The Impact of Food Price Changes and Food Insecurity on Economic Welfare: A Case of Selected Southern African Countries

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Abstract: Households are tremendously affected by changes in food prices. The extent of the impact depends on the income of households. This study is undertaken to analyse the impact of food price changes on food insecurity and economic welfare in selected southern African countries (Lesotho, Malawi, South Africa, Mozambique and Botswana). The Panel Auto Regressive Distributed Lag (PARDL) model is estimated using time series data from the period of 1980 to 2016. The findings of this study showed that food price changes positively affect economic welfare in the long run for the countries. Households that are net food sellers generate a higher income when prices go up. Therefore, food price changes are a gain for these households, especially producers and net sellers. Furthermore, the study revealed that inflation and net trade affect economic welfare for the countries in the short run. As a policy recommendation, the governments of these countries can subsidise food producers, most especially producers of staple foods that are seasonal; this can stabilize food price changes. As a result, both net sellers and net buyers of food can benefit from food prices. In other words, the benefit of food price can spread across to net buyers, not only net sellers. Also the governments of these countries can use monetary policy such as increase in interest rate to combat inflation.

Keywords: PARDL, Food Price Instability, Food Security, Economic welfare, Southern African countries.

BACKGROUND

Food price changes can be affected by many factors. Among other factors are seasonality of food production and trade restrictions. Over the years there has been a seasonality of price of food produce, most especially staple foods in Africa, of which southern Africa is no exception. Gilbert *et al*. (2017) found that among staple crops, maize seasonality is the highest, of which thirty-three percent on average is accounted for, and rice account for is 16.5 percent.

Across market places, seasonality varies most especially because maize is the only crop in which the country experience systematic effects. There are reasons why food price seasonality should be taken into consideration. Firstly, high seasonality in food prices may result in irregular changes in dietary intake and nutrition (Dercon and Porter, 2014). In addition, seasonality may result in an abrupt increase in volatility of global prices, as was the case of the global food crises of 2007-2008, instability since then has reduced (Ceballos *et al*., 2015). Furthermore, the changes in food price surges from both domestic and international costs to production and utilization (Gilbert *et al*., 2017).

According to the FNSWG (2015), it was documented that the price of maize in Angola increased by 50-75%, also prices in Zimbabwe, Malawi, and Lesotho surged by 20-75 percent during that year. By comparison, to the statistics of the World Food Program (WFP), Monthly Regional Food Price Update of 2017, WFP recorded that 58 of 68 out of 117 ALPS (Alert on Price Spikes) monitored markets in southern Africa were in either stress, alert or crises in March. Maize prices remained above their average price trend even until May 2017.

On the other hand, food security in the region of Southern Africa is on the surge. A release by SADC 2018 recorded that about 29.5 million people are food insecure in the region in the years 2018 and 2019; this is shown in the table below. This insecurity is a result of the poor harvest season together with other structural factors.

INTRODUCTION

Statistically, food prices have been unstable across the globe, and the prices of food products are not consistent (FFPI, 2019). These statistics have shown that food price most especially its fluctuation is a detriment to the economic system, especially in the future. This is because unexpected fluctuation in commodity prices causes a reduction in buyers' and investors' reliability in all nations, hence possibly decreasing economic development. Food price changes cause an imbalance between net sellers and net buyers in their economic welfare. Food-exporting and food-importing countries are equally affected (Anderson, 2012). To this effect, food price changes can be said to be the fluctuation in the average price of food commodities both globally and within countries.

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Table 1: Food Mode of Monitored Food Markets in Southern Africa in March 2016

Price Mode	Malawi	Mozambique	Tanzania	Zambia	Zimbabwe	Total markets for Southern Africa	% state of ALPS (Alert on Price Spikes
Normal	0	0	13	17	4	34	25.76
Stress	0	0	7	22	0	29	21.97
Alert	2	0	0	12	1	15	11.36
Crisis	43	9	0	2	0	54	40.91
Total monitored markets per country	45	9	20	53	5	132	NA

Source: Adopted from World Food Program (WPF) 2016.

Table 2: Food Insecure Population in SADC Member States, April 2018 – March 2019

Country	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2018/19 vs 2017/18
Angola	665,000	755,678	1,253,048	755,930	749,500		
Botswana	28,936	29,306	30,318	57,411	12,000	35,055	192%
DR Congo	7,318,639	6,591,535	4,456,106	5,900,000	7,700,000	7,249,998*	-6%
Eswatini	289,920	223,249	320,973	638,251	159,080	122,086	-23%
Lesotho	223,055	447,760	463,936	709,394	306,942	308,966	1%
Madagascar			1,800,000	1,140,000	855,796	1,261,323	47%
Malawi	1,855,163	1,312,376	2,833,212	6,692,114	1,043,000	2,397,220*	130%
Mozambique	212,000	150,000	375,905	1,980,000	313,481	531,476	70%
Namibia			7,195	13,706			
South Africa	13,798,024	14,060,928	14,349,445	14,349,445	13,700,000	13,930,354	2%
Tanzania	828,063	424,136	358,505	358,505	118,603		
Zambia	209,498	351,267	798,948	975,738	77,000	954,120*	1139%
Zimbabwe	2,206,924	564,599	2,829,159	4,071,233	1,052,768	2,423,568	130%
SADC	28,413,726	25,028,496	30,455,230	38,370,861	26,886,554	29,471,549	

Source: SADC RVAA Synthesis Report 2018.

Food security in the region of southern Africa is considered one of the serious challenges that are faced by the region. One of the main food challenges in the region is food availability especially on the agricultural level (see Abdalla, 2007; and Nafukh, 2017). Also, the region is faced with the problem of a diversified production structure which can hinder successful trade integration and economic development. These problems can eventually lead to unstable food prices because of fluctuation in production.

The fluctuation of food prices cause problems throughout the social, economic and political system. In countries where there is a substantial number of destitute, governments are unable to make fair decisions about food price changes (Jayne, 2012). Southern Africa is not an exception to this. The view that southern Africa is food insecure means that the living standard of most people is low. Agricultural products play a significant role in price fluctuation to determine how food secure a household is. A country like Botswana, with an estimation of 2.5 million population, having its major source of income through diamond and beef production is still food insecure (Acquah and Kapunda, 2016). Botswana is among the few countries in southern Africa having a steady economic growth however still experiencing a low standard of living, especially in the rural areas. Price fluctuation is primarily challenging in commodity markets. This is because the period between production and utilization is usually a long period due to harvest cycles (Assefa *et al*., 2015).

Table 3: Food Price Index (Base Period Price 2002-2004)

Index (Base)	Years
94.6	2001
89.6	2002
97.7	2002
112.7	2003
118	2004
127.2	2005
161.4	2006
201.4	2007
160.3	2008
188	2009
229.9	2010
213.3	2011
209.8	2012
201.8	2013
164	2014
161.5	2015
174.6	2016
168.4	2017
161.5	2018
177.2	2019

Source: FAO Food Price Index 2019.

