The key determinants of food inflation in the Kingdom of Eswatini

By

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DECLARATION

I, Mancoba Knowledge Mndzebele, declare that the dissertation, which I hereby submit for the degree of MSc (Agric) Agricultural Economics at the University of Pretoria, is my own work and has not been previously submitted by me for a degree at this or any other tertiary institution.

Signature:  **Date:** 19/03/2021

DEDICATION

The opportunity to pursue this Master's degree was through the grace of God. I therefore dedicate this dissertation to the Almighty God.

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ABSTRACT

It is important to track food inflation from a development perspective as it is indicative of food access for the poor. Discussions on food inflation in Eswatini have gained traction due to its effects on welfare erosion of lower income groups. Eswatini is faced with a problem of periods with high food inflation which hampers food access and affordability for low income groups. Patterns of high food inflation in Eswatini persists yet the drivers of food inflation remain unknown. A thorough understanding of these drivers is the first step towards sound policy intervention related to inflation management. This study drew on literature on food inflation in other countries to identify energy and agricultural prices and inflation dynamics of key importing partners as potential drivers of food inflation. An Autoregressive Distributed Lag model was implemented to determine the key determinants of food inflation in the Kingdom of Eswatini using monthly time series data from January 2009 to January 2020. The Gregory-Hansen technique was used to test for structural breaks in the series as numerous changes related to climate and political circumstances could have impacted relationships over the long run. The Gregory-Hansen technique facilitated the identification of this which ultimately allowed for more accurate estimation. The study found that all variables considered in the study had a positive and significant effect on Eswatini's food inflation at 5% confidence level and further unveiled that a 10% change in South African food inflation is associated with a 16.1% increase in Eswatini's food inflation while a 10% change in global oil prices increases Eswatini's food inflation by 56.7%. The results also revealed that a 10% change in global agricultural prices is associated with a 17.7% increase in Eswatini's food inflation. The error correction model was used to determine the magnitude and speed of adjustment of Eswatini's

food inflation after a shock to the long run equilibrium. The results from the error correction show that the speed of adjustment for Eswatini's food inflation shock in the long run relationship is almost instantaneous at 96.6% per month. This suggests that food inflation in Eswatini reflects changes in global oil prices, agricultural prices and inflationary changes in South Africa fully and immediately. The Toda Yamamoto Granger causality test revealed that South African food prices granger causes food prices in Eswatini at 5% confidence interval. Based on these findings, policy interventions focusing on curbing food inflation would include ensuring the efficiency of food production and distribution in Eswatini so that exogenous shocks can be buffered by high level of local production and availability.

Key words: Food inflation, cointegration, error correction.

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LIST OF ACRONYMS

ADF	Augmented Dickey Fuller
ARDL	Autoregressive Distributed Lag
CMA	Common Monetary Area
CPI	Consumer Price Index
CSO	Central Statistics Office
ECM	Error Correction Model
ECT	Error Correction Term
FAO	Food and Agricultural Organisation
GDP	Gross Domestic Product
HIES	Household Income and Expenditure Survey
IMF	International Monetary Fund
ITC	International Trade Commission
MoNRE	Ministry of Natural Resources and Energy
TYDL	Toda Yamamoto and Dolado and Lutkepohl
USAID	United States Agency for International Development
VAR	Vector Autoregresion
WFP	World Food Program

CHAPTER 1

INTRODUCTION

1.1 Background

Food inflation is defined as the continuous upsurge in the overall food prices over time (Blanchard, 2000). Ramlan and Suhaimi (2017) in turn defines inflation as the rate at which the overall level of prices for goods and services is increasing and, consequently the purchasing power of a currency is deteriorating. Another definition on food inflation is that it is the growth in local prices of the commodities relatively more than the global prices of food (Nyoni, 2019). It is evident that there exists no single definition of (food) inflation but the underlying conclusion by most scholars is that inflation erodes the purchasing power of money. In its entirety, inflation encapsulates various subsets such as core inflation and food inflation. According to Kenton (2019), core inflation covers the change in the cost of goods and services but excludes those from food and energy while food inflation looks at the increase in the retail price index of a food item in relation to the general consumer price index (CPI).

In the agriculture sector, discussions on food inflation have gained traction due to its relevance in determining consumer demand in agricultural food markets and also due to the possible effects of welfare erosion of lower income groups when food prices surge. The rate of food inflation is also indicative of food access for the poor and is therefore important to tract from a development perspective (Louw, 2017). As such, food inflation has intermittently been a subject for analysis in periods when food prices rise steeply or rapidly. World food commodity prices adjusted for inflation in global markets substantially dwindled in the early 1960s period until the beginning of 2000s where they hit a historic low (FAO, 2011). This report by FAO further states that food prices slowly increased from 2003 to 2006 and then surged greatly towards 2008 (see Figure 1.1). In the same era, world prices of staple foods like rice and maize rallied by 166% and 74% respectively, attaining its highest level in 30 years. The abrupt surge in global prices of food instigated increased concerns about the capacity of the global food economy to feed the multitude of billions of people presently and also in time to come.

Global prices of food also increased theatrically in 2007 and the first two quarters of 2008 creating a global crisis and causing economic, political and social unrests in both developing and developed countries (FAO, 2011). In 2008, the topic gained prominence

due to the effect of the commodity super cycle and other global events that supported food prices around the globe at unprecedented levels. The sharp spike in global food inflation evidenced during the 2008 period resulted in intensive research on the drivers, inflationary dynamics and response mechanisms by different economies (Ngidi, 2015). According to FAO (2011), the global spike in food inflation from 2008 to 2011 is attributed to droughts in grain producing countries and rising oil prices. The rise in oil prices caused escalations in the costs of agricultural inputs such as fertilizers and also food transportation. In addition, bio-fuel production created additional demand pull which supported prices to higher levels. Some international literature also attributes the global spike in food inflation from 2005 to 2008 to speculative activity and volatility of prices for agricultural products (Kenton, 2019).

Though there might be different views and findings on the factors that led to the surge in food prices that began in 2003, FAO (2011) recapitulates the following factors:

1. Weather related shocks such as the 2005-07 drought that hit Australia and led to a reduction in the production and trade of wheat.
2. Increased maize and vegetable oil demand due to policies that promoted the utilization of biofuels.
3. Devaluation of the United States dollar.
4. Long term growth of the economy in developing countries that exerted weight in fertilizer and petroleum prices due to their resource intensiveness and expanding economies led to a higher demand for meat.
5. Rising costs of production and transportation because of high petroleum and fertilizer prices.
6. Portfolio diversification and speculation resulted to high demand on commodity futures markets.
7. Low levels of stocks partially caused by some problems listed above.
8. Trade policies by governments such as export bans. Such stimulated producers to suppress supplies, traders to raise stock prices and consumers to fall into panic purchasing.

Globally, the 2019 summer season brought another round of surging food prices after a steady plunge in global food prices in 2017 and 2018. The global spike in food prices was primarily caused by rising meat prices which have increased by more than 10% in 2018 (Lusk, 2019).

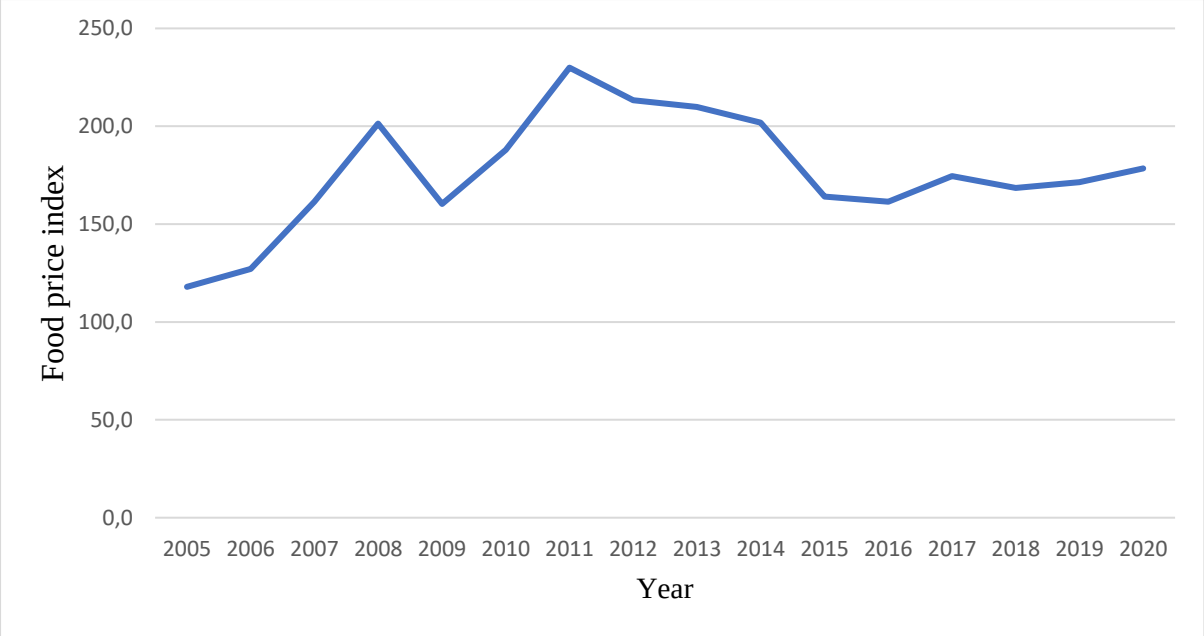

Figure 1. 1: FAO world food price index

Source: Created by author using data from Food and Agricultural Organization

1.1.1 An overview of food inflation in Eswatini

From the beginning of 2005, food inflation in the kingdom of Eswatini averaged 8.73 % and rose to an all-time high of 21.10 % in January of 2008, then subsequently plunged to a record low of -2.10 % in June 2010 (CSO, 2016). This is presented in figure 1.2. The average food inflation for the period since 2008 was higher than food inflation in other developing countries such as Zambia, Botswana and Lesotho. According to CSO (2016), the upsurge in food prices in the 2008-2009 period in Eswatini was attributed to the global upsurge in food prices while the sharp spike of food inflation experienced around the 2016 period was blamed on the El Nino drought that had a humongous effect on agricultural production in the Sub-Saharan region and pushed food prices in excess of 15%. According to the report by CSO (2016), food inflation has been at 14% in 2016 mainly due to drought. Nyoni (2019), attributed the surge in food prices in this period to a fall in domestic agricultural output in the country, an increase in the local demand of food, large scale procurement of food grains by the government and high world food prices. The global growth in oil prices also had a hand in increasing food inflation in the kingdom as it escalated the cost of fertilizers, food transportation and industrial agriculture (CSO, 2016). Although the food prices decelerated in 2019 following the sustained recovery from the El Nino drought, the aftermath of the high food prices in the country instigated a worsened wellbeing of poor households as the purchasing power of the Lilangeni (Eswatini's

currency) was eroded. According to CSO (2017), this was mainly because most of the households are in rural areas where expenditure on food comprises a big share of about 50% of total proceeds. The household income and expenditure survey also established that 69% of the population in Eswatini is living in poverty. Figure 1.2 gives an overview of food inflation in Eswatini which shows that food inflation is an intermittent problem in Eswatini.

Figure 1. 2: Eswatini's food inflation

Source: Generated by author using data from Central Bank of Eswatini

1.1.2 Food inflation and historical political and social unrests.

There are many historic examples of "food riots" which consequently prompted political change and social instability (Lagi et al., 2011). Poor nations nowadays depend on worldwide food supply systems and they are vulnerable to food price swings globally. Food importing countries with high levels of poverty rely on political organizations to ensure food security. Failure of the organizations to ensure sustainable supply of food demoralizes the very purpose of presence of the political system. According to Lagi et al. (2011), when this occurs, protests reflect reasons of dissatisfaction and making immediate trigger of the unrest.

