and Horsewood, D. (2009). Are regional trading Agreements beneficial? Static and Dynamic Panel Gravity Models. *North American Journal of Economics and Finance*. 20:46-65.

Martinez- Zarzoso, I. and Nowak-Lehmann, F. (2003). Augmented Gravity Model: An empirical Application to MERCOSUR-European Union Trade Flows. Journal of Applied Economics. 6(2):291-316.

Mayda, A. M. and Steinberg, C. (2009). Do South-South Trade Agreements increase Trade? Commodity-Level Evidence from COMESA. *The Canadian Journal of Economics*. 42(4):1361-1389.

McCarthy, C. (2003). The Southern African Customs Union. Food and Agricultural Organization of the United Nations. http://hubrural.org/IMG/pdf/fao_etude_sacu.pdf. [Accessed 20 January 2015].

Medvedev, D. (2010). Preferential Trade Agreements and their Role in World Trade. *Review of World Economics*. 146:199-222.

Meldrum, D. H. (2000). Country Risk and Foreign Direct Investment: Customized, Systematic Country Risk Assessment is Critical for Companies that contemplate Activity Abroad. *Business Economics*. 35(1):33-40.

Melitz, J. (2007). North, South and Distance in the Gravity Model. *European Economic Review*. 51:971-991.

Mirza, D. and Verdier, T. (2008). International trade, security and transnational terrorism: Theory and a survey of empirics. *Journal of Comparative Economics*. 36:179-194.

Mistry, P. S. (2000). Africa's Record of Regional Co-operation and Integration. *African Affairs*. 99:553-573.

Mlipha, S.S.B. and Kalaba, M. (2019). The impact of risk on bilateral trade in the Southern African Customs Union (SACU). *Development Southern Africa*. 37(1):1-18.

Mitchell, T. and Harris, K. (2012). *Resilience: A risk management approach*. ODI Background Note. Overseas Development Institute: London 2012.

Moschini, G. and Hennessy, D. (1999). Uncertainty, Risk Aversion and Risk Management for Agricultural Producers. Economic Staff Paper Series. 315. http://lib.dr.iastate.edu/econ_las_staffpapers/315. [Accessed 06/01/2021].

Moser, C. and, Rose, A. K. (2014). Who benefits from regional Trade Agreements? The View from the Stock Market. *European Economic Review*. 68:31-47.

Nardo, M., Saisana, M., Saltelli, A. and Tarantola, S. (2005). Tools for Composite Indicators Building. European Commission. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.114.4806&rep=rep1&type=pdf. [Accessed 19/05/2016].

Ndulu, B., Kritzinger-van Niekerk, L. and Reinikka, R. (2005). Infrastructure, Regional Integration and Growth in Sub-Saharan Africa: in Africa in the World Economy. http://www.fondad.org/product_books/pdf_download/5/Fondad-AfricaWorld-BookComplete.pdf. [Accessed 23/04/2014].

Ngalawa, H. P. E. (2013). Anatomy of the Southern African Customs Union: Structure and Revenue Volatility. ERSA working paper 374. http://www.econrsa.org/system/files/publications/working_papers/working_paper_374.pdf. [Accessed 10/09/2014].

Nicoletti, G., Scarpetta, S. and Boylaud, O. (2000). Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation. OECD. Economics Department Working Paper. No. 226, OECD. http://dx.doi.org/10.1787/215182844604. [Accessed 26/04/2016].

Nitsch, V. and Schumacher, D. (2004). Terrorism and International Trade: An Empirical Investigation. *European Journal of Political Economy*. 20:423-433.

Nordas, H. K. and Piermartini, R. (2004). Infrastructure and Trade. WTO Economic Research and Statistics Division, Staff Working Paper ERSD-2004-04. Geneva: World Trade Organization. https://www.econstor.eu/bitstream/10419/90657/2/772238901.pdf. [Accessed 12/04/2016].

Noy, I. (2009). The Macroeconomic consequences of Disasters. *Journal of Development Economics*. 88:221-231.

Oh, C. H. and Reuveny, R. (2010). Climatic natural Disasters, political Risk, and international Trade. *Global Environmental Change*. 20:243-254.

Organisation for Economic Co-operation and Development (OECD), (2008). *Handbook on Constructing Composite Indicators*. Methodology and User Guide. OECD Publishing. Paris. https://www.oecd.org/std/42495745.pdf. [Accessed 22/03/2016].

Ornelas, E. (2007). Exchanging Market Access at the Outsiders' Expense – the Case of Customs Unions". *Canadian Journal of Economics*. 40:207-224.

Ossa, R. (2011). A "New Trade" Theory of GATT/WTO Negotiations. *Journal of Political Economy*.119:122-152.

Outreville, J. F. (1998). The Meaning of Risk. https://www.researchgate.net/publication/302305568_The_Meaning_of_Risk. [Accessed 22/01/2019].

Panagariya, A. (2000). Preferential Trade Liberalization: The Traditional Theory and Developments. *Journal of Economic Literature*. 38:287-331.