Food security has four major components, which are availability, access, utilization, and stability. The economic welfare of individuals can be explained in diverse ways. Economic welfare can be in the form of employment, consumption, and investment (Meyer, 2003). Therefore, the changes in food prices play a role in the attainment of the four components of food security and the three areas of economic welfare. In as much as controlled food fluctuation translates to better food security, one should not ignore that the economic welfare of individuals brings a more long-lasting result for a food secure nation. An economy that has a good and steady economically developed welfare in the aspect of employment, consumption, and investment, can result in a buoyant economy and standard of living for its people (Meyer, 2003).

THEORETICAL LITERATURE REVIEW

The theoretical aspect for food price instability, food security and economic welfare will be dealt with individually. This is because each of this main variables have individual elements that pertains to them.

The Theory of Commodity Price Stabilization Rule

This theory was developed by Waugh (1944) and was expanded by Oi (1961) and Massel (1969). The theory assumes linear demand and supplies schedules, the instantaneous reaction of supply and demand to changes in market prices, additive stochastic disturbances and price stabilization at the mean of the prices which would have prevailed in an unsterilized market (Stiglitz and Newbery, 1979). In the analysis by Waugh, he was of the opinion that when instability is due to a shift in supply, consumers preferred such price instability. On the other hand, in Oi's analysis, producers prefer price instability if it is a result of a shift in demand. Massell showed that, by integrating the analysis of Waugh and Oi, if compensation is permitted, the society will gain from stabilization, regardless of the cause of instability (supply of demand variability). Compensation is a great necessity before an improvement in welfare can be observed (Van Kooten and Schmitz, 1985). The approach of the Waugh-Oi-Massell model is a partial equilibrium analysis that evaluates the benefits of price stabilization by examining changes in producer and consumer surplus. One of the strengths of the theory is that it can be used for policy recommendation particularly with countries with an unstable but moderate rate of inflation. Also, the agricultural sector can benefit from this theory. Articles written by Braverman (1990) and Buainain and Garcia (2015) used the theory to recommend policies for the Brazilian agricultural sector. The major limitation with the Waugh-Oi-Massel theory is that more emphasis was made that producers can postpone their production until prices are revealed. This may not be the case in many industries, especially that of agriculture. Production decisions need to be made before prices are known. Therefore, one can say that unless perfect future markets exist, there is uncertainty with producers regarding the price they will finally offer. A major drawback of the relatively simple models is that the well-known welfare theory result implies that there is a competitive equilibrium which is Pareto optimal. At the other extreme the models can be criticized for failing to consider the impediments to market-achieved Pareto-optimum in the absence of price stabilization (Peak & Thompson, 1982). The theory is also criticized for assuming that producers can make no change in their mean output in response to decreased price variance.

Bergson's Welfare Function theory

Bergson's welfare use of the social welfare function was developed in 1938. The interesting aspect of this

theory is that it is an ordinal index of society's welfare. It shows individual utilities constituting society. Bergson (1938) described the object of his paper as being "to state in a precise form the value judgments required for the derivation of the conditions of maximum economic welfare".

In this theory, there are a few assumptions pertaining to it which are - two consumption goods, two types of labour, two non-labour inputs into production, and that each commodity was produced in a single production unit. Bergson focused on an economic welfare function (EWF), in which economic welfare was a function of each person's consumption of each of the two consumptions (*x*&*y*), each person's supply of each type of labour in producing each consumption good (*xx*,*yx*,*xy*,*yy*), and the quantities of non-labour inputs (*a*,*b*) used in producing each consumption good (Graaff, 1967).

He further discussed the conditions under which economic welfare would be maximised. He assumed that if the quantities of consumption goods and labour supplied were constant for all except the i^{th} individual, and if the i^{th} individual consumed the different products and executed the various types of work in combinations which were indifferent to him, the welfare of the economy would be constant (Bergson, 1938). Additionally, according to Bergson and Samuelson "one and only one of the possible patterns of individuals' orderings is needed." The welfare function may be expressed in the following form if the decision is in favour of consumers' sovereignty.

$$W = F(U^1, U^2, U^3, \ldots)$$

Where U^1, U^2, U^3 signify household individual utilities and W, which shows the community welfare which is an increasing function of the utilities (Graaff, 1967). This welfare equation can be applied over a single profile of individual utilities to get "single-profile inter-pair" welfarism. Bergson and Arrow's social functions are closely related. The difference between the two frameworks rests primarily on the fact that Bergson and Samuelson did not impose any 'inter-profile' condition such as independence of irrelevant alternatives (Sen, 1979). According to Samuelson (1948), only one of the possible individual patterns for ordering is needed. The critique with this welfarism arose from combining it with poor utility information. In other words, there is no credibility concerning the welfare equation.

The strength of this theory is that the social welfare function is used to illustrates value judgement. The function incorporates various economic and non-economic elements of individual welfare. Thus this theory is an advancement in other theories such as the Compensation Principle of Kaldor. On the other hand, the limitation of this theory is that the social welfare function is constructed on the basis of ordinal preferences which can lead to contradictory results when choices are made between more than two alternatives. Also, the equation of the social welfare function does not help resolve the problem of welfare because welfare functions of individuals cannot be known. Therefore, the equation of the welfare function is illogical and imaginary. Additionally, the welfare function is constructed in such a way that individual preferences are aggregated. However, this should not be the case as individual preferences are not equal.

Empirical Literature

Empirical literature on the relationship between food price changes, food insecurity and economic welfare show contradicting result as to whether there is a positive or negative relationship. The different econometric techniques, study durations and variables have resulted in different study findings.

Literature from Developing Countries

Odusanya and Akinlo (2016), analysed the impact of food price rise on economic well-being. Data from thirty-one Sub-Saharan nations from 2001-2012 was used through panel regression. The generalised methods of moments (GMM) estimator was used to analyse the dynamic associations of the variables. The regression result of the GMM showed that concurrent prices of food were negatively connected with economic well-being at the significant level of ten percent. All in all, the finding from this study showed a negative relationship between food prices and economic wellbeing in the region. In other words, food costs negatively affect economic wellbeing in the region. Also the results showed that expenditure on health care, apart from food costs, strongly affects economic well-being.

Quentin *et al*. (2015) examined the effect of volatility of food price on the welfare of consumers in Cameroon. The data used was obtained from the Cameroonian Household Consumption Surveys. The elasticity of price was obtained using the Quadratic Almost Ideal Demand System model. The findings indicates that households that are poor are the most

affected by instability of food prices. Also welfare loss occurs.