Latin America recorded episodes of hyperinflation which erupted a political calamity in the late 1980's and early 1990's. In 2008 alone, more than sixty "food riots" were recorded in thirty different countries around the globe. South Africa also experienced xenophobic attacks in 2008/09 which coincided with the period of high food prices and subsequently snowballed into

the Marikana mining massacre in 2011/12 (Louw, 2017). Further afield, countries like Mauritania, Uganda, the Middle East and North Africa had large protests in 2010 to 2011 because of rising food prices (Lagi et al., 2011). The Arab Spring that occurred in 2011 across Muslim countries such as Tunisia, Morocco, Syria, Libya and Egypt are also examples of countries who were victims of the political and social aftermaths of increasing food inflation. All these examples are all synonymous with the impact of high food inflation on social wellbeing and there are relatively less food riots when the prices of food are lower (Lagi et al., 2011). Figure 1.3 shows the global association between food inflation and social unrest.

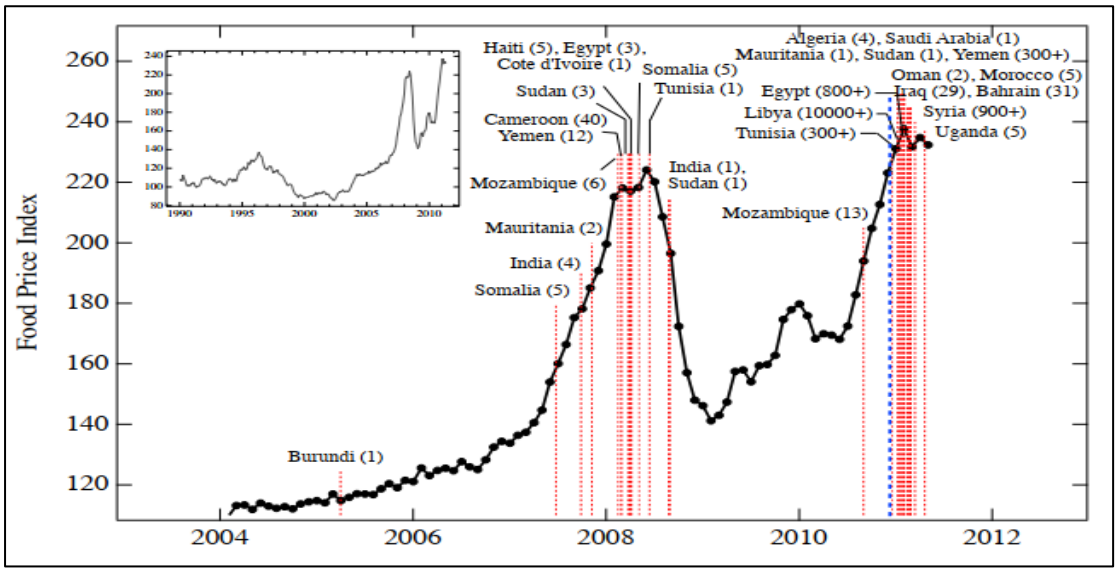

Figure 1. 3: FAO food price index from January 2004 to May 2011 showing food riots associated with food prices over time

Source: (Lagi et al., 2011)

Like any other developing low and middle-income country, Eswatini is not exempt from political and social unrests. Social and political unrests in Eswatini began to increase after the 2008 global food price crisis. According to Rice (2011), Eswatini recorded a number of riots over economic conditions which started when South Africa experienced an economic slump in 2009. This prompted a decrease in the Eswatini's government revenue while government spending remained high in Eswatini. Consequently, the budget deficit surged to 14% of the Gross Domestic Product (GDP). In light of an increasing budget deficit, the government slashed civil servant's salaries by 10% while politician's allowances were raised at the same period (Tran, 2011).

Having the uppermost civil service wage bill as percentage of GDP in Africa, Eswatini's workforce felt the squeeze under the state's austerity plans as nearly 7 000 civilians got laid off on top of the 10% salary cut (Rice, 2011). As reported by Tran (2011), despite the International Monetary Fund's (IMF) recommendations to cut government spending, about two thirds of the 1.4 million populace of Eswatini continued to live below the poverty line. As a result, in 2011 civilians started demonstrations and protests around the county's major cities demanding a reduction in government spending particularly on the royal household and military (Tran, 2011).

In 2019, Eswatini also experienced anti-monarchy protests where civil servants demanded a 7.5% increment in their salaries. These protests were backed by outcries of low pay and high costs of living for the civil servants. These followed accusations that the monarchy drains public coffers to finance a lavish lifestyle at the expense of the citizen (Sakutin, 2019). Figure 1.4 shows the political and social unrests associated with high food inflation in the period considered in this study. All these events in Eswatini connect with the periods of high food prices and seem to suggest that high food inflation is associated with political and economic unrest (Ngidi, 2015).

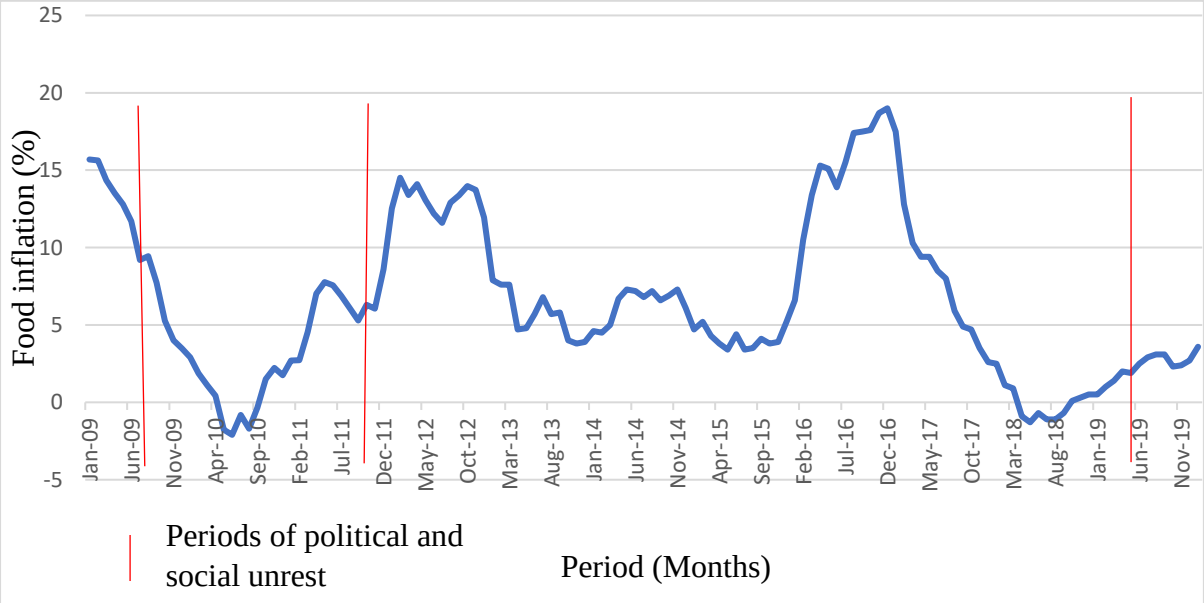

Figure 1. 4: Eswatini's food inflation showing food riots associated with food prices under the study period

Source: Created by author using data from Central Statistics Office of Eswatini

1.2 Inflationary dynamics between Eswatini and South Africa

Eswatini's economy has been largely dependent on that of South Africa for a considerable period of time (Dlamini and Nxumalo, 2001). This dependence is evidenced by the close shadowing of the South African fiscal actions by Eswatini. Eswatini also imports 18.5% of food from South Africa inclusive of its staple food, maize (ITC, 2020). This is shown by the International Trade Commission's (ITC) report on the share of Eswatini's food imports in Table 1.1. The great import quantities are largely due to supply driven factors such as low production in the country to par with the demand of the ever-growing population of the kingdom (CSO, 2016). Production was greatly hindered by environmental factors such as the El Nino drought that affected the region in the 2015/16 period (ITC, 2020). Consequently, Eswatini was compelled to import food from neighboring countries.

Table 1. 1: Share of Eswatini's food imports for the year 2020

Exporters	**Eswatini's food import volume (%)**
South Africa	10.92
United States of America	4.03
China	9.99
Mozambique	28.94
Namibia	66.35

Source: ITC (2020).

1.3 Problem Statement

Drought is the primary cause of food insecurity in Eswatini with a population of 1.4 million, 70% of which are dependent on agriculture for their livelihoods (USAID, 2018). Irregular rainfall and the 2016/17 El Nino drought prolonged dry spells in production and the invasive fall army worm massively affected local maize output. As a result of the decline in local production of the staple crop, approximately 13% of the population needed food aid with a target to feed 11 000 people per month. Through the USAID's office of food for peace, about 48 000 food-insecure households received cash transfers for food (USAID, 2018). During the 2016 drought, the World Food Program (WFP) together with the World Vision provided emergency food aid to drought-affected population through monthly take home food rations (WFP, 2020). According to WFP (2020), high food inflation patterns left a greater percentage

of the population exposed and vulnerable with no means to access sustainable healthy food. The 22.85% unemployment rate is a depiction of the population group that cannot afford basic healthy meals due to high food prices as domestic white maize prices surged by 42.5% per ton in 2016 alone (Plecher, 2020).

Food continued to be demanded even though agricultural production in the country was compromised by the drought and irregular rainfall patterns. This instigated a rise in the prices of food in local retailers. As such, high food prices affected food access and affordability for the low-income groups who cannot afford food when food prices surge above their financial means as about 58.9% of the population of Eswatini live below the poverty line (less than US$1.9 per day) with 20% of the population considered to be extremely poor (WFP, 2020). The increase of food prices in Eswatini inflicted dreadful effects not only by eroding the purchasing power of consumers but also by destabilising the political and socioeconomic wellbeing as witnessed by the “food riots” predicaments. Numerous changes related to climate and political circumstances could impact the relationship between Eswatini and South Africa as trading partners in the long run, and this might cause a structural break. Therefore, determining the presence of structural breaks and having knowledge about the drivers of food inflation will enable innovative approaches to ameliorate the effects inflicted on low income groups.

A major problem is that the drivers of food inflation in Eswatini remains unknown yet periods of rapid food inflation continue to threaten food access and affordability of lower income groups. While most empirical research on inflation in Eswatini focuses on core inflation, there is lack of empirical evidence that speaks to food inflation, and as a result, there seems to be poor corresponding policy interventions to combat the effects of high food prices. This study builds on this gap to come up with innovative measures to address the dire effects of high food inflation in Eswatini.

1.4 Research question and objectives of the study

The broad research question of this study is: what are the key determinants of food inflation in the kingdom of Eswatini?

1.4.1 The broad objective of the study

The broad objective of this study is to understand the main factors that drive food prices in the kingdom of Eswatini. To achieve the overarching objective, the study addresses the following specific objectives:

1. To identify the key determinants of food inflation in Eswatini that affect inflation levels over the long run.
2. To determine the size and the magnitude of the effect of changes in the variables identified in the first objective on food inflation in Eswatini.

1.5 Hypothesis

The following null hypotheses will be tested in the study.

1. H_0: The key determinants of food inflation in Eswatini do not significantly affect food inflation levels in the long run.
2. H_0: There is no significant difference in the size and magnitude of the effect of changes of the determinants of food inflation in Eswatini

1.6 Significance of the study

Whilst most literature covers the causes of food inflation in other African countries and some parts of the world, there is lack of scientific research that explores the causes of food inflation in Eswatini. This study therefore leans on the significance of understanding food inflation in Eswatini as it is still an issue affecting food access and affordability for the poor. The results of the study will elicit the determinants of food inflation in Eswatini and will give fundamental knowledge in terms of informing policy makers on the measures that could be taken to combat the effects of high food inflation especially on the lower income groups who are always hit hard by surging food prices.

1.7 Outline of the study

This study gives an economic understanding of the determinants of food inflation in the Kingdom of Eswatini. Preceding the introductory chapter of the study, a review of related literature is given in Chapter 2. The procedures and methods that are used to address the objectives of the study are outlined in Chapter 3. The fourth chapter provides an economic

discussion of the results obtained after analysis, then recommendations and conclusions are made in the final chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Many economists and researchers have carried out research investigations about the determinants of food price inflation, see inter alia (Baltzer *et al*., 2008; Dewbre *et al*., 2008; 2008; Abbott *et al*., 2008; Yang *et al*., 2008; *Helbling et al., 2008*). These studies provide literature to grasp the understanding of the phenomenon on the economy, socioeconomic wellbeing and on supply and value chains especially on agricultural food systems.