Pant, M. and Paul, A. (2018). The Role of Regional Trade Agreements: In the Case of India. Journal of Economic Integration. 33(3):538-571.

Pencheon, D. (2008). *The Good Indicators Guide: understanding how to use and choose indicators*. UK National Health Service Institute for Innovation and Improvement website, www.institute.nhs.uk. [Accessed 18/02/2015].

Plumper, T. and Troeger, V. E. (2007). Efficient Estimation of Time-Invariant and Rarely Changing Variables in Finite Sample Panel Analyses with Unit Fixed Effects. *Political Analysis*. 15:124-139.

Pomfret, R. (2006). Regional Trade Agreements. Working Paper 2005-15. https://core.ac.uk/download/pdf/6414586.pdf. [Accessed, 16/04/2015].

Prehn, S., Brummer, B. and Glauben, T. (2016). Gravity Model Estimation: Fixed Effects vs. Random Intercept Poisson Pseudo-Maximum Likelihood. *Applied Economics letters*. 23(11): 761-764.

Pritchard, C. L. (2010). *Risk management: Concepts and guidance* (4^{th} Ed.). Virginia: ESI International.

Raddatz, C. (2007). Are External Shocks responsible for the Instability of Output in Low-income Countries? *Journal of Development Economics*. 84:155-187.

Robinson, R. M., Francis, G., Chan, A., Kanga, M., Procter, T., Stoks, F. and Wallis, J. (2007). *Risk and reliability: An introductory text* (7^{th} Ed.). Melbourne: R2A.

Romilly, P. (2007). Business and Climate Change Risk: A Regional Time Series Analysis. *Journal of International Business Studies*. 38:474-480.

Ronen, E. (2017). Tariffs and Non-tariff Measures: Substitutes or Complements. A Cross-Country Analysis. *Bank i Kredyt*. 48(1):45-72.

Rose, A. K. (2000). One Money, One Market: Estimating the Effect of Common Currencies on Trade. *Economic Policy*. 30:9-45.

Rosson, C. P., Runge, C. F. and Moulton, K. S. (1996). Preferential Trading Arrangements: Gainers and Losers from Regional Trading Blocs. http://www.ces.ncsu.edu/depts/agecon/trade/eight.html. [Accessed 27/03/2014].

Rothstein, H., Huber, M. and Gaskell, G. (2006). A Theory of Risk Colonization. The spiralling regulatory Logics of societal and institutional Risk. *Economy and Society*. 35(1):91-112.

Roy, J. (2010). Do customs union members engage in more bilateral trade than free trade agreements members? *Review of international Economics*. 18(4):663-681.

Sabir, I. and Sabir, R. M. (2010).Managing technological innovation: China's Strategy and Challenges. *Journal of Technology Management in China*. 5(3):213-226.

Saisana, M., Saltelli, A. and Tarantola, S. (2005). Uncertainty and Sensitivity Analysis Techniques as Tools for the Quality Assessment of Composite Indicators. *Journal of the Royal Statistical Society*. 168(2):307-323.

Sala-I-Martin, X., Bilbao-Osorio, B., Blanke, J., Crotti, R., Hanouz, M. D., Geiger, T. and Ko, C. (2012). World Economic Forum. The Global Competitiveness Report 2012–2013: Full Data Edition.

Salvatici, L. (2013). The Gravity Model in International Trade. AGRODEP Technical Note TN-04. http://www.agrodep.org/sites/default/files/Technical_notes/AGRODEP-TN-04-2_1.pdf. [Accessed 12/08/2014].

Salvatore, D. (2004). *Introduction to international economics* (7th Ed.). New York: Wiley and Sons.

Sandrey, R. (2013). An analysis of the SADC Free Trade Area. Tralac Trade Brief D13TB01. Tralac. Stellenbosch.

Santos Silva, J. M. C. and Tenreyro, S. (2006). The Log of Gravity. *The Review of Economics and Statistics*. 88(4):641-658.

Schiff, M. and Winters, L. A. (2003). *Regional Integration and Development*. Washington D.C. Oxford University Press.

Scrivens, K. and Iasiello, B. (2010). Indicators of "Societal Progress": Lessons from International Experiences. OECD Statistics Working Papers, 2010/04. OECD Publishing. http://dx.doi.org/10.1787/5km4k7mq49jg-en. [Accessed 18/02/2015].

Sheer, A. (1981). A Survey of the Political Economy of Customs Union. *Law and Contemporary Problems*. 44(3):33-53.

Snorrason, S.T. (2012). *Asymmetric economic integration: Size characteristics of economies, trade costs and welfare*. London: Springer.

Solberg, R. L. (1992). *Country-risk analysis: A handbook*. London: Routledge.

South African Customs Union (SACU). (2012). Annual Report 2012. http://www.sacu.int/publications/reports/annual/2012/annualreport2012.pdf. Accessed 17/09/2014.