Demeke and Rashid (2012) examined rural Ethiopia's rising food price as an impact on welfare. The Quadratic Almost Ideal Demand System (QUAIDS) approach was used. A panel data of from the period of 1994-2009 was utilised. The results showed that price hikes was a gain for rural households by a percent on average. Also, welfare gains at the level of aggregate are not equally distributed between rural households. Furthermore, the analysis also showed that real high food and agricultural prices benefited both net-cereal sellers and net-cereal buyers.

Literature from Developed Countries

Xie and Wang (2017) conducted a study on the effect of fluctuation of agricultural production on China's grain. The study used data on agricultural production dated from 1970-2015 to analyse how changes in prices of agrarian produce affected production of food. To investigate the link between prices of agricultural products and production of food, production of grain is used as a symbolic gauge of food production. The VEC model was used as the regression technique. Findings showed that the link between fluctuation of price and sown area of agricultural products is a uni-directional granger causality. Also the VEC model showed that price instability of agrarian harvests will affect the sown area and its yield. Generally, economic growth in China and farmers' welfare is highly affected by food price.

Ait Sidhoum and Serra (2016) carried out a research using time series by investigating volatility spill-overs in the Spanish food marketing chain using tomato as a case study. Three weekly price series namely: producers, wholesalers, and consumers, were considered from the first week of 2004 to the last week of 2011, leading to a total of 416 observations. The techniques used were VECM and BEKK-GARCH model to achieve the objectives of the analysis. The outcome of the techniques used revealed that an equilibrium relationship exists in the long run among the three prices considered. The BEKK-GARCH result demonstrated volatility evidence spill-overs along the chain of tomato market. Furthermore, the VECM reveals that short-run dynamics showed that prices of producers have a significant effect on their own and that of wholesale lag. In a nutshell, the result showed a positive association between food volatility and tomato marketing chain. Therefore, evidence has shown that price patterns in the tomato marketing chain in Spain are characterised by significance of volatility spill-over and price transmission.

Literature from Selected Southern African Countries

Prifti *et al*. (2017) analysed Lesotho's effect of increasing prices of food on welfare of consumers. The main focus for the food price is that of cereals as it is the main staple food in the country. The analysis is based on collected data from the assessment of the Child Grants Programme (CGP). Based on the findings, it was discovered that for every one percent rise in cereal price, consumption reduced by a comparable amount. Therefore, according to the study, in order to retain utility of households unaffected, every one percent increase in the cereal price would need to be matched by 0.4% increase in income.

Harttgen *et al*. (2015) examined the impact of Malawi's food prices and income related shocks on households' entitlement to food. The study used a micro-based simulation approach. A total of 11 208 families were used for data collection. The findings appeared that staple food price shocks have a huge impact on Malawi's food security. Poor net food buyers in urban and rural zone area equally affected.

A study by van Wyk and Dlamini (2018) is a research that examined the impact of food costs on welfare of families in South Africa. The study utilized yearly time series data covering the period of 1990-2015. It also attempted to examine the relationship of welfare of households and food prices for both long and short run. The VEC model was used as a method to estimate the regression model. The result uncovered that a one percent rise in the price of food would diminish welfare of households by 21.3 percent. The study also found a negative relationship among factors. The cointegration analysis showed a long-run relationship among factors. A negative significant association existed between food costs and welfare of families, which supports that a rise in prices of food resulted in the decline of family welfare in South Africa.

Brück and Van den Broeck (2006) studied growth, employment and poverty in Mozambique. Two household surveys were utilized from 1996-1997 and 2002-2003. The authors also estimated the effect of employment outcomes on household welfare, which addresses an important linkage between growth, employment and poverty. The authors discovered that there was no direct influence of employment on consumption at the household level in 1996. However,

in the year 2002, such influence is noticeable in some regions in Mozambique, and non-agricultural employment is positively significant on household consumption in urban areas. By contrast, agricultural employment has significant consumption effects for northern rural areas.

Okurut *et al*. (2014) investigated the impact of microfinance on family welfare in Botswana employing a nationally representative sample of 503 family units. All locales in Botswana were covered. A survey was utilized to get data from household heads. This information included family wage, access to micro-finance, demographics and socio-economic characteristics. The findings appeared that microfinance has no critical impact on family welfare in Botswana. In any case, family welfare is emphatically and significantly affected by education level, household assets and being in paid work within the public/private sector.

Going by the forgoing empirical literatures, it is obvious that the researchers focused on various indices to analysis food price and welfare. The uniqueness of this study is that Human Development Index will be used as a measure of welfare. This variable is a better measure of welfare. Furthermore, the study uses a panel approach using Southern Africa as the focus and not Sub-Saharan Africa.

Model Specification and Data Source

This study adopts and modifies the model of van Wyk and Dlamini (2018) who conducted a study that examined the impact of food price on household welfare in South Africa. The modified model for this study is presented by equation 1:

$$GDP\_PC_{it} = \beta_0 + \beta_1 FP_{it} + \beta_2 FPI_{it} + \beta_3 INF_{it} + \beta_4 NT_{it} + \beta_5 POP_{it} + \mu_t \quad (1)$$

where GDP_PC (proxy for welfare) represent the natural logarithm of Gross Domestic Product per capita growth, FP represent the logarithm of food price changes, FPI (proxy for food insecurity) represent food production index, INF represent inflation, NT represent the logarithm of net trade, POP is the logarithm of population and μ_t is the error term.

Annual panel time series from the period of 1980 to 2016 was covered. The World Bank and UNCTAD data base was used for the empirical analysis. Refer to Table **4** below.

Methodology and Empirical Results

In examining the variables, the study begins by testing for unit root using the Levin, Lin & Chu (LLC) test and Im, Pasaran and Shin (IPS) test. The essence of performing the unit root test is to check the order of integration and to avoid spurious regression. These unit root tests are appropriate for the model because, LLC assumes a common autoregressive parameter for all the panels and IPS permits for residual serial correlation and heterogeneity of the dynamics and error changes across groups (Barbieri, 2006).

Levin, Lin & Chu (LLC)

This test was proposed by Levin, Lin and Chu (1993) to assess the hypothesis that every individual time series has a unit root against the alternative hypothesis that every time series is stationary (Latif, 2015). Also in this test, both the short and long run assessments can be computed either under the null hypothesis or under the alternative hypothesis. The general form of panel unit root model is as follows:

$$\Delta y_{it} = \rho_i y_{i,t-1} + \sum_{t=1}^{Pi} \phi i, l \Delta y_{i,t-1} + \alpha_i d_{it} + \varepsilon_{it} \quad (2)$$

where d_{it} are the deterministic components, $\rho_i = 0$ which means that the *y* process has a unit root for

Table 4: Data Sources and Measures

Variable	Measure	Frequency	Data Source
Gross Domestic Product per capita growth *(GDP_PC)*	Annual Percentage	Yearly	World Bank under Quantec
Food Prices *(FP)*	US dollars per ton	Yearly	World Bank under Quantec
Food Production Index *(FPI)*	Food Production Index (2004-2006=100)	Yearly	World Bank under Quantec
Inflation *(INF)*	Consumer Prices Annual percentage	Yearly	World Bank under Quantec
Net trade *(NT)*	US dollars	Yearly	UNCTAD
Population *(POP)*	Millions	Yearly	World Bank under Quantec

individual *I,* whereas $\rho_i < 0$ implies that the process is stationary around the deterministic part.