This chapter presents an overview of studies on food inflation. The chapter is organised to first discuss global food and non-food price inflation studies after which the following section will be dedicated to studies conducted on the determinants of food inflation where the main interest is the methodical approach employed by other authors on the same theme and also the variables that they have considered. The last section of the chapter entails the conclusion which sums up the entire chapter.

2.2 An overview of studies on global food and non-food price inflation

Many researchers have made efforts to identify the factors that might have been responsible for the global hike in food prices. Increasing food prices does not only affect developing countries such as Eswatini but it is a global phenomenon. This section gives an overview of studies done by other researchers on the topic.

The 2008 global food price crisis caused a surge in prices of major agricultural goods and other food products. Most empirical work are in agreement that the spike in food prices was caused by economic and non-economic reasons such as depreciation of major currencies, high oil prices, low interest rates, increased demand of biofuel for maize production, high prices of inputs such as fertilizer, rapid income growth, little food stocks, local policies such as export bans and restrictions, structure of markets and unpredictable weather conditions such as drought (Yang et al., 2008). Food inflationary pressure are more sensitive to production shocks

compared to monetary policy operations (Abbas, 2008). However, some production factors lack concrete evidence to explain causality effects.

The literature reviewed in this discussion provides two themes under which food inflation is discussed. The first theme considers money supply or money growth in the economy as an important factor to include in the analysis of food inflation determinants, see *(Abdullah and Kalim, 2013, Qayyum and Sultana, 2018, Ocran and Kofi, 2007, Gilbert, 2010, Dlamini and Nxumalo, 2001, Barnichon and Peiris, 2008).* Findings of these studies have one overarching consensus: money supply is not a significant factor in causing food inflation.

The second theme includes factors such as input prices, local and international commodity prices, real exchange rates, interest rates, food imports and exports, agricultural support prices and energy prices (oil prices in particular) as potential determinants of food inflation, see *(Makaiko and Ularo, 2010, Longinus, 2004, Gilbert, 2010, Dlamini and Nxumalo, 2001).* The results for most of the studies that utilised the above independent variables as determinants of food inflation revealed that all factors are significant contributors to increasing food prices especially for developing countries. This study draws from studies which followed this theme and selected global oil and agricultural prices as well as inflationary dynamics of neighbouring countries as potential determinants of food inflation. These variables were amongst those which were commonly used in literature. Based on the relevance of the commonly used variables to the context of Eswatini, this study will follow this theme in order to establish the key determinants of food inflation in the kingdom of Eswatini.

Few empirical researches have concentrated on food inflation in the Sub Saharan African (SSA) context in particular. Headline inflation is something that has been analysed in the Eswatini context but no relation is made to food inflation in these studies. If food inflation is a major determinant of headline inflation since consumers spend a substantial share of their expenditure on food, then it shows that research on headline inflation can also benefit from an improved understanding of inflationary dynamics associated with food.

A study by Mosayeb and Mohammad (2009) was conducted to determine the sources of food inflation in Iran with the application of the ARDL approach. This study employed the approach because of its convenience in small samples and that it can be used irrespective of the order of integration of the variables. The authors took into account the traits of Iran's economy and considered recent empirical studies in the context of food inflation and constructed an empirical model which emphasized the effects of liquidity, GDP, the exchange rate, the expected rate of

inflation and imported inflation factors along with the dummy variable (demarcating a structural break) presenting the effect of Iran/Iraq war on Iran's economy. The empirical findings of the study reveal that in the long run, the main determinants of food inflation are liquidity, exchange rate, rate of imported inflation and rate of expected inflation. Similarly, all the variable had a significant effect ion Iran's food inflation in the short run. The error correction term was found to be negative and statistically significant.

A similar study using the ARDL model was conducted by Kamel et al. (2015) to find out the main determinants of food inflation in Algeria. The study used annual data from 1980-2012. The findings established that import prices, oil prices, money stock, government expenditure and effective nominal exchange rate of the Algerian Dinar have a stable long run relationship with the Algerian food inflation. However, the study found that in the short run only exogenous factors (import prices, oil prices, and effective nominal exchange rate) have a significant influence on food prices.

The crux of the studies cited above agrees to the claim that food inflation is a concern in many developing countries. Time series econometric techniques were applied to understand the drivers of food inflation using time series data in different countries. This study will benefit from these empirical approaches by considering the long run and short run dynamics of food inflation in Eswatini.

2.3 Headline inflation in Eswatini

Headline inflation in Eswatini, like any developing country is a major concern for macroeconomic policy formulation. A handful of researchers have made attempts to study headline inflation in Eswatini and its effect on the economy. According to Nyoni (2019), the foremost inflation shocks for Eswatini emanates from the behavior of global prices of oil and food. A study by Mkhatshwa et al. (2015) analyzed the association between inflation, agricultural growth and economic growth for Eswatini for the 1980-2013 period. The Autoregressive Distributed Lag (ARDL) results revealed a long run relationship and a unidirectional causality was found to exist flowing from economic growth to inflation using a Granger causality test. This presents an opportunity to understand food inflation in order to inform macro-economic and monetary policy in Eswatini.

In another study conducted by Khumalo et al. (2017), it is claimed that the stability of developing economies is a function of inflation and interest rates. The relationship between

inflation and interest rates for Eswatini was assessed by Khumalo et al. (2017) with the prime aim to provide sound monetary and fiscal policies to administrate a competent economy. Using a descriptive approach to analyze quarterly time series data for the period 2010-2014, the results revealed that there was a positive relationship between inflation and interest rates. With much research covered for headline inflation, there is still a gap for food inflation as a critical subcomponent. Food inflation needs to be better understood for food security reasons and to inform headline inflation dynamics and monetary policy as it plays a significant role in the determination of headline inflation (Nyoni, 2019).

On the basis of the reviewed literature, there is only a minority of studies conducted for headline inflation in Eswatini. The prominent studies conducted for Eswatini are by Khumalo et al. (2017), Mkhatshwa et al. (2015) and Salami (2018). Inflation as an enveloping concept has been covered for Eswatini, but food inflation as a critical subcomponent for this study has not been explored by researchers.

2.4 Studies conducted on the key determinants of food inflation

This section differs from the former sections of this chapter in the sense that it gives a methodical overview of the methods and procedures commonly employed by other researchers to address an analysis of the determinants of food inflation. This will not only give guidance on the choice of methods and procedures to be used in this study, but will also facilitate the choice of variables associated with food inflation in relation to the context of the study.

Makaiko and Ularo (2010) studied the key drivers of food inflation rate in Malawi and also looked at its consequence on the Malawian economy. After analysis of the monthly and annual time series data from 1978–2008 using standard time series techniques, the results revealed that fertilizer prices, a crop diversification index, maize prices, diesel prices, real exchange rates and interest rates are significant and positive factors that influence food price inflation in the country. Eswatini is also a developing country like Malawi, with similar issues of high food prices and food insecurity. These variables included here could provide insight for Eswatini's monetary policy as food inflation was found to erode the purchasing power of consumers in Malawi, which is a similar case for Eswatini.

A study was conducted by Abdullah and Kalim (2013) to understand the key causes of food price inflation in Pakistan using time series data from 1972 to 2013. The study used the

Johansen test for cointegration to determine the long run relationship amongst food price inflation and money supply, GDP per capita, support prices for food products, food imports and food exports. Empirical evidence of the study proved the existence of a long run relationship amongst the dependant and independent variables. The VECM findings showed that only inflation expectations, support prices and food exports affect food inflation in the short run. In Pakistan, both demand and supply side factors affect food price inflation (Abdullah and Kalim, 2013).

A similar study for Pakistan was done by Qayyum and Sultana (2018) to understand the determinants of food inflation using time series data. This study used 47 years compared to the 41 years used by Abdullah and Kalim (2013) in their study. The author includes Gross Domestic Product (GDP) and taxes as part of the independent determinants. The Autoregressive Distributed Lag results reveal that all factors contribute to an increase in food price inflation except for money supply which was negative and insignificant. Particular emphasis should be put on food exports and imports along with money supply in order to overcome food price inflation in Pakistan (Qayyum and Sultana, 2018).

Gilbert (2010) in his study uses granger causality analysis to establish the role of demand growth, monetary expansion and exchange rate movements to explain the movements of food prices over the years in Australia since 1971. A capital asset pricing model showed why agricultural price explosions are better elucidated by factors such as support prices, demand growth and exchange rate movements than by market specific factors such as supply shocks (Gilbert, 2010). The findings of the study revealed that there are factors which have a causal impact on agricultural goods prices like fickle GDP growth, sharp oil prices, changes in money supply and exchange rate.

Mitchell (2008) takes into consideration maize, wheat, rice and soybeans using monthly series of the 2002-2008 period in a study that identifies the factors influencing internationally traded food commodity prices. The study shows that the leading factor that increased the prices of food after late 2006 was growth in both United States and European Union biofuels production.

Kwon and Koo (2009) explores the dependency of food and energy prices by considering different energy products by stage of processing. In this study, the Toda Yamamoto and Dolado and Lutkepohl (TYDL) models for granger causality are employed to identify how exchange rate movements and various energy prices affect prices of food from farmers to consumers. It

was found that energy prices granger causes food price increase with a unidirectional causality from energy prices to food prices (Kwon and Koo, 2009). Though inflation in developed countries is driven by fuel prices, it is a different case for developing countries where it is more susceptible to food inflation. High energy prices, especially oil prices are also experienced in Eswatini and this provides a need to analyse how energy prices relate to an increase in food prices in Eswatini.

In the South African milieu, the movement of food prices have played a huge role in producing inflationary episodes. According to Rangasmay (2011), most movements in South African food prices are due to domestic stimuli which presents a huge role to be played by the national policy in taming domestic food price movements. Food inflationary episodes in Eswatini have also been occurring but there is no study that suggests policy initiatives to combat the dire effects of inflation in Eswatini. It would be worthwhile to understand such so that monetary policy makers can also give it prime devotion.

The drivers of food inflation vary across different countries. Most of these studies used similar techniques to understand the drivers of food inflation and the findings show that factors mostly considered include oil prices and agricultural prices. This study will consider global oil prices, global agricultural prices and also South African food inflation as potential determinants of food inflation in Eswatini. The choice of these variables is based on the fact that Eswatini is an agriculture-based economy and oil is a critical input in agricultural production. Furthermore, it is worthwhile to consider global agricultural prices because Eswatini is a food importing country, so it is beneficial to understand hoe global agricultural prices affect food inflation in Eswatini. South Africa is Eswatini's leading trade partner when it comes to food, this therefore beckons the significance of determining if South African inflationary undercurrents affect food inflation in Eswatini. This study will benefit from the variables commonly used by many authors in the same field by using time series techniques to understand the key determinants of food inflation in the kingdom of Eswatini.

Theoretically, this study leans on the theory of agricultural prices as postulated by (Sasmal, 2015). The author notes that one important feature of agricultural prices is that it has sharp fluctuations over time unlike non-agricultural prices. According to Sasmal (2015), the reason for this is because agricultural supply cannot immediately adjust itself with changes in demand. Furthermore, the author postulates that the elasticity of demand for most agricultural products is very slow that a unit change in supply with demand remaining constant or a small change in

demand with supply remaining constant causes a huge change in price. This theory has informed critical considerations to be made in this study. For instance, it is considered significant in this study to account for the sharp fluctuations in price levels through the use of econometric techniques that will account for structural breaks in the time frame considered in the study as other authors have done in the literature cited. Furthermore, with Eswatini being a net importer of food from South Africa (Eswatini being on the demand side and South Africa on the supply side), it has transpired that it would be pivotal in this study to understand the nature of the size and magnitude of the effect of changes of South African food prices on food prices in Eswatini.