South African Customs Union (SACU), (2014). Publications. SACU Agreements. http://www.sacu.int/main.php?include=docs/legislation/1910-agreement.html. [Accessed 29/04/2014].

South African Customs Union (SACU), (2018). Merchandise Trade Statistics. https://stats.sacu.int/v2TradebyProduct.php. [Accessed 20/09/2018].South African Customs Union (SACU), (2018). Annual Report 2018. http://www.sacu.int/docs/reports_annual/2019/SACU-Annual-Report-2018.pdf. [Accessed 13/11/2019].

Tansey, M. M. and Touray, A. (2010). The Gravity Model of Trade applied to Africa. *International Business and Economics Research Journal*. 9(3):127-130.

Tate, E. (2012). Social Vulnerability Indices: A Comparative Assessment using Uncertainty and Sensitivity Analysis. *Natural Hazards*. (Online). 63(2):325-347.

Tayyab, M., Tarar, A. and Riaz, M. (2012). Review of Gravity Model Derivations. *Mathematical Theory and Modeling*. (Online). 2(9):82-96.

Timurlenk, O. and Kaptan, K. (2012). Country Risk. *Social and Behavioral Sciences*. 62:1089-1094.

Toya, H. and Skidmore, M. (2007). Economic Development and the Impacts of Natural Disasters. *Economics Letters*. 94:20-25.

United Nations, (2018). Recent Economic and Social Conditions in Southern Africa in 2017, and Prospects for 2018. https://www.uneca.org/sites/default/files/uploaded-documents/SROs/SA/ICE-24/report_on_economic_and_social_conditions_2017.pdf. [Accessed 29/11/2019].

United Nations Development Programme (UNDP), (2010). Human Development Report. 20th Anniversary Edition. The Real Wealth of Nations: Pathways to Human Development. Palgrave Macmillan. New York.

United Nations Development Programme (UNDP), (2016). Sustainable Development Goals (SDGs). https://www.undp.org/content/undp/en/home/sustainable-development-goals.html. [Accessed 18/06/2019].

United Nations Comtrade, (2018). https://comtrade.un.org/data/. Accessed 22/09/2018.

Valsamakis, A. C., Vivian, R. W. and du Toit, G. S. (2000). Risk Management 2 ed. Heinemann. Johannesburg.

Westerlund, J. and Wilhelmsson, F. (2011). Estimating the Gravity Model without Gravity using Panel Data. *Applied Economics*. 43:641-649.

Whalley, J. (1998). *The regionalization of the world economy*. Chicago. USA: University of Chicago Press.

White, K. D. (2010). Geography, Policy, and Barriers to International Trade in Central Asia. *Central Asia Business Journal*, 3:44-54.

Wiemer, C. and Cao, H. (2004). *Asian economic cooperation in the new millennium: China's economic presence*. Beijing: World Scientific.

Winters, L. A. (2002). Trade liberalization and poverty: What are the links? Discussion paper No. 2382. London: Centre for Economic Policy Research.

World Bank, (2018). World Bank Open Data. https://data.worldbank.org/. Accessed 20/09/2018.

World Bank, (2018). South African Customs Union (SACU): Macro Poverty Outlook. http://documents.worldbank.org/curated/en/926691525954797052/pdf/126115-WP-PUBLIC-IO-2029184-MPO-SACU-region-Final-04-13-2018.pdf. [Accessed 24/05/2019].

World Bank, (2010). Botswana Climate Variability and Change: Understanding the Risks. https://www.car.org.bw/wp-content/uploads/2016/06/Botswana-Climate-Change-Policy-Note.pdf. [Accessed 12/10/2012].

World Development Report (WDR), (2009). Agriculture for development. Washington: The World Bank.

World Development Report (WDR), (2014). *Risk and opportunity: Managing risk for development*. Washington: The World Bank.

World Economic Forum (WEF), (2013). Global Risks 2013. http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2013.pdf. [Accessed 24/09/2014].

World Economic Forum (WEF), (2012). Global Risks 2012. http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2012.pdf. [Accessed 24/09/2014].

World Trade Organization (WTO), (2019). Annual Report 2019. https://www.wto.org/english/res_e/booksp_e/anrep19_e.pdf. [Accessed 16/09/2019].

World Trade Organization (WTO), (2018). Regional trade agreements. http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx. [Accessed 18/09/2018].

World Trade Organization (WTO), (2013). Trade Negotiations. Annual report. http://www.wto.org/english/res_e/booksp_e/anrep_e/anrep13_chap3_e.pdf. [Accessed 21/04/2014].

World Trade Organization (WTO), (2014), Understanding on the Interpretation of Article XXIV of the General Agreement on Tariffs and Trade 1994. http://www.wto.org/english/docs_e/legal_e/10-24.pdf. [Accessed 10/03/2014].

World Trade Report, (2013). Factors Shaping the Future of World Trade. https://www.wto.org/english/res_e/publications_e/wtr13_e.htm. [Accessed 24/07/2013].