Im, Pasaran and Shin (IPS)

Im, Pesaran, Shin (2003) compared the Levin, Lin, Chu test under the presumption of no cross-sectional relationship in panels, and it was found that IPS is more effective than the LLC test (Hoang and McNown, 2006). IPS recommends a more adaptable and computationally straightforward unit root testing strategy for panels, which is alluded to as t-bar statistics. It permits for simultaneous stationary and non-stationary series, meaning that ρ_i can vary between individual factors. Moreover, the test permits for residual serial correlation and heterogeneity of the dynamics and error changes across groups (Barbieri, 2006). Rather than pooling the information, IPS consider the mean of Augmented Dickey Fuller (ADF) measurements computed for each cross-section unit within the panel when the error term μ_{it} of the model is serially correlated (Latif, 2015). The general form of panel unit root model is as follows:

$$\Delta\gamma_{i,t} = \mu + \varphi\gamma_{i,t-1} + \varepsilon_t \quad (3)$$

where $\Delta\gamma_{i,t}$ is the first difference representation of the panel series, γ is the constant while μ is the error term.

Referring to Table **5**, the t-statistical probability for LGDP_PC, LFPI, INF, LNT and LPOP are below the significant level at level form. This therefore means that the null hypothesis (there is unit root) is rejected for these variables at level form. Hence, it can be concluded that there is no unit root (stationarity) at level form for LGDP_PC, LFPI, INF, LNT and LPOP. On the other hand, LFP is not stationary at level because the probability values are more than the significant levels. It is however stationary at first difference. Hence, we

Table 5: LLC Test Result

Variables	Model Specification	LLC T-Statistic and P-value results		Order of Integration	Conclusion
		T-Statistic	P-Value		
LGDP_PC	Intercept	-4.67324	0.0000***	I(0)	Stationary
	Trend and Intercept	-4.25797	0.0000***	I(0)	Stationary
	None	-5.12358	0.0000***	I(0)	Stationary
LFP	Intercept	-3.85637	0.0001***	I(0)	Stationary
	Trend and Intercept	-0.65749	0.2554	I(0)	Non-Stationary
	None	2.08079	0.9813	I(0)	Non-Stationary
(DLFP)	Intercept	-2.36541	0.0090***	I(1)	Stationary
	Trend and Intercept	-2.72438	0.0032***	I(1)	Stationary
	None	-2.60744	0.0046***	I(1)	Stationary
LFPI	Intercept	0.88182	0.8111	I(0)	Non-Stationary
	Trend and Intercept	-2.33857	0.0097***	I(0)	Stationary
	None	2.39227	0.9916	I(0)	Stationary
INF	Intercept	-2.63911	0.0042***	I(0)	Stationary
	Trend and Intercept	-3.65158	0.0001***	I(0)	Stationary
	None	-1.95395	0.0254**	I(0)	Stationary
LNT	Intercept	-4.92351	0.0000***	I(0)	Stationary
	Trend and Intercept	-4.06305	0.0000***	I(0)	Stationary
	None	-6.94514	0.0000***	I(0)	Stationary
LPOP	Intercept	2.48517	0.9935	I(0)	Non-Stationary
	Trend and Intercept	-5.34859	0.0000***	I(0)	Stationary
	None	-2.95791	0.9985	I(0)	Non-Stationary

***statistically significant at 1% / **statistically significant at 5% / *statistically significant at 10%.

Table 6: IPS Test Result

Variables	Model Specification	IPS T-Statistic and P-value results		Order of Integration	Conclusion
		T-Statistic	P-Value		
LGDP_PC	Intercept	-5.27576	0.0000***	I(0)	Stationary
	Trend and Intercept	-4.81239	0.0000***	I(0)	Stationary
LFP	Intercept	-1.25661	0.1044	I(0)	Non-Stationary
	Trend and Intercept	2.27567	0.9886	I(0)	Non-Stationary
D(LFP)	Intercept	-1.92240	0.0273**	I(1)	Stationary
	Trend and Intercept	-2.13313	0.0165***	I(1)	Stationary
LFPI	Intercept	1.39052	0.9178	I(0)	Non-Stationary
	Trend and Intercept	-3.31953	0.0005***	I(0)	Stationary
INF	Intercept	-2.66942	0.0038***	I(0)	Stationary
	Trend and Intercept	-2.76954	0.0028***	I(0)	Stationary
LNT	Intercept	-5.86253	0.0000***	I(0)	Stationary
	Trend and Intercept	-4.33045	0.0000**	I(0)	Stationary
LPOP	Intercept	4.38388	1.0000	I(0)	Non-Stationary
	Trend and Intercept	-6.15987	0.0000***	I(0)	Stationary

***statistically significant at 1% / **statistically significant at 5% / *statistically significant at 10%.

reject the null hypothesis at first difference for LFP. The conclusion of whether the variables are stationary is based on the observation of trend and intercept. This study uses trend and intercept as the major determinant for the stationarity test.

Referring to Table **6**, LGDP_PC, LFPI, INF, LNT, and LPOP are stationary at level form, which implies that the null hypothesis is rejected at level. The other variable, which is LFP, is stationary at first difference implying that at I(1) the null hypothesis is rejected.

Granger Causality Test

The Granger causality test seeks to answer simple questions of the type, 'Do changes in y_1 cause changes in y_2? If y_1 causes y_2, lags of y_1 should be significant in the equation for y_2. Therefore, it would be said that y_1 'Granger-causes' y_2, in other words there exists a unidirectional causality from y_1 to y_2. On the other hand, if y_2 causes y_1, lags of y_2 should be significant to the equation in y_1. Therefore, it would be said that there is a 'uni-directional causality' or 'bi-directional feedback' (Brooks, 2014).

The Granger causality test result in Table **7** shows that LFP granger causes LGDP_PC. This implies that economic welfare of the selected southern African countries (Lesotho, Malawi, South Africa, Mozambique and Botswana) is affected by food price changes. Additionally, the causal linkage between food price changes and economic welfare is uni-directional; this is because the association runs in one direction (LFP→LGDP_PC).

The causal link between population (LPOP) and economic welfare (LGDP_PC) is bi-directional since it runs in two directions. In other words, economic welfare is affected by population and population is affected by economic welfare in these selected southern African countries. The result also shows that economic welfare Granger-causes inflation, implying that economic welfare is one of the primary causes of inflation in these countries. The causal link is uni-directional.