2.5 Conclusion

In the broader context of food inflation, this study attempts to fill the gap in scientific literature on the drivers of food inflation in Eswatini. Noteworthy is that the studies reviewed provide agreements pertaining to the determinants of food inflation and this is even more clear on developing economies such as Pakistan and Malawi which are mentioned in the literature review. Eswatini being a developing country like Malawi and Pakistan, it is expected for Eswatini to share similar factors that affect food inflation with Malawi and Pakistan. The factors considered in the studies include inflation expectations, support prices, food exports and imports, money supply, GDP, taxes on food, exchange rate movements and energy prices particularly oil prices. This study will use global oil prices, global agricultural prices and food inflation for South Africa as potential determinants of food inflation in Eswatini. These variables were selected on the basis of data availability in Eswatini. Data unavailability limited the inclusion of the other variables in this study. The exchange rate variable was also excluded because Eswatini imports food from South Africa directly and the exchange rate between the two countries are pegged on the same rate.

As intended, the literature has informed both the choice of variables and methods to be used in this study. On the basis of the reviewed literature and the precis of South African food inflation over the last ten years, it appears apparent that factors to consider in the analysis of determinants of food inflation in Eswatini are South African food inflation, agricultural prices, and oil prices. This study considered these factors because Eswatini relies on South Africa for food imports, oil is a pivotal input in agricultural production and since Eswatini imports food,

it is imperative to see how agricultural food prices affect inflation in the country. Considering the nature of this research and aligning it to relevant studies reviewed above, the choice of methods and procedures to be utilized in this study have become apparent. The study will rely on standard time series econometric techniques based on the examples from the studies considered in the review of literature.

CHAPTER 3

METHODS AND PROCEDURES

3.1 Introduction

This chapter presents the methodical approach towards addressing the specific objectives of this research. The chapter builds on the conclusions of the preceding chapter by discussing the methods and procedures applied by other researchers. In the literature, food inflation is broadly examined by standard time series methods. These techniques allow for the estimation of long run and short run dynamics of the data. The sections covered in this chapter include a description of the type of data that is used in the study, how the data was analyzed and the sources it was obtained from. Lastly, the analytical framework explaining how the specific objectives were addressed is provided in the last section of this chapter.

3.2 Data type and sources

For the purposes of this research, a time period of eleven years observed at a monthly frequency (January 2009 to January 2020) was considered. The time series data that is utilized in this study was obtained from various sources as presented and described in Table 3.1.

Table 3. 1: Datasets and sources

Dataset	Description	Source
Food inflation for Eswatini	This dataset covers the overall monthly change in food prices for the period under study.	Central Statistics Office (CSO) of Eswatini
Food inflation for South Africa	Overall monthly change in South African food prices for the period under study.	Statistics South Africa
Agricultural prices	Monthly changes in global agricultural prices.	Food and Agricultural Organization (FAO)
Oil prices	Monthly changes in global oil prices	World Bank

Source: Author's computation.

3.3 Data preparation and analysis

The data in this study was analysed by means of two statistical analysis software packages for social sciences known as R-studio and STATA version 15. In the case of R-studio, the *"tseries"* and *"urca"* packages were used as recommended by (Pfaff et al., 2016). Table 3.2 presents the packages used in the analysis and their functions.

Table 3. 2: Time series packages in R-Studio and their functions

Package	Function
tseries	Time series analysis and computational finance.
urca	Unit root and cointegration tests for time series data.

Source: Pfaff et al. (2016)

3.3.1 Analytical framework

Initially, the univariate properties of the data were established. This provided information on the general and unit root properties of the data. The Augmented Dickey Fuller (ADF) test was performed to determine the order of integration of the variable under consideration. Moreover, the Phillips Peron and the Kwiatkowski-Phillips-Schmidt-Shin test for stationarity were also used to confirm this. The findings of these tests are presented and discussed in the following chapter.

Numerous political and climatic circumstances could impact the long run relationship between Eswatini and South Africa. This is depicted by the social unrests that were experienced in Eswatini as captured in section 1.1.2 and are suspected to cause structural breaks in the long run relationship. The nature of the series used in the study presents the possibility of the existence of structural breaks. According to Boetel and Liu (2010), overlooking structural breaks may cause biased estimates of price associations. Hence, the study used a procedure proposed by Gregory and Hansen (1996) to test for the existence of a structural break in the series.

As mentioned in section 1.4.1, to address the main objective of the study which is to determine the key determinants of food inflation in the kingdom of Eswatini, secondary objectives were developed. The subsection below outlines how the first secondary objective will be addressed.

Objective 1: *To determine the key drivers of food inflation in Eswatini that affect inflation levels over the long run.*

Johansen (1988) developed different techniques to determine price relationship among variables such as cointegration tests. The limitation of this test is that it assumes linearity and the assumption of symmetric dynamics. This study, however, utilises the Autoregressive Distributed Lag (ARDL) model to establish the price relationships. As noted by (Hassler and Wolters, 2005), an advantage of the ARDL approach over the Johansen cointegration approach is that, while the Johansen cointegration technique requires the variables to be integrated of the same order, ARDL can be applied regardless of their order of integration. Thus, the ARDL approach avoids the pretesting glitches allied with standard cointegration tests.

Therefore, the study addresses this objective by using the ARDL which is reparametrized into an error correction model as proposed by Hassler and Wolters (2005). This is done to determine if the dependant variable (food inflation in Eswatini) is cointegrated with South African food inflation, global oil and agricultural prices. The ARDL reparametrized model of order *p* and *n* is represented by the following equation for a scalar variable y_t:

$$y_t = \sum_{i=1}^{p} a_i y_{t-1} + \sum_{i=0}^{n} c_i' X_{t-1} + \varepsilon_t \quad (1)$$

Where the number of lags is represented by *p*, the number of leads is represented by *n*, ε_t denoted a scalar zero mean error term and χ_t is the k-dimensional column vector process. The coefficients a_i are scalars while c_i' is a vector. The term y_t is the dependant variable (Eswatini's food inflation) whereas X_{t-1} represents the independent variables (South African food inflation, global oil prices and global agricultural prices).

Objective 2: *To determine the size and the magnitude of the effect of changes in the variables identified in the first objective on food inflation in Eswatini.*

After addressing the first secondary objective of the study, the second objective as captured in section 1.4.1 will then be addressed. The following subsection reveals the methods and procedures to be employed in order to address the second objective of the study.

3.3.2 The Error Correction Model (ECM)

After the ARDL cointegration test, the study employed the error correction model to test if the variables are cointegrated in the short run. The tight association between cointegration and

error correction models emanates from the Granger representation theorem. According to Engle and Granger (1987), the theorem states that "two or more integrated time series that are cointegrated have an error correction representation, and two or more time series that are error correcting are cointegrated".

To achieve the second objective, the Error Correction Model (ECM) was performed. The ARDL – error correction model has built-in specifications that confines the long-run behaviour of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The error correction mechanism is the adjustment of y_t via $a_i(1)$ to equilibrium deviations in the previous period, $y_{t-1} - \beta^1 x_{t-1}$. The model is specified as follows;

$$\Delta y_t = \Upsilon y_t + \theta' X_{t-1} + \sum_{i=1}^{\rho-1} \alpha_i \Delta y_{t-1} + \sum_{i=0}^{n-1} \phi_i' \Delta X_{t-1} + \varepsilon_t \quad (2)$$

Where $y = -a(1), \theta = a(1), \beta = -y\beta$.

Since the work by Engle and Granger (1987), cointegration of nonstationary processes is known to be corresponding to a data generating error-correction process. The characteristic "error correction" cointegration specifies a change in one variable that is associated with a change in another variable, as well as the gap between the variables in the previous period. The cointegration term is referred to as the *error correction term* (ect) since the deviation from long-run equilibrium is corrected steadily through a series of short-run adjustments after a price shock (Hassler and Wolters, 2005).

3.4 Diagnostic tests

Since time series datasets are used in the study, numerous postestimation tests were done with the aim of evaluating the validity of results and examining statistical properties of the models used. These tests included the Jarque-Bera test for normality, the Cumulative Sum of Squares test for model stability and the Breusch-Godfrey LM test for serial correlation. All these tests were performed in STATA version 15 and are discussed in detail in the following chapter. According to Gujarati (2003), diagnostic tests aids in assessing the competence of the estimated error correction and multiple regression models.

3.5 Conclusion

The sole purpose of this chapter was to explicitly outline the methods and procedures to be used in the study in order to adequately address the overarching objective. A description of the variables to be used in the study was provided and the statistical softwares for data analysis were stated. The analytical framework gave a step-by-step approach towards tackling the specific objectives of the study and careful justifications of the choices of methods was made. Various tests for postestimation model diagnostics in time series econometric analysis were also included. The results from these methods and procedures are presented and discussed in detail in the following chapter.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter discusses the findings obtained from the analysis of the time series data used in the study. Firstly, the univariate properties of the variables were explored for testing for stationarity. Results from the lag selection criterion are also presented and discussed before the results for the long run relationship. Since political circumstances might cause structural breaks, the study employed the Gregory-Hansen (1996) procedure to test for cointegration and determine the structural break in the series. The long and short run elasticities and also the adjustment coefficient from the ARDL model is presented last in the chapter.

4.2 Univariate properties of the data

Prior to time series estimation, it is imperative to determine the univariate properties of the series as presented graphically in the appendix section. Appendix A shows a graphical plot for the movement or changes in Eswatini's food inflation over the period considered in the study. Looking at the changes in food inflation, the lower bound of the series extends below zero and the presence of a trend cannot be determined since the series reverts back to its mean even though there are spikes in some periods. This series therefore contains a constant and the ADF used for this variable specified the presence of a constant in the series.

Appendix B presents the graphical plot for the movement or changes in South Africa's food inflation over the period considered in the study. Similarly, the lower bound of the series extends beyond zero for South Africa and the presence of a trend cannot be determined since the series reverts back to its mean even though there are spikes in some periods. This series therefore contains a constant and the ADF test used for this variable specified the presence of a constant in the series.

Appendix C illustrates the changes of global prices of oil under the period considered in the study. The graph shows an increasing upward trend of the oil prices at the beginning of the period of study then a sharp plummet nearing zero. This presents a random walk with a drift. Therefore, the appropriate ADF test used for oil prices specified the presence of a drift in the

series. Similarly, for global agricultural prices, the series shows an upward growth of agricultural prices at the beginning of the period of study then a downward movement presenting a random walk with a drift. This is illustrated in appendix D. Therefore, for agricultural prices, the appropriate ADF employed specified the presence of a drift.

Based on the properties of the series, as discussed above, tests for stationarity of the variables were conducted. Non-stationary data cannot be used for the examination of relationships between variables because it can lead to spurious regression and invalid OLS estimates. One characteristic of macroeconomic time series data is a stochastic trend (Engle and Granger, 1987). However, by differencing, non-stationary data can be made stationary. According to Engle and Granger (1987), "if a series is such that its first difference is stationary and has a positive spectrum at zero frequency, then the series has a pure unit root".

Three different tests for stationarity were conducted to determine stationarity and the order of integration of the variables. These tests are the Augmented Dickey Fuller (ADF) test as proposed by Dickey and Fuller (1979), the Phillips Peron (PP) test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The results from the different tests for stationarity are presented in Table 4.1.