Yeyati, L. E. (2003). On the Impact of Common Currency on Bilateral Trade. *Economics Letters*. 79:125-129.

Yotov, Y. V. (2012). A simple solution to the distance puzzle in international trade. *Economic Letters*. 117(3):794-798.

Zwinkels, R. C. J. and Beugelsdijk, S. (2010). Gravity Equations: Workhorse or Trojan horse in explaining Trade and FDI Patterns across Time and Space? *International Business Review*. 19:102-115.

APPENDICES

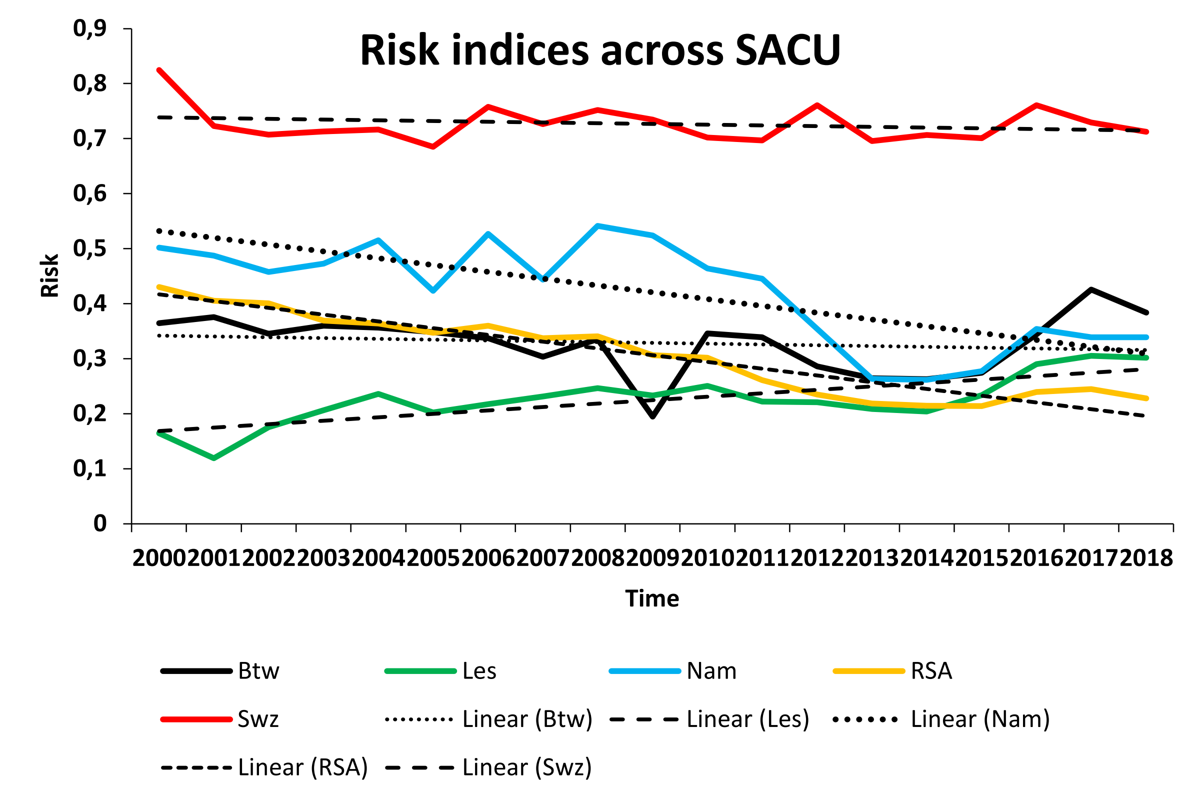
Appendix A: Composite Risk Index Construction Results

Table A 1: Summary of composite risk index construction

Process	Action	Justification	Result
Multivariate Data Analysis (MDA)	Choice had to be made between PCA and FCA	MDA reduces measurement error and provides data-based weights	PCA chosen
PCA	Determine correlation between variables	Absence of correlations and high collinearity nullifies use of PCA	Moderate and high correlation; no collinearity issues
Principal components	Finding Eigen values	Variation in data is usually explained by a few of the principal components	3 Principal components were retained
Eigen vectors	Determine which of the principal components explain variation in the variables	Need to determine the relationship between principal components and risk dimensions (using the variables)	Results not conclusive, only one component had clear economic foundation
Factor loadings	Rotate principal components	Rotation isolates relations between variables and principal components	Construction of PCA weights

Source: OECD (2008).