Residuals Diagnostic Tests

The diagnostic tests are carried out to test whether the model used in this study meets the criteria of satisfaction and efficiency. The hypothesis to test for normality, cross section independence and heteroscedasticity test is outlined below.

Normality Test Null Hypothesis

H_0: The residuals are normally distributed.

Cross-section Independence Tests Null Hypothesis

H_0: There is no cross-sectional dependence (No serial correlation) in residuals

Heteroscedasticity Null Hypothesis

H_0: Residuals are homoscedastic

Table 7: Granger Causality Test Results

Null Hypothesis	Obs.	Chi-sq	Probability	Conclusion
LFP does not Granger cause LGDP_PC	185	8.044078	0.0179**	Causality
LGDP_PC does not Granger cause LFP		3.576829	0.1672	No Causality
LFPI does not Granger cause LGDP_PC	185	0.918000	0.6319	No Causality
LGDP_PC does not Granger cause LFPI		1.892615	0.3882	No Causality
INF does not Granger cause LGDP_PC	185	2.092255	0.3513	No Causality
LGDP_PC does not Granger cause INF		6.955868	0.0309**	Causality
LNT does not Granger cause LGDP_PC	185	4.328931	0.1148	No Causality
LGDP_PC does not Granger cause LNT		0.121137	0.9412	No Causality
LPOP does not Granger cause LGDP_PC	185	9.729116	0.0077***	Causality
LGDP_PC does not Granger cause LPOP		8.992190	0.0112**	Causality

***statistically significant at 1% / **statistically significant at 5% / *statistically significant at 10%.

Table 8: Residuals Diagnostic Tests Results

Test	Type of the test	Test Stat.	Probability	Conclusion
Normality test	Jacque Bera	4.724516	0.094207**	Fail to reject H_0
Cross Section Independence tests	Breusch and Pagan LM dependence test	14.23298	0.1626	Fail to reject H_0
	Pesaran scaled LM dependence test	0.946524	0.3439	Fail to reject H_0
	Pesaran cross-section dependence test	-0.369263	0.7119	Fail to reject H_0
Heteroscedasticity LR test	Likelihood Ratio	9.029495	0.1079	Fail to reject H_0

***statistically significant at 1% / **statistically significant at 5% / *statistically significant at 10%.

The residuals diagnostic test result in Table **8** indicates that the probability result for the tests are above the level of significance. Therefore, the null hypothesis fails to be rejected for normality, cross section dependence and heteroscedasticity test. In conclusion, the residuals are normally distributed, there is no cross sectional dependence and there is homoscedasticity of residuals.

Cointegration Test

Kao's test forces homogeneous cointegrating vectors and AR (auto regressive) coefficients. Be that as it may, it does not permit variables to be multiple exogenous within the cointegrating vector. Another confinement is that Kao's cointegration does not address the issue of recognizable proof of the cointegrating vectors in the cases where more than one cointegrating vector exists. Furthermore, according to the Kao Residual cointegrating Test (1999), the speculation of zero non-cointegrating is rejected which confirms the existence of a long-term relationship. In the case of co-integration of variables, one can utilize the level of variables to gauge the coefficients and avoid wrong regression (Dimitrios, 2006). Hence this cointegration test is suitable for this study.

Optimal Lags Selection

The maximum lag order for the variables is specified by introducing a zero on the parameter matrices. The decision made for the maximum lag order and model selection is based on the information criteria. Thus the value for the information criteria must

Table 9: Cointegration Test

Test	ADF T-Statistic	Probability	Conclusion
Kao Cointegration Test	-2.485570	0.0065***	Reject H_0

Table 10: Lag Structure Criteria for the Dependent and Independent Variables

Dependent Variable (LGDP_PC)			
Lag	**AIC**	**SIC**	**HQIC**
1	3.214	3.251	3.229
2	3.177*	3.233*	3.200*
3	3.186	3.262	3.217

Independent Variables	Information Criteria	Lags				
		0	**1**	**2**	**3**	**4**
LFP	AIC	3.497	-1.620	-1.928	-1.943*	-1.931
	SIC	3.516	-1.583	-1.871*	-1.868	-1.837
	HQIC	3.505	-1.605	-1.905	-1.913*	-1.893
LFPI	AIC	0.533	-1.689	-1.715*	-1.711	-1.701
	SIC	0.552	-1.652	-1.659*	-1.636	-1.607
	HQIC	0.541	-1.674	-1.681*	-1.681	-1.663
INF	AIC	8.719	8.521	8.448	8.446	8.382*
	SIC	8.738	8.558	8.505	8.521	8.476*
	HQIC	8.727	8.536	8.471	8.476	8.420*
LNT	AIC	4.609	4.607*	4.619	4.631	4.640
	SIC	4.627*	4.645	4.676	4.706	4.734
	HQIC	4.616*	4.623	4.642	4.661	4.678
LPOP	AIC	3.391	-6.288	-8.526	-10.205	12.010*
	SIC	3.410	-6.250	-8.470	-10.129	-11.916*
	HQIC	3.399	-6.272	-8.503	-10.174	-11.972*

*connotes optimal lag selected by AIC, SIC and HQIC.

be small as far as possible in the chosen maximum lag and model. It is of great significance to choose the lag length to be used when performing the tests as this has an impact on the result.

Based on the information criterion in Table **10**, the optimal lag result for the dependent variable is lag two. The overall result for the optimal lag for the independent variables shows that the information criteria chose lag order four for most of the variables. Therefore, it can be concluded that the lag order for the independent variables is lag order four. Hence, the PARDL model to be assessed is ARDL (2,4,4,4,4,4).

Explanation of Long and Short Run Panel Auto Regressive Distributed Lags Model Evaluations

One of the crucial assumptions of heterogeneous dynamic panel data modelling is that N (number of countries or groups) must be less than T (number of years or variables). If this assumption is met, then the pooled mean group estimation can be carried out. For this study, the selected southern African countries which are 5 (N) is less than the number of variables (T) therefore this assumption is satisfied.