Table 4. 1: Results of the different tests for stationarity

ADF test results for stationarity *H0: Non stationarity*					
	Levels		**First difference**		**Remark**
Variable	**Test statistic**	**Critical value at 5%**	**Test statistic**	**Critical value at 5%**	
Food inflation Eswatini	-2.62***	-1.95	-	-	I(0)
South African food inflation	-2.25**	-1.95	-	-	I(0)
Oil prices	-1.90	-2.88	-7.07***	-2.88	I(1)
Agricultural prices	-1.94	-2.88	-5.64***	-2.88	I(1)
Phillips Peron test results for stationarity *H0: Non stationarity*					
	Test statistic	**Critical value at 5%**	**Test statistic**	**Critical value at 5%**	**Remark**
Food inflation Eswatini	-2.45	-2.88	-6.93***	-2.88	I(1)
South African food inflation	-2.57	-2.88	-6.43***	-2.88	I(1)
Oil prices	-2.48	-3.44	-8.51***	-3.44	I(1)
Agricultural prices	-2.30	-3.44	-7.18***	-3.44	I(1)
Kwiatkowski-Phillips-Schmidt-Shin test results for stationarity *H0: Stationarity*					
	Test statistic	**Critical value at 5%**	**Test statistic**	**Critical value at 5%**	**Remark**
Food inflation Eswatini	0.155	0.14	0.082***	0.14	I(1)
South Africa food inflation	0.154	0.14	0.109***	0.14	I(1)
Oil prices	0.324	0.16	0.148***	0.14	I(1)
Agricultural prices	0.324	0.16	0.170***	0.14	I(1)

*Note: */**/*** indicates 5%, 10% and 1% level of significance respectively, I(0) and I(1) indicate order of integration.*

Source: Author's computation

4.2.1 The ADF test for stationarity

For the ADF test, if the test statistic is smaller (larger) than the critical values, we do not reject (fail to reject) the null hypothesis of unit root in the data. The null hypothesis for this test is non-stationarity of the variables.

From the findings presented in Table 4.1, only two variables (food inflation Eswatini and food inflation South Africa) were stationary in levels with significant test statistics at 1% and 10% confidence interval respectively. The rest of the variables (oil prices and agricultural prices) were stationary after first differencing at 1% confidence interval. The results provided by the ADF test shows that the variables are not integrated of the same order. The ADF test was conducted with the *ur.df* command under the *"urca"* package with the Akaike Information Criterion (AIC) used as a chief information criterion for lag selection in R-studio. The differences in the orders of integration of the included variables supports the application if integration test with the ARDL model.

4.2.2 The PP test for stationarity

Table 4.1 also presents results for the Phillips Peron test for stationarity. The results show that all the variables are insignificant and non-stationary at level. This called for first differencing where all the variables became stationary at 1% confidence interval. Similarly, for the PP test, if the test statistic is smaller (larger) than the critical values, we do not reject (fail to reject) the null hypothesis of unit root in the data. The null hypothesis for this test is non-stationarity of the variables. With respect to the results obtained, the null hypothesis of non-stationarity was therefore rejected upon first differencing at 1% confidence interval. The PP test was conducted with the *ur.pp* command under the *"urca"* package in R-Studio with the AIC used as a chief criterion for lag selection.

4.2.3 The KPSS test for stationarity

This is another test performed to test for stationarity of the variables. For the KPSS test for stationarity, the rule of thumb is to reject the null hypothesis if the test statistic is smaller than the critical values at all levels of significance. The results for the KPSS test for stationarity are also presented in Table 4.1. The findings obtained from the KPSS test for stationarity reveals that all variables were not stationary at level showing insignificant values of test statistics at all confidence intervals. After first differencing, all variables were stationary with significant

values of test statistics at 1% confidence interval. Correspondingly, there was no evidence to reject the null hypothesis of stationarity upon first differencing at 1% confidence interval. These results are in agreement with those of the PP test since the variables from both tests are all integrated of order 1 which is denoted by I(1) in Table 4.1. The KPSS test was performed with the *ur.kpss* command under the *"urca"* package in R-studio.

4.3 Lag length selection

The importance of lags in time series econometric analysis arises because the value of the past affects the value for today for any given variable (Wooldridge, 2012). Numerous methods to determine the number of lags were developed and this study used the Akaike Information Criterion (AIC), the Final Prediction Error (FPE), the Schwarz Bayesian Information Criterion (SBIC) and the Hannan-Quinn Information Criterion (HIQ) generated using the *Varsoc* command in STATA. The results for the selection of lag length of the variables are presented in appendix E.

The number of lags to include in the model vary per variable. As shown by the results in appendix E, the number of lags to include for food inflation in Eswatini is one, whereas the number of lags to include for food inflation in South Africa is three as determined by the significant values of the FPE and AIC criterion. Oil prices and agricultural prices both have one lag to be included in the model as determined by the significant values of FPE and AIC.

4.4 Estimating a long run relationship.

Engle and Granger (1987) and Johansen (1988) developed techniques to study relationships of prices such as correlation tests and cointegration tests. These cointegration approaches assume symmetry and linearity which is their ultimate shortcoming. To inspect the presence of a structural break in the series as captured in section 1.1.2, this study used a method developed by Gregory-Hansen in 1996 to determine the likelihood of structural breaks in the long run relationships. Boetel and Liu (2010) stipulates that overlooking structural breaks may cause biased estimations of price associations. Table 4.2 shows the results obtained from the Gregory and Hansen (1996) procedure to determine the structural breakpoint date in the series.

Table 4. 2: Gregory-Hansen cointegration test results with change in levels

Change in levels					
			Critical values		
Test statistics		Breakpoint date	1%	5%	10%
ADF	-8.36	September 2011	-6.05	-5.56	-5.31
Z_t	-8.52	September 2011	-6.05	-5.56	-5.31

Source: Author's computation

The Gregory-Hansen procedure was employed to determine if and where the structural break in the series. According to the properties of the data, the procedure was conducted with change in levels. The results in Table 4.2 shows that the ADF and Z_t statistics were significant and larger than the critical value at 5% confidence interval indicating cointegration (existence of a long run relationship) among the variables.

The Gregory-Hansen procedure shows that the break point date was September 2011 with a small and significant absolute value of the Z_t test statistic of -8.52. This break point date falls within the period of the anti-monarchial democracy protests that took place in 2011 in Eswatini. In this period, there was a sharp upsurge in the domestic prices of food caused by increased government spending which led to the social and political unrests in the country as captured in section 1.1.3 of this study. The breakpoint date and the social and political unrest events are consistent with findings by Ngidi (2015) which revealed that historical events such as political and socioeconomic unrest correlate with high food inflation especially in developing economies. Figure 4.1 gives a graphical presentation of the series over time and also the break point date indicated by the red vertical line (September 2011).

The implication of a structural break is that there is a change in the long run relationship of the variables under study (Louw et al., 2017). However, even after the structural break (September 2011), it seems Eswatini still continued to rely on South Africa for food imports. This is illustrated by figure 4.1 where Eswatini's food inflation continues to shadow South African Food inflation closely.

The structural break was caused by a series of anti-monarchial demonstrations as captured earlier. It seems apparent that the anti-monarchial demonstrations had an impact on the relationship Eswatini has with South Africa in as far as food import is concerned. After 2011, food inflation in Eswatini remained higher than in South Africa and the effects in South Africa

are more moderate than in Eswatini as shown by Figure 4.1. This edifies the claim that inflationary dynamics occurring in South Africa have significant spillover effects into Eswatini.

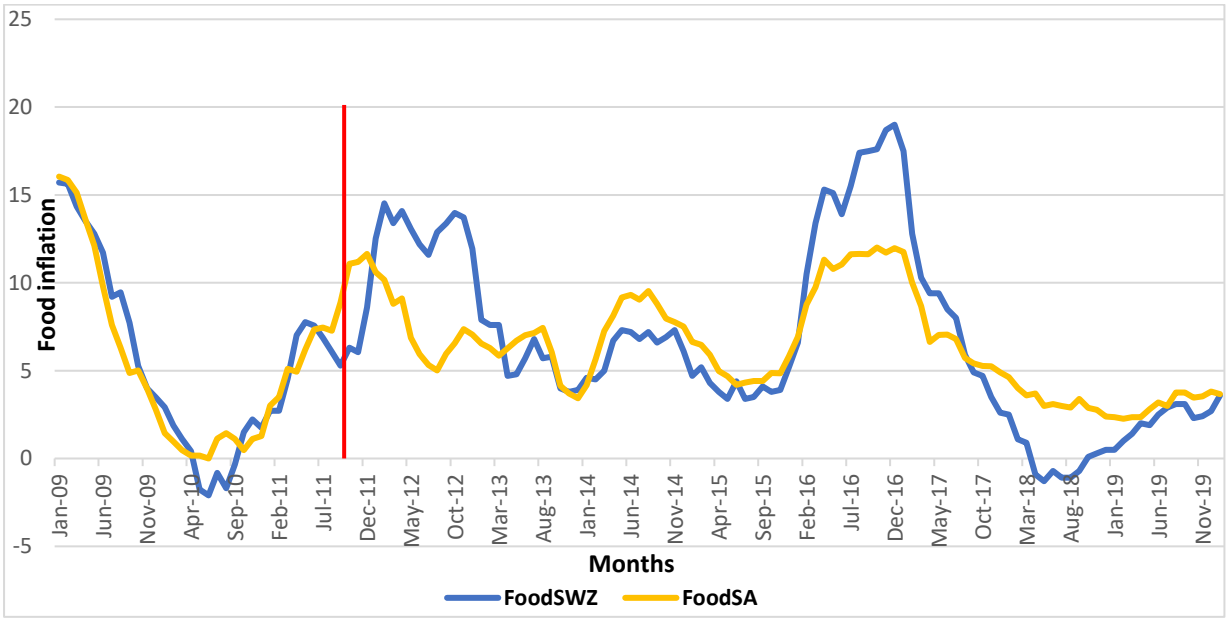

Figure 4. 1: Food inflation over time with the break point date = September 2011

Source: Computed by the author using data obtained from the Central Statistics Office of Eswatini and Statistics South Africa

After the Gregory-Hansen procedure was conducted to determine the existence and timing of the structural break in the series, the long run relationship was estimated using the ARDL bound test and the results are presented in Table 4.3.

Table 4. 3: ARDL Bounds test for cointegration

Null hypothesis (H_0)	**F-Statistic**	**95% lower bound**	**95% upper bound**	**Remark**
No cointegration	19.78	2.72	3.77	Reject H_0

Source: Author's computation

According to Pesaran and Shin (2001), cointegration is confirmed when the combined significance of the parameters of the lagged variables, in levels, surpasses the upper bound of

the critical values. The results from the ARDL bounds test shown in Table 4.3 reveal that there is cointegration between the variables as the F-statistic exceeds the 95% upper bound. Therefore, the null hypothesis of no cointegration was rejected at 5% confidence interval. Table 4.4 presents the results for the long run relationship obtained from the ARDL test.

Table 4. 4: Non-linear ARDL estimation results

Independent Variable	Coefficient
Constant	0.351***
$\Delta LFoodSWZ_{t-1}$	0.312**
$\Delta LFoodSA_{t-3}$	0.701***
$\Delta LOilprices_{t-1}$	0.086***
$\Delta LAgrprices_{t-1}$	0.753**
$LFoodSWZ_{t-1}$	0.318***
$LFoodSA_{t-1}$	0.512***
$LOilprices_{t-1}$	1.805**
$LAgrprices_{t-1}$	0.568**
Z	0.371**

*Note: */**/*** indicates 5%, 10% and 1% level of significance respectively and z denotes the breakpoint dummy variable.*

Source: Author's computation

From the findings shown in Table 4.4, it is evident that all the variables have a positive and significant relationship with Eswatini's food inflation. Since the study considered a structural break as determined by the Gregory and Hansen (1996) procedure, a dummy variable denoted by *"z"* in Table 4.4 was used to demarcate the structural break. The breakpoint dummy took values of 0 and 1 (0 = period before September 2011 and 1 = period after September 2011). The breakpoint dummy *"z"* is significant at 5% confidence interval indicating that the structural break has a significant effect on the long run elasticities of the variables. For the dummy variable which took values of 0 and 1, the average food inflation for the period before September 2011 is given by the value of the constant term (0.351). The average food inflation of the period after September 2011 is given by the summation of the coefficient of the dummy variable (0.371) and the constant term. The sum becomes 0.722 which means that the average

food inflation of the period after September 2011 was 0.722% higher than the food inflation before September 2011.

The long-run coefficients are used to establish the long-run relations (β parameters) by dividing the coefficient of the lagged dependent variable (φ_{t-1}) by the long-run coefficients (θ_i). The estimated ARDL long run elasticities shown in Table 4.5 are discussed below.