Figure A 1: Risk indices across the SACU with trend lines

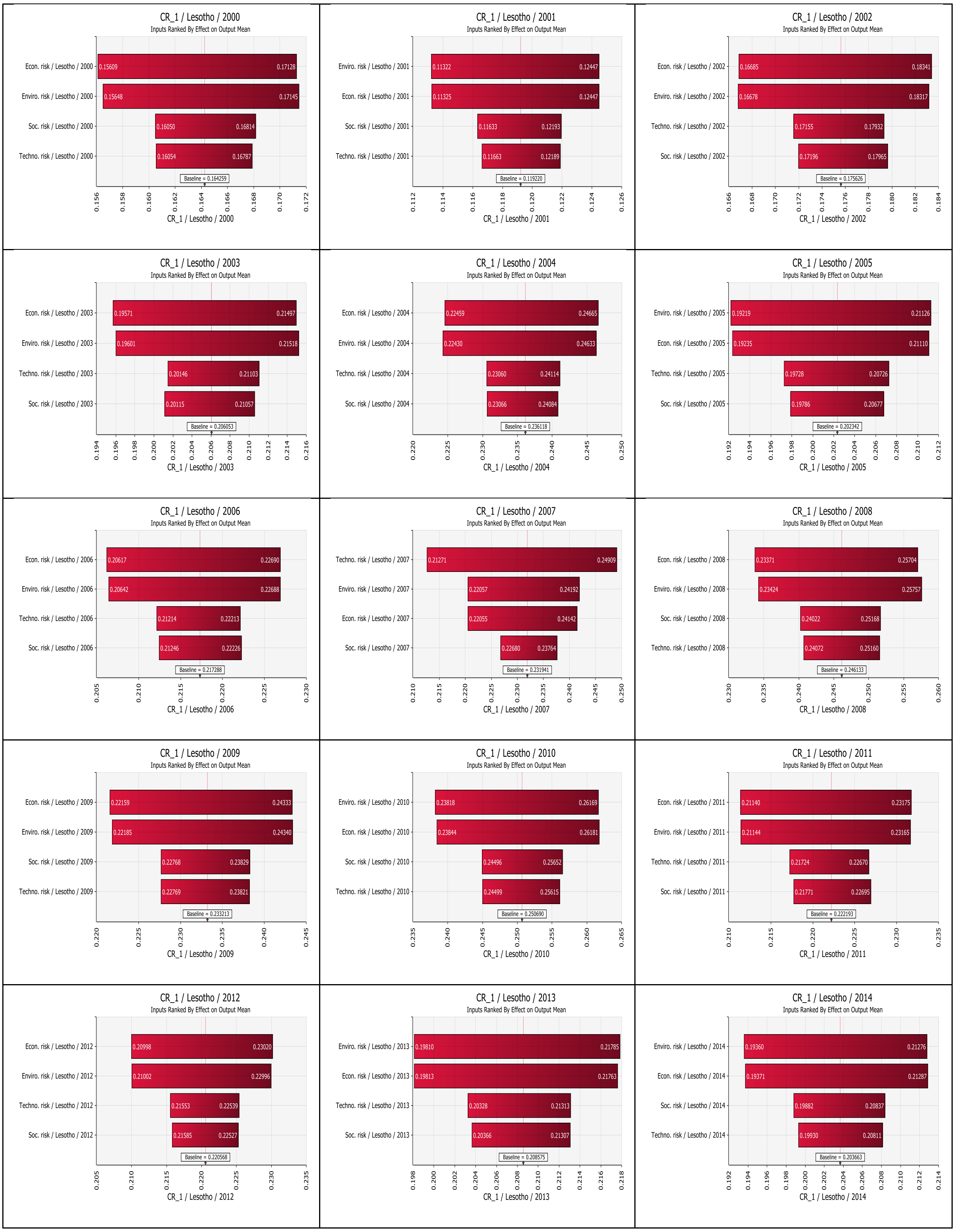


Source: Output from risk analysis.

Figure A 2: Contribution of each dimension to the composite risk indices of Botswana