The Pooled Mean Group (PMG) estimate addresses homogeneity over the long run and heterogeneity over the short-run on the cross section. Thus, the Panel ARDL estimation of the long-run are the same across all the countries (Lesotho, Malawi, South Africa, Mozambique and Botswana) whereas the short-run coefficients differ across this countries. Therefore, the ARDL model of (2,4,4,4,4,4) is estimated through the PMG model estimator.

$$LGDP\_PC_{it} = \alpha + 1.63LFP_{it} + 2.72LFPI_{it} + 0.03INF_{it} - 0.02LNT_{it} - 9.65LPOP_{it} + \mu_t$$

Table **11** shows that a 1 percent increase in LFP will significantly result in a 1.63 percent increase in LGDP_PC. Since GDP per capita growth is used to broadly measure economic welfare, the result shows

Table 11: Panel ARDL (2,4,4,4,4,4) Long Run Results (Dependent Variable:LGDP_PC)

Regressors	Coefficients	T-Statistic	Probability
LFP	1.627035	11.80557	0.0000***
LFPI	2.719049	2.691683	0.0090***
INF	0.026974	3.331994	0.0014***
LNT	-0.02326	-0.954667	0.3433
LPOP	-9.647741	-6.785818	0.0000***

***/**/* connotes 1,5 and 10 percent level of significance respectively.

that welfare will rise by 1.63 percent due to a 1 percent increase in food price changes in the long-run. This finding confirms the Commodity Price Stabilization Rule theory. The theory emphasizes that consumers' benefit from price instability due to a shift in supply, while producers benefit from price instability due to a shift in demand. Demeke and Rashid (2012) and Shittu *et al*. (2014) found similar result. They discovered that households benefit from price changes depending on whether they are net sellers or net buyers. Tadasse *et al*. (2016) also confirmed this findings. Also these selected southern African countries (Lesotho, Malawi, South Africa, Mozambique and Botswana) are agro-based economies and an increase in food prices implies an increase in per capita income. For instance, in Malawi, more than 80% of the population is based in rural areas with agriculture as the main economic activity. Increase in food prices implies that net food-selling households have their take-home income increasing.

Furthermore, the result also show that a 1 percent increase in LFPI will significantly result in 2.72 percent increase in LGDP_PC. This implies that a 1 percent increase in food security will result in 2.72 percent increase in economic welfare in the selected southern African countries in the long-run. The implication is that net food-selling households, with high food production, need not spend part of their income in buying food but rather use it to meet other household needs such as health, education and other social services. This then enhances their living standards or economic welfare. Several writers confirm this finding. In South Africa, Phali (2015) found that food-secured households have better welfare. In Zimbabwe, Pedzisai *et al*. (2014) discovered that food security and economic welfare is enhanced through urban agriculture. Chavas (2017) also discovered that having access to food increases purchasing power which therefore affects their economic welfare state.

The relationship between INF and LGDP_PC shows a positive and significant relationship. A 1 percent increase in inflation will significantly result in 0.03 percent increase in economic welfare, implying that in the long run, inflation will result in 0.03 percent increase in economic welfare for the selected southern African countries. This result is against theory because there should be a negative relationship between inflation and economic welfare. Although the finding is against theory, Benabou (1988) discovered that inflation can increase price dispersion, thereby intensifying competition, reducing real prices and increasing welfare. So according to Benabou (1988), inflation may cause welfare to rise. It should be noted that in most of these countries, food constitutes a larger percentage of the basket that is used to calculate inflation or CPI. Hence, given that most families are farmers, inflation implies more income hence the increase in GDP per capita growth (economic welfare).

The relationship between LNT and LGDP_PC shows a negative and insignificant relationship. A 1 percent increase in net trade will insignificantly result in 0.02 percent decrease in economic welfare. This simply means that when net trade increases by 1 percent, economic welfare deceases by 0.02 in the long run. This could be because most countries register a trade balance deficit. However, this finding is insignificant which means that net trade does not have an impact on economic welfare in the long run for the selected southern African countries.

LPOP and LGDP_PC have a negative and significant relationship. A 1 percent increase in population will cause economic welfare to decrease by 9.65 percent, implying that in the long-run, a 1 percent increase in population decreases economic welfare by 9.65 percent in the selected southern African countries. This finding confirms the Population Driven theory; it emphasizes that increase in population affects wages and lowers resources. Toth and Szigeti (2016) also found a similar result.

Cross Sectional Panel Auto Regression Distributed Lags Estimates of Short Run

Pooled Mean Group (PMG) of ARDL model causes heterogeneity of short-run coefficients through cross-section. Therefore, the impact of food price changes on food insecurity and economic welfare is expected to be different in these selected southern African countries in the short run.

Short Run Result for Lesotho

In the short run, food price have both positive and negative relationship on economic welfare. However, from lag one to three, LFP is insignificant in the short run to economic welfare (LGDP_PC). This is contrary to the result in lag order zero that shows a positive and significant relationship. This mixed effect (positive and negative) is supported by the Commodity Price Stabilization Rule theory that states that price instability can be either a gain or a loss to producers or consumers depending on shift in supply or shift in demand.

Logged food production index (LFPI) affects economic welfare both positively (from lag order zero to two) and negatively (in lag order three by 1.396 percent). However, there is an insignificant relationship between them. This insignificance is expected because Lesotho is a landlocked country of which most of its population is involved in subsistence agriculture. Therefore, this implies that in the short-run, households are still able to cater for themselves through crop production, which means that food security may have little or no impact on economic welfare in the short run (Mokitimi, 2015). In the short run, logged inflation negatively and significantly affect economic welfare from lag zero to two. Kurlat (2018) confirms this finding. It was discovered that inflation negatively affects individual welfare.

Furthermore, logged net trade has a negative significant relationship on economic welfare from lag zero to three. A deficit net trade balance will negatively affect economic welfare as is the case of Lesotho in this short run. Pereirinha and Murteira (2016) confirm this finding. It was discovered that trade deficit will increase debt, which can affect the welfare system. Furthermore, there are mixed relationship effects between logged population and economic welfare. The short run result shows that there are both positive and negative insignificant relationships. This result contradicts the Population Driven theory. The error correction term is negative and statistically significant [-2.355112 (0.0011)]. This is an indication that the model converges towards equilibrium. It also implies that previous year's deviation from long run equilibrium are being corrected at a speed of 2.4 percent of previous years.

Short Run Result for Malawi

In the short run, LFP, LFPI and LPOP have insignificant mixed effects (both positive and negative relationships) on LGDP_PC. The result indicates that LFP has negatively affected economic welfare at lag order zero and three. For LFPI, the negative effect is from lag one to three while the negative effect for population is for lag zero to two. However, these impacts are not important since logged food price, food production index and population are insignificant. This means that food price, food security and population do not affect Malawi's economic welfare in the short run.