Table 4. 5: Long run elasticities

	Long-run elasticities
LFoodSA	1.61***
LOilprices	5.67**
LAgrprices	1.77**

*Note: */**/*** indicates 5%, 10% and 1% level of significance.*

Source: Author's computation

From the ARDL long run elasticities presented in Table 4.5, it can be seen that a 10% increase in the South African food inflation is responsible for a 16.1% significant increase in food inflation in Eswatini in the long run. This positive relationship is consistent with the expected results as Eswatini is a net importer of food from South Africa. As a result, inflationary dynamics in South African food markets are expected to have significant spillover effects into Eswatini's food markets. Given the similarities between the South African macro-economic environment and that of Eswatini, combined with the reliance of Eswatini on South Africa for food imports, a strong relationship in terms of food inflation dynamics was expected.

The global prices of oil have a positive and significant effect on Eswatini's food inflation as a 10% increase in the global prices of oil is associated with a 56.7% increase in Eswatini's food inflation. Albeit the large elasticities, these results align with the expected results and are consistent with findings by Kwon and Koo (2009) and Chand (2010) that the food sector heavily depends on energy consumption for its operations. The department of energy in the Ministry of Natural Resources and Energy (MoNRE) revealed that Eswatini gets its crude oil from Durban refineries in South Africa as an input (fuel for machinery) for agricultural production. As stated in reports by the ministry, Eswatini consumes 5,300 barrels of oil per day as of the year 2016. Oil is a significant input in agricultural production and also contributes largely to manufacturing and distribution costs of food in the country (Chand, 2010). As

expected, a rise in the cost of input for production, the final cost of food (food inflation) is expected to increase as well and these results conforms.

Literature further gives evidence of studies conducted by various authors on the same theme. The findings on global oil prices of this study are in agreement with findings by Makaiko and Ularo (2010) who also considered fuel (oil prices) in determining factors affecting food inflation in Malawi and found that fuel prices have a positive and significant influence on food inflation. Kwon and Koo (2009) also found that energy prices have a positive and significant influence on food prices and that energy prices granger causes food prices with a unidirectional causality from food energy prices to food prices.

Table 4.5 further shows that global agricultural prices have a positive and significant effect on Eswatini's food inflation as a 10% increase in the global agricultural prices is associated with 17.7% increase in Eswatini's food inflation. Similarly, these results are in congruence with the expected results as prices in global food markets are expected to be transmitted down into domestic food markets and consumers pay more money for less quantities of food. This aligns with the findings by Nyoni (2019), that food inflation erodes the purchasing power of money.

The findings on agricultural prices are consistent with results of some studies done on the same topic. Literature unveils a study conducted by Gilbert (2010) which also found agricultural prices to have a positive and significant effect in explaining the food price changes in developing countries. The results of the study revealed that there are factors which have a causal effect on agricultural goods prices such as fickle GDP growth and sharp oil prices.

4.7 Granger causality test

To further understand the causal relationship between Eswatini's food inflation and the regressors in this study, the Toda-Yamamoto Granger causality test was conducted. This model was developed and proposed by Toda and Yamamoto (1995) as a superior model compared to the Granger causality test since it can be applied in non-stationary series to provide valid estimators as long as the order of integration of the series is included in the model. The model was developed to overcome the short comings of the conventional Granger causality test. The Toda-Yamamoto Granger causality test between the variables of the study was estimated through the following augmented VAR model:

$$y_i = a_0 + \sum_{i=1}^{k+M} a_i y_{t-i} + \sum_{j=i}^{k+m} b_i X_{t-j} \ldots + u_{it} \quad (3)$$

$$\chi_i = \mathrm{C}_0 + \sum_{i=1}^{k+M} c_i \chi_{t-i} + \sum_{j=i}^{k+m} d_i \gamma_{t-j} \ldots + u_{it} \quad (4)$$

Where Y is Eswatini's food inflation, X represents the regressors (South African food inflation, global oil prices and global agricultural prices), *m* represents the maximal order of integration of the variables in the model. The model is based on the estimation of an augmented VAR model ($k+d_{max}$) where *k* is the optimal time lag of the first VAR.

From the Toda-Yamamoto Granger causality test, four outcomes are possible (Toda and Yamamoto, 1995). The outcomes could be a unidirectional causality either from the dependent variable to the independent variables or from the independent variables to the dependent variables, a bidirectional causality and no causality. The results obtained from the estimation of the Toda-Yamamoto Granger causality estimation are presented in Table 4.5.

Table 4. 6: Results from the Toda-Yamamoto test for Granger causality

Null hypothesis	Chi-square	p-values	Decision
H_0: Eswatini's Food inflation does not Granger-cause South African food inflation	6.690	0.183	Fail to reject H_0
H_0: South African food inflation does not Granger-cause Eswatini's food inflation	5.732	0.034*	Reject H_0

*Note: */**/*** indicates 5%, 10% and 1% level of significance respectively*

Source: Author's computation

The results from the Toda-Yamamoto Granger causality test provide evidence of the causal relationships amongst Eswatini's food inflation and South African food inflation. Based on the results, we fail to reject the null hypothesis that Eswatini's food inflation does not granger cause South African food inflation at 5% confidence interval. The results also show that South African food inflation granger causes Eswatini's food inflation at 5% confidence interval, hence the null hypothesis that South African food inflation does not granger cause Eswatini's

food inflation was rejected at 5% confidence interval. From these results, we can confirm a unidirectional causality flowing from South African food inflation to Eswatini's food inflation. This direction of causality is in line with the expected as Eswatini relies much on South Africa for food imports as highlighted earlier in section 1.2 that about 18.5% of food imports come from South Africa including staple food, maize. As such, inflationary undercurrents happening in South Africa have a spill over effect in to Eswatini's food inflation.

The unidirectional causal relationship between Eswatini's food inflation and South African food inflation may also be explained by the relationship Eswatini has with countries in the Common Monetary Area (CMA) in southern Africa. According to an IMF working paper by Masha et al. (2007), the national currencies of Lesotho, Namibia and Eswatini were pegged against the South African Rand since their introduction. This made it possible for these countries to trade with one another through the Southern African Customs Union (SACU). Also, the same reason can justify why exchange rate was factored out in the estimation. The causal relationship among the variables is presented in Figure 4.2 which also illustrates the direction of causality (in arrows).

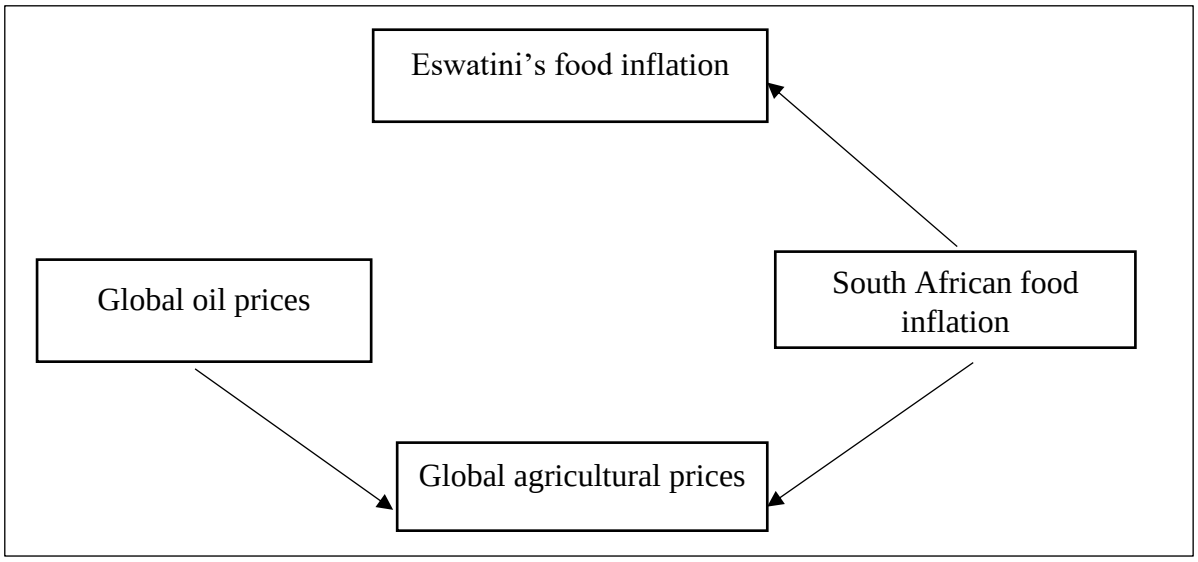

Figure 4. 2: The causal relationship between the variables (arrows = direction of causality)

Source: Created by author

4.8 Error correction model

After the long run relationships were determined, the error correction model was estimated to get the short run dynamics and the speed of adjustment of Eswatini's food inflation in response

to shocks in South African food inflation, global oil prices and global agricultural prices. The error correction parameter shows how quickly or slowly the relationship returns back to its equilibrium path after a shock in one of the exogenous variables included in the model. The error correction parameter should have a negative and statistically significant coefficient. The results are presented in Table 4.7.

Table 4. 7: Results for error correction estimation

Variable	Coefficient	t-statistic	P>|t|
Constant	-0.3521*	-3.35	0.001
dFoodSWZ	1.008	20.08	0.000
ΔFoodSA	-0.1644*	-2.14	0.034
ΔdOilprices	-0.0024	-0.26	0.794
ΔdAgrprices	-0.0066	-0.32	0.750
ect (-1)	-0.9667*	-24.71	0.000

*Note: * indicates 5% level of significance and ect (-1) denotes the error correction term.*

Source: Author's computation

The error correction term of -0.9667 is negative and significant at 5% confidence interval. This provides evidence of the existence of a long run relationship between the variables under study. The error correction term also shows the magnitude and the speed of adjustment back to long run equilibrium after a shock as cited by (Mkhatshwa et al., 2015, Makaiko and Ularo, 2010, Ahmed and Singla, 2014). This means that the speed of adjustment for Eswatini's food inflation shock in the long run relationship is almost instantaneous at 96.6% per month. This suggests that food inflation in Eswatini reflects changes to global oil prices, global agricultural prices and inflationary changes in South Africa fully and immediately. Any deviation from equilibrium from the long run relationship is corrected almost instantly as the speed of adjustment is close to one and that there is no lag between what happens to food inflation in South Africa and food inflation Eswatini.

From the results presented in Table 4.7, it can be seen that in the short run, only South African food inflation has a significant but negative effect on Eswatini's food inflation at 5% confidence interval. The negative coefficient of South African food inflation means that in the short run, food inflation in Eswatini is corrected by South African food inflation. The -0.164 coefficient also means that the magnitude of correction of Eswatini's food inflation is 0.164%.

4.9 Postestimation model diagnostics

The model was further imperilled to diagnostics tests to ascertain the suitability of the ARDL model. Three postestimation model diagnostics (normality test, stability test and serial correlation test) were used in this study.

4.9.1 Jarque-Bera test for normality

The assumption that the errors are independently, identically and normally distributed with finite variance and zero mean allows for the derivation of the likelihood function. If the errors are not normally distributed but are independently and identically distributed with zero mean and finite variance, the parameter estimates are still consistent, but they are not efficient.

The study used the Jarque-Bera technique to test for the null hypothesis of normality of the residuals as proposed by Jarque and Bera (1980). According to Jarque and Bera (1980), the Jarque-Bera test is a type of Lagrange multiplier test used to test for normality. The authors further state that normality is one of the assumptions for many statistical tests, like the t test or F test; the Jarque-Bera test is usually run before one of these tests to confirm normality. Specifically, the test matches the skewness and kurtosis of data to see if it matches a normal distribution. Table 4.8 presents the results obtained from the test.

Table 4. 8: Jarque-Bera test for normality

Jarque-Bera. H_0: Normality			
Variable	**Chi-square**	**Df**	**Prob > Chi-square**
D_FoodSWZ	9.391	2	0.009
D_FoodSA	2.369	2	0.305
D_oilprices	1.834	2	0.399
D_agrprices	1.807	2	0.405
ALL	15.401	8	0.051

Source: Author's computation

The results from the Jarque-Bera test show that the errors are normally distributed with a significant Prob > Chi^2 which is greater than the 5% confidence interval. Therefore, we fail to reject the null hypothesis of normality at 5% confidence interval. This gives confirmation that the model was correctly specified and residuals are normally distributed. A similar test was

also conducted by Sukati (2013) but his results contradict the findings of this paper as they revealed that the residuals did not follow a normal distribution.