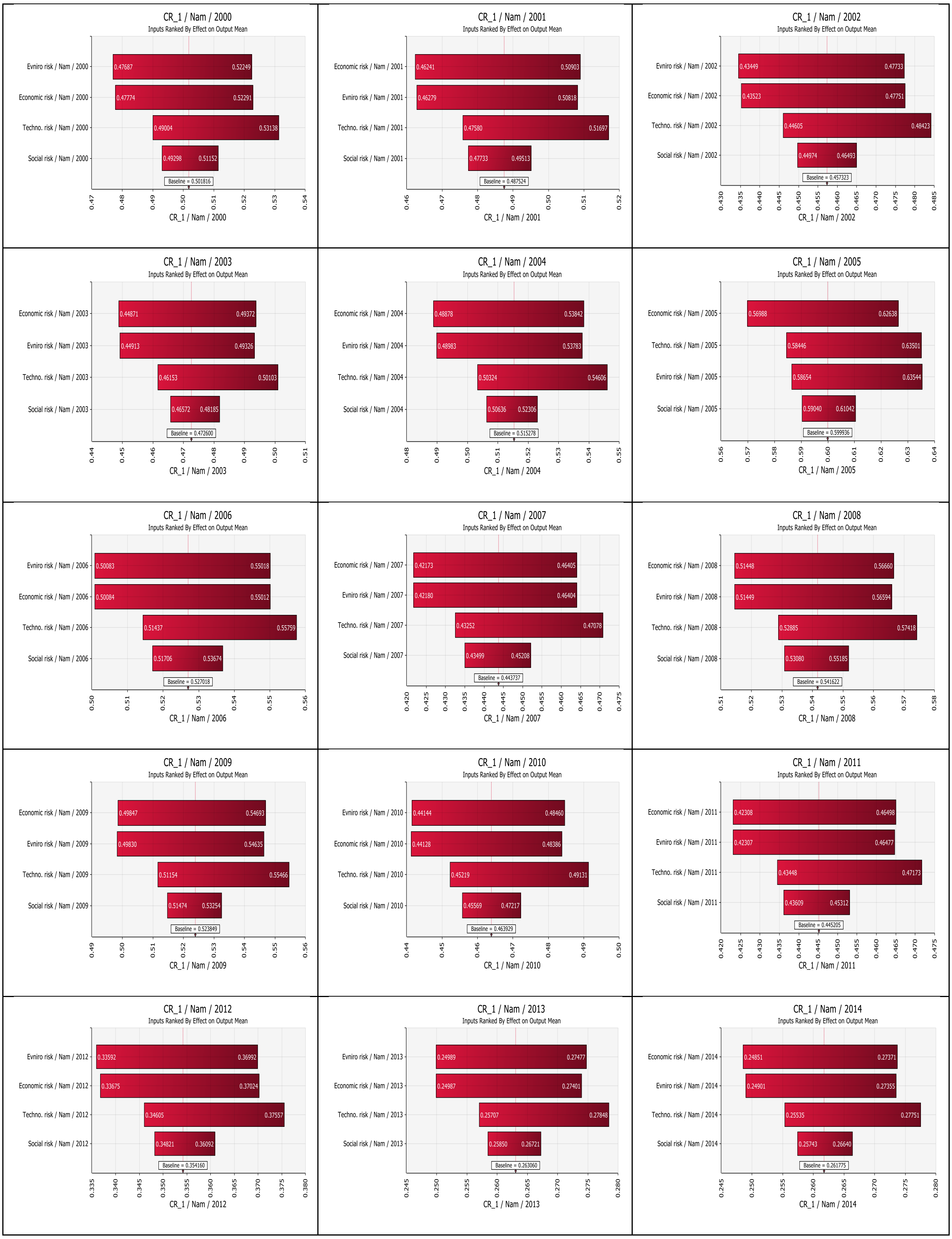
Source: Output from risk analysis.

Figure A 3: Contribution of each dimension to the composite risk indices Lesotho



Source: Output from risk analysis.