The short run effect of logged net trade on economic welfare indicates a positive and significant relationship. A positive relationship that exists between these two variables can be traced to a surplus in net trade. This implies that in the short run, Malawi is likely

Table 12: Short Run Result for Lesotho Panel ARDL (2,4,4,4,4,4) Dependent Variable: LGDP_PC

ECT (-1) [-2.355112 (0.0011)***]						
Lag Order	**D(LGDP_PC)**	**D(LFP)**	**D(LFPI)**	**D(INF)**	**D(LNT)**	**D(LPOP)**
0		5.178768 (0.0127)**	-3.284443 (0.4691)	-0.059599 (0.0000)***	-0.033262 (0.0009)***	-1546.897 (0.9983)
1	0.500779 (0.0027)***	2.139473 (0.3088)	-0.271218 (0.9277)	-0.033770 (0.0000)***	-0.041107 (0.0003)***	3904.310 (0.9994)
2		-2.132821 (0.1976)	-0.753616 (0.7559)	-0.058187 (0.0000)***	-0.021446 (0.0004)***	-3712.243 (0.9994)
3		5.757160 (0.2843	1.396110 (0.5333)	-0.011589 (0.0000)***	-0.110184 (0.0000)***	1057.551 (0.9986)

***/**/* connotes 1,5 and 10 percent level of significance respectively. In parenthesis ( ) are probabilities.

Table 13: Short Run Result for Malawi Panel ARDL (2,4,4,4,4,4) Dependent Variable: LGDP_PC

ECT (-1) [-0.184944 (0.0015)***]						
Lag Order	**D(LGDP_PC)**	**D(LFP)**	**D(LFPI)**	**D(INF)**	**D(LNT)**	**D(LPOP)**
0		-36.20686 (0.9095)	1.963394 (0.5845)	0.216304 (0.0008)***	0.268597 (0.0000)***	-353.0224 (0.9987)
1	-0.451609 (0.0028)***	17.68055 (0.9735)	-2.107697 (0.5603)	0.141602 (0.0077)***	0.274171 (0.0003)***	814.7834 (0.9987)
2		27.22438 (0.9584)	-0.334582 (0.9246)	-0.118789 (0.0091)***	0.130128 (0.0027)***	-764.4353 (0.9989)
3		-9.767009 (0.9786)	-2.814082 (0.4315)	0.007786 (0.0002)***	0.111217 (0.0006)***	288.2836 (0.9978)

***/**/* connotes 1,5 and 10 percent level of significance respectively. In parenthesis ( ) are probabilities.

to have a surplus net trade balance which may affect its economic welfare (Nyasulu, 2013).

On the other hand, the relationship between logged inflation and economic welfare shows a significant relationship from lag one to three. Although there is a significant relationship, lag zero, one and three show a positive effect while lag two indicates a negative effect of 0.12 percent. The positive relationship is not in line with theory. However, the negative relationship is in line with the findings of Ularo (2010) who discovered that high inflation induces low purchasing power in Malawi. The error correction term is negative and statistically significant [-0.184944 (0.0015)]. This is an indication that the model converges towards equilibrium. The deviation from the long run equilibrium is corrected gradually through 0.18 percent of the short run speed of adjustment for Malawi.

Short Run Result for South Africa

In the short run, LFP, LFPI and LPOP have positive and negative effects on LGDP_PC. The result indicate that LFP has negatively affected economic welfare at lag order zero, one and three; for LFPI, the negative effect is from lag zero to two, while the negative effect for LPOP is for lag zero and two. However, these impacts are not important since logged food price, food production index and population are insignificant. This means that food price, food security and population do not affect South Africa's economic welfare in the short run.

The short run effect of LNT on economic welfare indicates a positive and significant relationship. A positive relationship that exists between these two variables can be traced to a surplus in net trade. This implies that in the short run, South Africa is likely to have a surplus net trade balance which may affect its economic welfare through employment and income rising. Edwards and Stern (2006) discovered that trade, both in the short and long run, is an important source of welfare gain and growth to the South African economy as a whole.

The relationship between logged inflation and economic welfare shows a mixed significant relationship from lag one to three. Lag order two shows

Table 14: Short Run Result for South Africa Panel ARDL (2,4,4,4,4,4) Dependent Variable: LGDP_PC

ECT (-1) [-0.195808 (0.0529)*]						
Lag Order	**D(LGDP_PC)**	**D(LFP)**	**D(LFPI)**	**D(INF)**	**D(LNT)**	**D(LPOP)**
0		-35.45078 (0.9775)	-1.397083 (0.7013)	0.294031 (0.0366)**	0.108890 (0.0004)***	-1731.687 (0.9991)
1	-0.321048 (0.0013)***	-102.4691 (0.9431)	-2.628229 (0.6067)	1.030062 (0.0008)***	0.371398 (0.0000)***	4080.601 (0.9995)
2		160.1411 (0.9206)	-0.645693 (0.9038)	-0.144721 (0.1028)	0.245748 (0.0000)***	-3378.539 (0.9994)
3		-29.96887 (0.9807)	3.840354 (0.3085)	0.033985 (0.0041)***	0.186314 (0.0000)***	1041.379 (0.9983)

***/**/* connotes 1,5 and 10 percent level of significance respectively. In parenthesis ( ) are probabilities.

a negative and insignificant relationship. This effect is not important since the relationship is insignificant. However, this result complements the findings of Vermeulen (2015) who explained that there is no significant relationship in the short run between inflation, employment and welfare in South Africa. The other lags indicate a positive and significant relationship. This effect is however contrary to theory. The error correction term is negative and statistically significant [-0.195808 (0.0529)] at 10 percent. This is an indication that the model converges towards equilibrium. The deviation from the long run equilibrium is corrected gradually through 0.20 percent of the short run speed of adjustment for South Africa.

Short Run Result for Mozambique

In the short run, LFP have both positive and negative effects on economic welfare (LGDP_PC). This mixed relationship is supported by the Commodity Price Stabilization Rule theory that states that price instability can be either a gain or a loss to producers or consumers depending on shift in supply or shift in demand. However, lag one and three are insignificant in the short run. This is contrary to the result in lag order zero and two that shows a negative, positive and significant relationship. That been said, most articles associate a negative relationship in the short run between food price and economic welfare [see Van Campenhout *et al*. (2013), Martin and Ivanic (2016), Headey and Martin (2016) and van Wyk and Dlamini (2018)].

Logged food production index (LFPI) and economic welfare (LGDP_PC) have an insignificant relationship except for lag order two [-3.655217(0.0160)], that indicates that the relationship is negative and significant. These implies that economic welfare will be negatively affected in the short run when food insecurity increases. Ferrao *et al*. (2018) confirm this finding. They emphasised that agricultural productivity in Mozambique can be a strong factor that can influence food insecurity which in turn affects household wellbeing. On the other hand, logged inflation and economic welfare have positive and significant relationship for all the lag periods. However, this finding is against theory.

Logged population and economic welfare have insignificant relationship. The signs of the coefficients show both positive and negative. The negative sign of the coefficient is supported by the Population Driven theory. However, since population is insignificant, it therefore means that population does not affect Mozambique's economic welfare in the short run. According to IOF (2014/15) report, population has risen in Mozambique but since the level of poverty is high the death rate is equally high. Therefore population may not so much affect economic welfare in the short run.

In the short run, logged net trade has a significant relationship on economic welfare. The sign of the coefficients shows both positive and negative effects. This implies that Mozambique is likely to have mixed effect of surplus and deficit net trade balance. The error correction term is negative and statistically significant [-1.455264 (0.0000)]. This is an indication that the model converges towards equilibrium. It also implies that previous years' deviations from long run equilibrium are being corrected at a speed of 1.46 percent of previous years.