4.9.2 Testing for model stability.

As Adil et al. (2016) notes, the stability of the coefficients of any model is crucial. The stability of the coefficients is tested by employing the CUSUM squares test. Under the null hypothesis, the statistic is drawn from a distribution called the cumulative sum (CUSUM) of squares distribution. If the calculated CUSUM statistics appear to be too large to have been drawn from the CUSUM distribution, we reject the null hypothesis of model stability. The output is a graph of the CUSUM statistics and bands representative of the bounds of the critical region for a test at the 5% significance level (Adil et al., 2016).

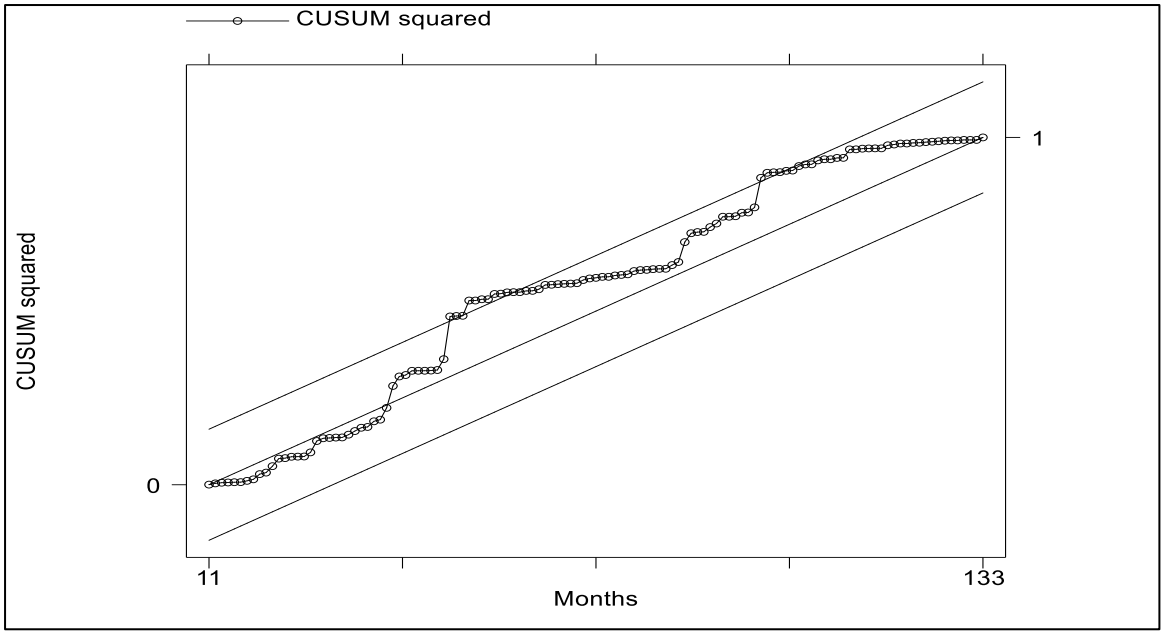

Figure 4. 3: Plot for CUSUM square test results.

Source: Author's computation

Figure 4.3 shows the graphical presentation of the results of the test. The CUSUM square test results show that the model is stable and we fail to reject the null hypothesis of model stability at 5% confidence interval.

4.9.3 Testing for autocorrelation.

As Sukati (2013) notes, one of the problems in statistical analysis of time series data is autocorrelation amongst the variables which may be defined as the relationship between members of a series of observations ordered in time. Many reasons exist that may lead to serial correlation. According to Durbin and Watson (1950), some of the causes of autocorrelation may include specification bias (excluded variables or incorrect functional form), lags, data manipulation and non-stationarity. To correct for serial correlation, many tests have been proposed ranging from the Durbin Watson test as proposed by Durbin and Watson (1950). Another test is the Breusch Godfrey LM test for serial correlation proposed by (Breusch and Pagan, 1979).

As a postestimation prerequisite in time series econometric analysis, a test for detecting serial correlation was performed using the Breusch-Godfrey LM test for serial correlation. An auxiliary regression was performed with the residuals as an independent variable and the model was found to be suffering from serial correlation with the Prob. Chi-Square being less than the 5% confidence interval as shown on Table 4.8.

Table 4. 9: Breusch-Godfrey serial correlation LM test

Breusch-Godfrey Serial Correlation LM test before correcting autocorrelation			
F-statistic	17.435	Prob. F (2.125)	0.000
Observed R-squared	28.791	Prob. Chi-square (2)	0.000
Breusch-Godfrey Serial Correlation LM test after correcting autocorrelation			
F-statistic	0.305	Prob. F (2.125)	0.739
Observed R-squared	0.643	Prob. Chi-square (2)	0.725

Source: Author's computation

Taking the lag of the independent variable (food inflation in Eswatini (-1)) and including it in the regression treated the model from autocorrelation. The Breusch-Godfrey LM test for serial correlation was performed anew to diagnose the model and the results presented in Table 4.8 shows indication of no serial correlation in the model as the 0.725 Prob. Chi-Square value was greater than the 5% confidence interval. Therefore, we failed to reject the null hypothesis of no serial correlation at 5% confidence interval. This cements the validity of the long run estimates generated in the study.

4.10 Conclusion

This chapter presented the results obtained through the methods and procedures stated in the previous chapter in order to address the main objective of the study. The univariate properties of the data informed the choice of ADF test used for the variables as a first step. In accordance with the first objective of the study, the long run relationship between the variables under study was determined by means of the proposed ARDL approach. Long run elasticities were also used to show the relations amongst the variables. Furthermore, the error correction model was employed to estimate the short run dynamics of the variables. To further understand the relationships amongst the variables, the Toda Yamamoto model was used to test for the causal relationship between the variables. Postestimation model diagnostics were also carried out to test for the validity and stability of the model as a standard practice in time series econometric analysis.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The contents of this chapter include a conclusive summary of the research work. The summary covers an outlook of the problem addressed by the study, the objectives and the corresponding methods and procedures employed to address the specific objectives. The chapter then provides a conclusion which encompasses the findings of the study. The penultimate section of this chapter features policy recommendations based on the findings of the study that gives tentative remedies and directions to be considered by relevant bodies such as the government. Lastly, the chapter gives some directions for further research endeavours.

5.2 Summary

The study investigated the key determinants of food inflation in the kingdom of Eswatini using monthly time series data for eleven years. This investigation was inspired by growing discussion on food inflation and its relevance in determining consumer demand and its effects on welfare erosion of lower income groups. Eswatini is faced with a problem of high food inflation which hampers food access and affordability for low income groups. Hence, the study had a main objective of understanding the main factors that drive food prices in the kingdom of Eswatini.

The overarching objective of the study was achieved by the use of an ARDL analysis to understand the long run relationships between the variables considered in the study. The error correction model was employed to determine the short run dynamics, the magnitude and speed of adjustment of Eswatini's food inflation back to equilibrium after inflationary shocks. The study considered the possibility of a structural break in the series and used the Gregory-Hansen procedure to detect the existence of a structural break or truncation which was included in the ARDL estimation. This was considered in order to avoid having biased estimates of the price relationships.

5.3 Conclusion

The Gregory-Hansen results showed September 2011 as the structural break point of the series. This period correlates with the sharp upsurge of domestic food prices which were caused by increased spending by the government and consequently led to the social and political unrests in the country. This is in conformity with the claim that social and political unrests have a relationship with high food prices.

Various findings were drawn on the basis of the results obtained in the study. The results confirmed that there is a long run association between Eswatini's food inflation and food inflation in South Africa. Furthermore, conclusions drawn from the results of the study is that the key determinants of food inflation in Eswatini significantly affect food inflation levels in Eswatini in the long run as South African food inflation, global oil prices and agricultural prices all impose a positive and significant effect on Eswatini's food inflation at 5% confidence interval. This, to some extent was expected considering that Eswatini is an importer of food largely from South Africa. The high cost of food prices is transferred down to consumers directly thereby resulting in skyrocketing food inflation, hence eroding the purchasing power of low-income earners as they are more prone to the dreadful effect of high domestic food prices. This provides insight on why food inflation remained high despite some years of good domestic agricultural output. The results showed that the external factors such as global oil prices and global agricultural prices considered in the study have a huge impact on food inflation in Eswatini.

Furthermore, results from the error correction estimation showed that 96% of the disequilibrium of Eswatini's food inflation is corrected monthly. This implies an instantaneous correction of Eswatini's inflation and that there is no lag between food inflation in South Africa and Eswatini. This relationship was expected given the macroeconomic reliance of Eswatini's economy to that of South Africa. The results of this study further revealed that the size and magnitude of changes in South African food inflation have a significant effect on food prices in Eswatini. This spillover effect of South African food inflationary undercurrents into Eswatini was also expected given Eswatini's reliance on South Africa for food imports. The estimated ARDL model passed multiple postestimation diagnostic tests which included the Jarque – Bera test for normality, the Breusch – Godfrey LM test for serial correlation and the CUSUM square test for model stability.

5.4 Recommendations

The kingdom of Eswatini can benefit from understanding the dynamics between its food price inflation and that of South Africa and this could provide knowledge for the food access and food affordability constraint in Eswatini. Understanding the key determinants, the spillover effects, the direction of food inflation causality and the speed of adjustment of Eswatini's food inflation can assist in coming up with innovative policies to protect consumers from the dreadful effects of high food inflation. Inclined to the findings of the study, the following recommendations were drawn.

1. As shown by the findings of the study, an increase in local food prices in the long run is caused by exogenous factors such as South African food inflation, global oil prices and global agricultural prices. The recommendation is that means to curb the increase in food prices be put in place for domestic agricultural prices. In the long run, the study revealed that significant factors that are responsible for driving food prices in Eswatini are exogenous, the government of Eswatini should therefore implement policies that makes the local food production and distribution system as efficient as possible. This could serve as a buffer for exogenous shocks. If Eswatini is self-reliant, imported inflation could also be buffered through these initiatives.

2. As shown by the results of the study, the size and the magnitude of changes in South African food inflation significantly affects food inflation dynamics in Eswatini. Given this information, the National Disaster Management Agency (NDMA) under the Deputy Prime Minister's office in Eswatini can rely on South African indicators to pre-empt what happens to food inflation in Eswatini. South African indicators such as inflation expectation and crop harvest projection for a growing season could assist in providing warnings beforehand to signal preventative measures that the agency could take to buffer the effects of high food prices. If need arises to source external food aid, it can be done on time.

3. Another recommendation is that policies to enhance the comparative competitiveness of Eswatini's food production to ensure self-sufficiency be promoted in order to cushion the inflationary pressures coming from South African food inflation, global oil prices and agricultural prices. Although Eswatini currently has an existing input subsidy program, there is still a need to ensure long term sustainability of food production in

the country. This could come in the form of tailor-made subsidies for producers that are hit hard by natural disasters such as drought in the rural areas. This is one way the pressure of food access and affordability can be ameliorated in low income groups residing in rural areas.

5.5 Areas for further research

The study focused on the determinants of food inflation in the kingdom of Eswatini. After having determined the key determinants of food inflation, the effect of the speed and magnitude of changes of South African food inflation and the direction of causality, further research endeavors could focus on the price transmission processes for specific agricultural products. Due to data limitations during the course of the study, this aspect was not covered. Here, the crux of concern could be how prices of staple foods such as maize are formed and transmitted in the value chains of the food market systems given that Eswatini still imports maize from South Africa. Having a clear-cut understanding of the price transmission processes of staple foods would provide information of how prices of staple foods are formed in the value chains. In turn, this could serve as an initial point to identify bottle necks and inefficiencies in key supply chains, which, if addressed, could ultimately help to alleviate price pressures associated with these products.