Figure A 4: Contribution of each dimension to the composite risk indices Namibia

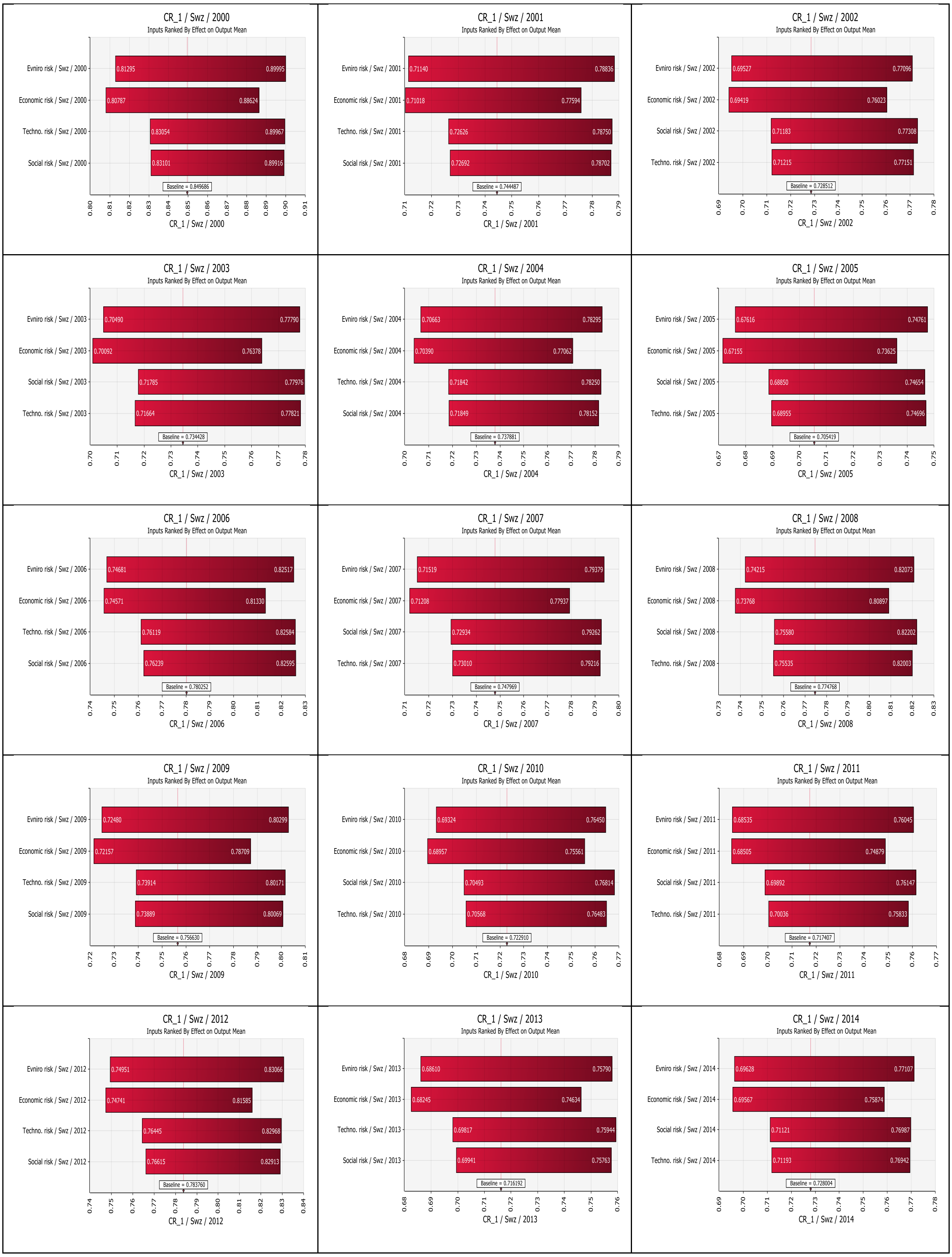


Source: Output from risk analysis.

Figure A 5: Contribution of each dimension to the composite risk indices South Africa

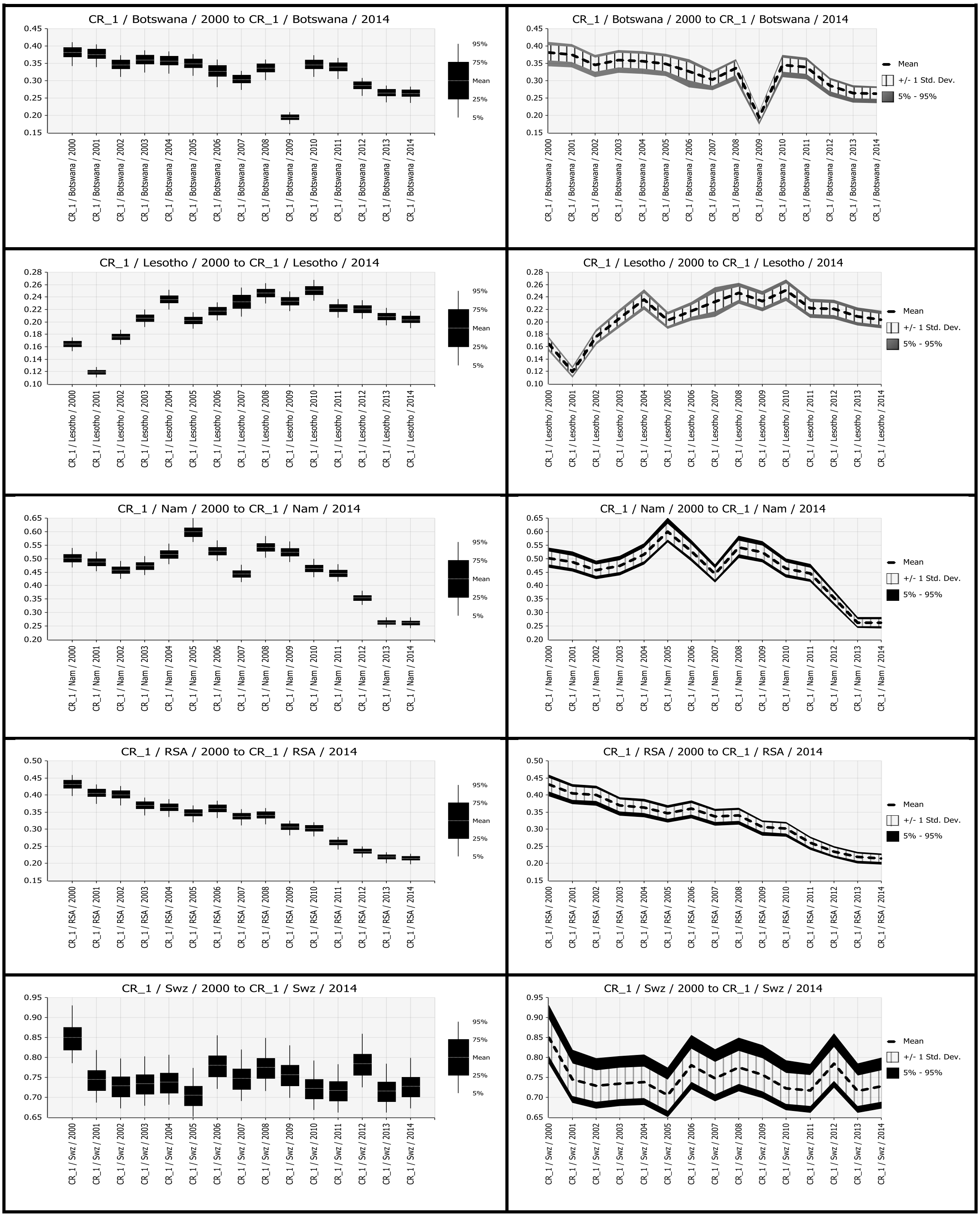
Source: Output from risk analysis.