Short Run Result for Botswana

In the short run, LFP and LPOP have insignificant mixed effects on LGDP_PC. The result indicate that logged food price and population negatively and

Table 15: Short Run Result for Mozambique Panel ARDL (2,4,4,4,4,4) Dependent Variable: LGDP_PC

ECT(-1) [-1.455264 (0.0000)***]						
Lag Order	**D(LGDP_PC)**	**D(LFP)**	**D(LFPI)**	**D(INF)**	**D(LNT)**	**D(LPOP)**
0		-16.70264 (0.0049)***	-3.302225 (0.2804)	0.031143 (0.0000)***	0.049589 (0.0001)***	-406.285 (0.9852)
1	0.070657 (0.0013)***	0.513743 (0.7179)	1.827235 (0.4158)	0.038694 (0.0000)***	-0.120323 (0.0000)***	-171.151 (0.9991)
2		5.136233 (0.0159)**	-3.655217 (0.0160)**	0.021171 (0.0000)***	-0.008375 (0.0617)*	990.4349 (0.9953)
3		0.938302 (0.3617)	-1.24794 0.2336	0.018322 (0.0000)***	0.137216 (0.0000)***	-700.856 (0.9818)

***/**/* connotes 1,5 and 10 percent level of significance respectively. In parenthesis ( ) are probabilities.

Table 16: Short Run Result for Botswana Panel ARDL (2,4,4,4,4,4) Dependent Variable: LGDP_PC

ECT(-1) [-1.527229 (0.0003)***]						
Lag Order	**D(LGDP_PC)**	**D(LFP)**	**D(LFPI)**	**D(INF)**	**D(LNT)**	**D(LPOP)**
0		350.2294 (0.9667)	-13.78166 (0.1480)	-3.097753 (0.0172)**	0.060190 (0.0006)***	1582.141 (0.9984)
1	0.740243 (0.0003)***	760.8337 (0.9915)	-6.096850 (0.1873)	-1016771 (0.1837)	-0.094572 (0.0003)***	-1487.934 (0.9998)
2		1109.812 (0.9934)	-2.284347 (0.5629)	-19.95687 (0.1618)	-0.112739 (0.0001)***	-834.1802 (0.9999)
3		-2226.282 (0.9876)	-6.065435 (0.0782)*	-0.078663 (0.0002)***	-0.083155 (0.0001)***	795.7878 (0.9992)

***/**/* connotes 1,5 and 10 percent level of significance respectively. In parenthesis ( ) are probabilities.

positively affect economic welfare at different lags. However, these impacts are not important since logged food price, and population are insignificant. This therefore implies that food price and population do not affect Botswana's economic welfare in the short run. Logged food production index has an insignificant relationship with economic welfare except at lag order three; that shows that food insecurity negatively and significantly affects economic welfare in the short run at 10 percent level of significance (0.0782). This result is confirmed by the finding of Verpoorten *et al*. (2013). Their findings emphasis that food insecurity negatively correlates with economic welfare.

The short run effect of logged net trade on economic welfare indicate a significant relationship of which both negative and positive effects are recorded at different lags. These positive and negative effects would imply that in the short run, Botswana is likely to have a surplus and deficit net trade balance which may affect its economic welfare. According to the Botswana trade statistics of 2018, the country indeed experienced both surplus and deficit in the year 2018.

The relationship between logged inflation and economic welfare shows a mixed significant relationship from lag one to three. Lag order one and two show a negative and insignificant relationship. This effect is not important since the relationship is insignificant. The other lags indicate a negative and significant relationship between logged inflation and economic welfare. This result complements the findings of Seleteng (2012), who emphasised that inflation and the welfare of Botswana are negatively and significantly related. The error correction term is negative and statistically significant [-1.527229 (0.0003)]. This is an indication that the model converges towards equilibrium. It also implies that previous years' deviations from long run equilibrium are being corrected at a speed of 1.53 percent of previous years. The ECT is the speed of adjustment that occurs in the country.

CONCLUSION AND RECOMMENDATIONS

This study started by asking for the impact of food price changes on food insecurity and economic welfare in selected southern African countries. To answer this question, the study adopted the panel ARDL technique. The study showed that there is a long-run relationship between the variables using the Kao cointegration test. This long-run relationship was further analyzed using the Pooled Mean Group (PMG) long term estimate (this is ARDL 2,4,4,4,4,4). This estimation equally examined homogeneity within the countries. The result revealed that food price changes, food insecurity, and inflation positively and significantly affected economic welfare in the long-run for Lesotho, Malawi, South Africa, Mozambique, and Botswana. Population negatively and significantly affected economic welfare in the long-run. However, net trade had an insignificant impact on economic welfare, in the end, implying that net trade does not affect economic welfare in the long run in these selected southern African countries.

The short-run effect was analysed for the individual countries through the PMG of the ARDL model, which causes heterogeneity of the short-run coefficient with the use of cross-sections. The findings revealed that food insecurity and population in the short run do not affect Lesotho's economic welfare. However, food price changes, inflation, and net trade affect its economic welfare in the short run. The result for Malawi showed that in the short run, food price changes, food insecurity, and population have no effect on its economic welfare. Inflation and net trade, on the other hand, affect Malawi's economic welfare both negatively and positively. The findings of South Africa are similar

to that of Malawi. Food price, food insecurity, and population have no effect on economic welfare in the short run, whereas, inflation and net trade negatively and positively impact economic welfare in the short run. The result for Mozambique revealed that population is the only variable that does not affect economic welfare in the short run. All other variables (food price, food insecurity, inflation, and net trade) play a significant role by affecting economic welfare in the short run. The short-run result for Botswana shows that food price changes and population do not affect Botswana, although food insecurity, inflation, and net trade affect economic welfare in the short run.

This study further analysed the Granger causality test. The result showed that there is a uni-directional link between LFP and LGDP_PC as well as LGDP_PC and INF. A bi-directional link was observed between LPOP and LGDP_PC.

According to the result, it was underlined that food price changes have a positive impact on economic welfare in the selected southern African countries in the long-run. It is therefore recommended that governments of these countries can subsidize farmers producing food products that are seasonal, especially staple crops. This can help farmers cover production costs. By so doing, economic welfare can spread for both producers and consumers and not just for producers. Furthermore, since it is apparent that food price changes, inflation, and population are the main causes of inconsistencies in economic welfare, the governments of these countries can use monetary policy as a way of combating a high inflation rate. Examples of such policies include an increase in interest rate. In addition, people can be advised to save more as this can also help to reduce inflation. Additionally, food prices can be managed though trade policies and barriers to support domestic producers. Population growth rates can be managed through immigration policies.

Suggestions for Further Study

Areas for further studies may include the aspect of seasonality in staple foods and climatic conditions as a variable in explaining the disparity in economic welfare. The area of volatility of food using the GARCH technique can also be considered.

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