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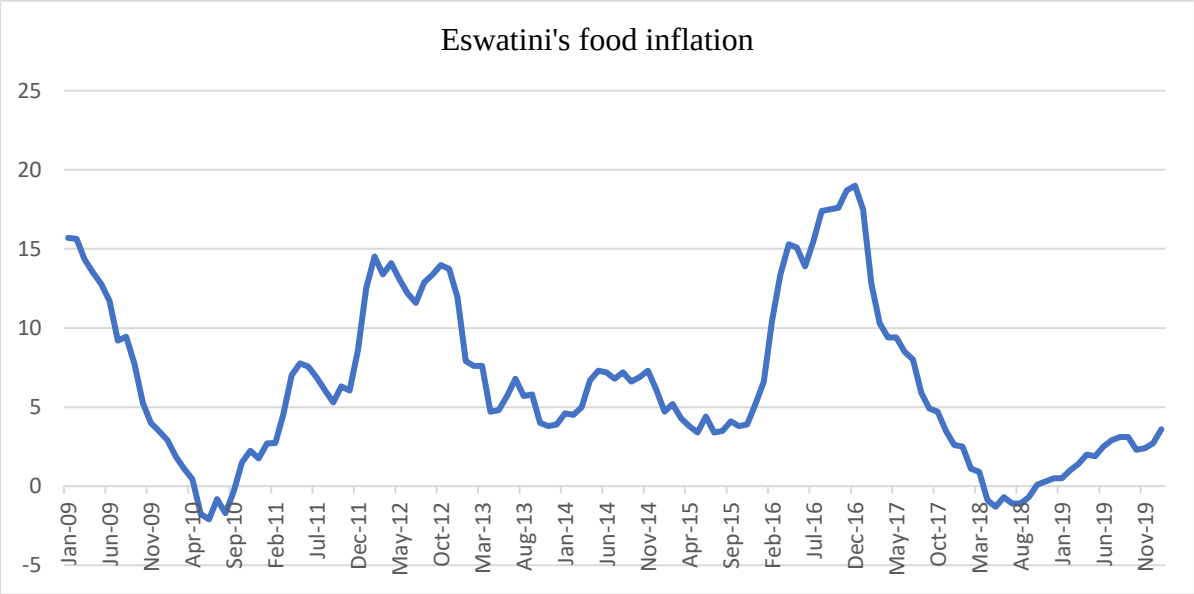
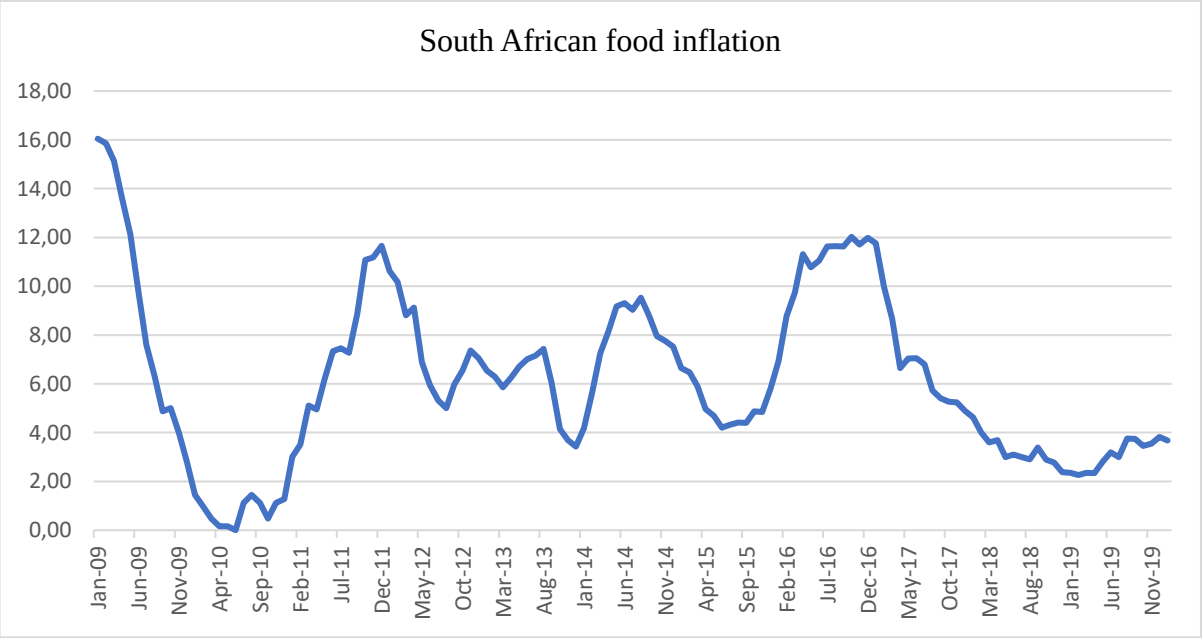
APPENDICIES

Appendix A: A graphical presentation of Eswatini's food inflation



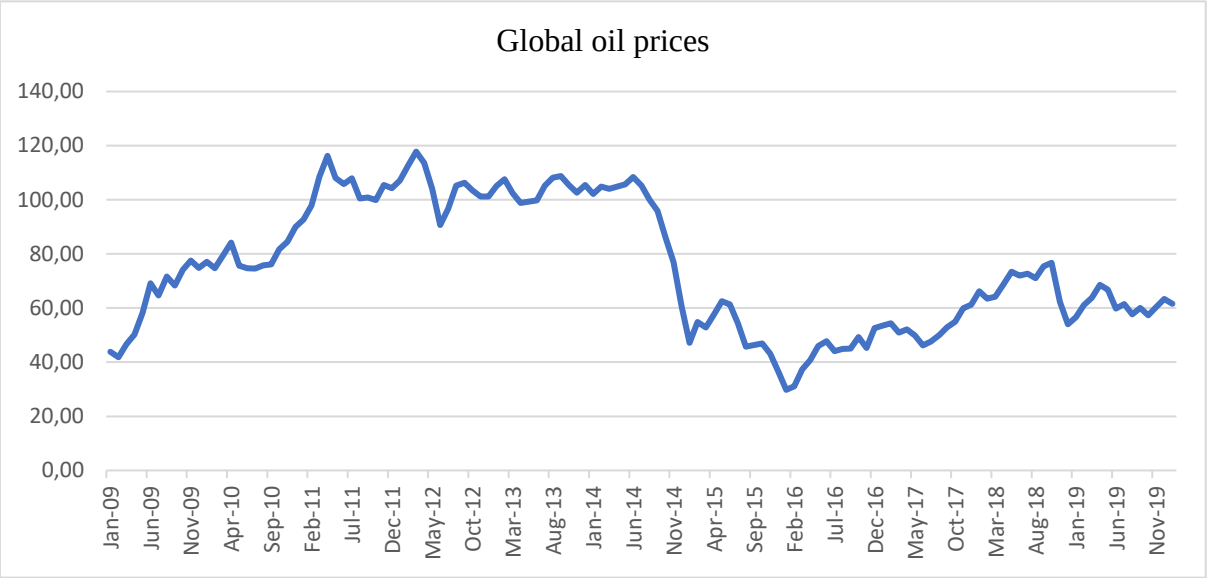
Source: Generated by author using data from the central bank of Eswatini

Appendix B: A graphical presentation of South African food inflation



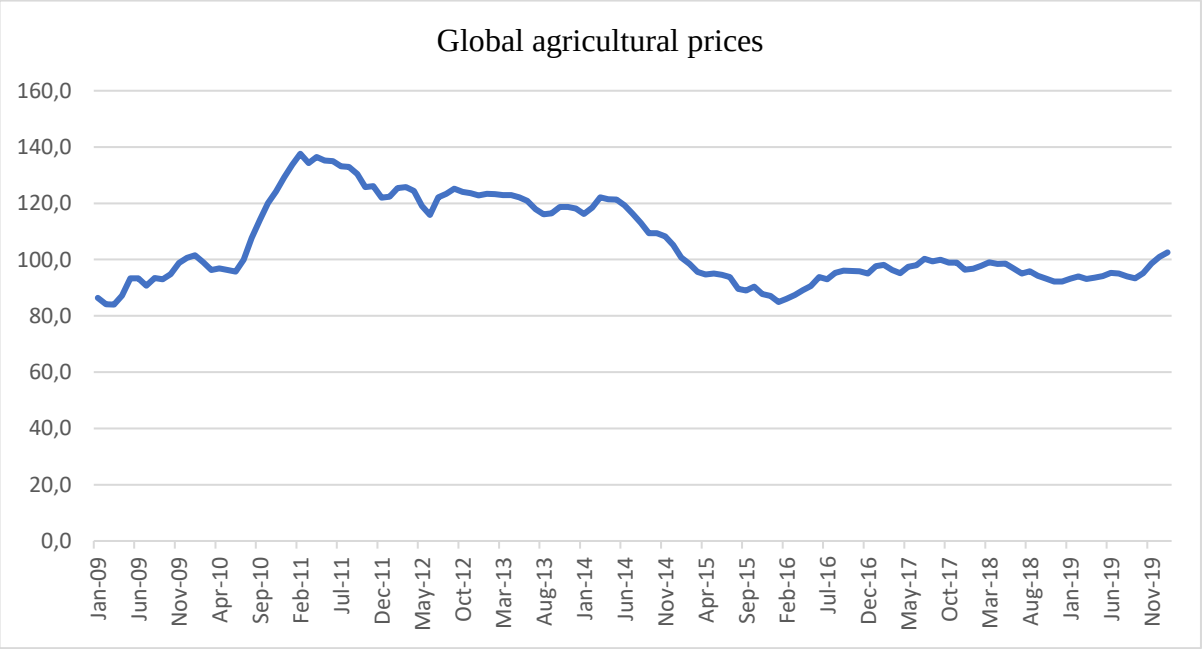
Source: Generated by author using data from Statistics South Africa

Appendix C: A graphical presentation of global oil prices



Source: Generated by author using data from the World Bank

Appendix D: A graphical presentation of global agricultural prices



Source: Generated by author using data from FAO

Appendix E: Lag selection

Lag selection for Eswatini's food inflation

Lag	LR	P	FPE	AIC	HQIC	SBIC
0	-	-	1.714	3.3769	3.3859	3.3991
1	30.032*	0.000	1.377*	3.1578*	3.176*	3.2024*
2	0.057	0.811	1.398	3.1730	3.2003	3.2399
3	1.3179	0.251	1.4057	3.1784	3.2146	3.2675
4	0.0242	0.876	1.4276	3.1938	3.2391	3.3052

Source: Author's computation

Lag selection for South African food inflation

Lag	LR	P	FPE	AIC	HQIC	SBIC
0	-	-	0.7189	2.5078	2.5169	2.5301
1	39.77	0.000	0.5352	2.2128	2.230	2.2573
2	8.1282*	0.004	0.5102	2.1649	2.1920*	2.2317*
3	2.11432	0.146	0.5097*	2.1640*	2.2002	2.2531
4	0.01098	0.917	0.5177	2.1795	2.2248	2.2909

Source: Author's computation

Lag selection for global oil prices

Lag	LR	P	FPE	AIC	HQIC	SBIC
0	-	-	26.0745	6.0988	6.1078	6.1211
1	9.9681*	0.002	24.5009*	6.0365*	6.0546*	6.0811*
2	0.3284	0.567	24.8231	6.0496	6.0768	6.1164
3	0.8655	0.352	25.0443	6.0585	6.0947	6.1476
4	0.0369	0.848	25.4319	6.0738	6.1191	6.1852

Source: Author's computation

Lag selection for global agricultural prices

Lag	LR	P	FPE	AIC	HQIC	SBIC
0	-	-	5.5900	4.5586	4.5679	4.5811
1	27.469*	0.000	4.5814*	4.3598*	4.378	4.4044*
2	0.6628	0.416	4.6295	4.3703	4.3975	4.4371
3	0.0049	0.944	4.7023	4.3859	4.4221	4.4750
4	1.0614	0.303	4.7370	4.3932	4.4385	4.5046

Source: Author's computation