Figure A 6: Contribution of each dimension to the composite risk indices Eswatini



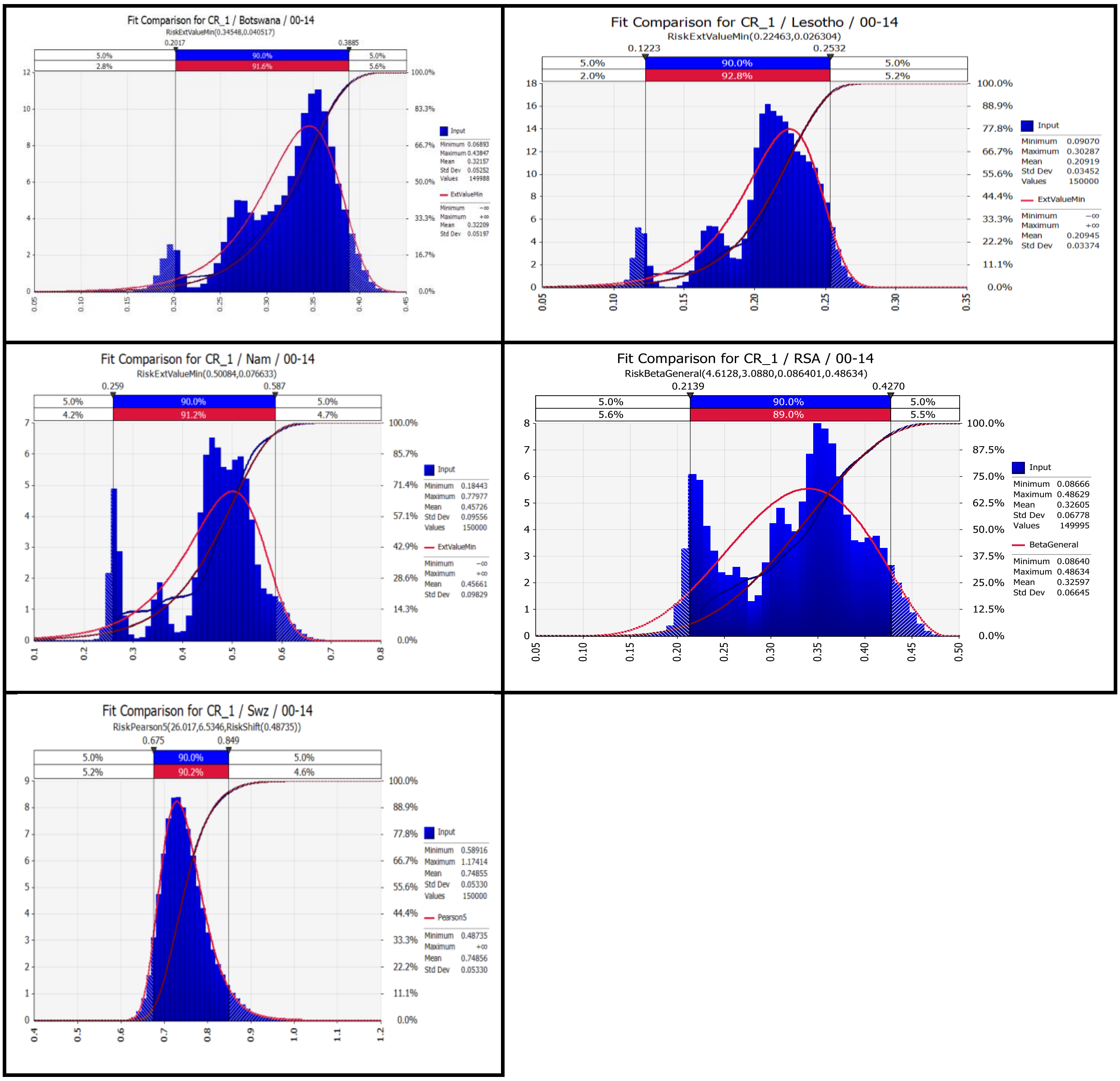
Source: Output from risk analysis.

Figure A 7: The SACU composite risk index boxplots and summary trends



Source: Output from risk analysis.

Figure A 8: Simulated probability density functions (PDFs) of the composite risk indices for the respective the SACU member states



Source: Output from risk analysis.