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30 March 2021

Online at <https://mpra.ub.uni-muenchen.de/106988/>  
MPRA Paper No. 106988, posted 06 Apr 2021 01:43 UTC

# **Impact of Agricultural Production on Economic Growth in Zimbabwe**

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## **Abstract**

African countries are expected to be having a comparative advantage when it comes to agricultural products. If this is true, specializing in agriculture can increase output levels. However, the effect of agriculture on growth has yielded various research interests and the results differ from country to country. In this paper, we try to ascertain the impact of agriculture on economic growth in Zimbabwe using the Autoregressive Distributed Lag (ARDL) estimation technique, employing data from 1970 to 2018. In both the short run and long run, the study found that inflation, government expenditure, and gross fixed capital formation have a positive impact on economic growth. The study also found that agricultural production has a positive impact on economic growth in the short run, and no impact on economic growth was found in the long run. Thus, the agricultural sector plays an important role in the early stages of economic development, and when the economy has developed, agriculture plays a minimal role. It is evident from the results of this paper that agriculture is an engine for growth in the short run and should eventually be supported by other macroeconomic policies to promote economic growth in the long run.

**Key Words:** Agricultural Production, Economic Growth, ARDL.

**JEL Classifications:** Q1, O4, F43, C13

## **1. Introduction**

Sub-Saharan countries seem to have a comparative advantage when it comes to agricultural production. If agriculture stimulates economic growth, then this is an opportunity to specialize in agricultural production to have a positive spillover on their growth. The fact that natural and human resources are abundant in Zimbabwe can give the country a high absolute advantage if these resources are used efficiently. With the growth of trade openness, Zimbabwe may then benefit from trading agricultural output with other countries that have a comparative disadvantage in these products. Various agricultural policies including land reforms have been implemented to improve agricultural production. The subsidizing of the agriculture sector has been done to promote and assist both small- and large-scale farmers. Irrigation systems and recently smart agriculture have been adopted and agriculture is now the

source of income for many families through employment creation. Many researchers are however trying to establish if agricultural production has an impact on economic growth and this topic has yielded several contradictions.

Zimbabwe is one of the Sub-Saharan countries that have been facing a severe economic crisis and this is expected to have been worsened by the covid-19 pandemic. In Zimbabwe, the contribution of agriculture to gross domestic product (GDP) is very high. There is highly productive land and a lot of potentials to stimulate growth through agriculture. If the available resources are utilized efficiently to grow agricultural output, this may have a significant impact on economic growth. Several severe droughts and cyclones have hit Zimbabwe and this resulted in a negative effect on agricultural production as well as economic growth leading to increased poverty and food insecurity. According to World Bank (2020), Zimbabwe's GDP is estimated to have contracted by 1.8% in 2019 and this may continue in the next two to three years due to the current covid-19 pandemic as well as climatic change. The World Bank (2020) also mentioned that Zimbabwe has been characterized by a substantial decline in agriculture production and high food prices which increased food insecurity, with close to 50% of the population being food insecure in 2019. With this climate change, smart agriculture has been introduced to stimulate agriculture.

Food and Agriculture Organization (FAO) (2020) mentions that agriculture is the backbone of Zimbabwe's economy as Zimbabweans remain largely rural people who derive their livelihood from agriculture and other related rural economic activities. According to United Nations Development Programme (UNDP) (2012), 75% of the world's poor are living in rural areas and highly dependent on farming and fishing. Besides providing food, employment, and income for people's survival, agriculture provides inputs and raw materials to other sectors of the economy. Bafana (2011) shows that agricultural activities in Zimbabwe provide employment and income to 60% -70% of the population, supplies 60% of the raw materials required by the industrial sector, and contribute 40% of total export earnings.

Zimbabwe can utilize its natural and human resources efficiently to increase agricultural production. Zimbabwe is a landlocked country with a total land area of over 39 million hectares, with 33.3 million hectares used for agricultural purposes (World Bank, 2020). There is about 6 million hectares that have been reserved for national parks and wildlife, and

urban settlements (Food and Agriculture Organisation (FAO), 2020). The country comprises four physio-geographic regions, which are the Eastern Highlands, the Highveld, the Middle veld, and the Low veld. The World Bank (2020) shows that the population is almost 15million and this information shows that land and labor are in abundance and these are key resources for farming.

Maiyiki (2010) also shows that agriculture contributes approximately 17% to Zimbabwe's GDP. As the main source of livelihood for the majority of the population, the performance of agriculture is a key determinant of rural livelihood resilience and poverty levels. There are however challenges facing smallholder farmers and these include low and erratic rainfall, low and declining soil fertility, low investment, shortages of farm power - labor and draft animals, poor physical and institutional infrastructure, poverty, and recurring food insecurity. The availability of key resources needed for agriculture in Zimbabwe raises much concern on whether agriculture should be used as an instrument for growth. In Zimbabwe, agricultural production has been regarded by several studies as a paramount prerequisite for industrialization and economic growth. This paper re-examines the impact of agriculture production on economic growth since development policies in Zimbabwe have been primarily based on the assumption that agriculture production is of paramount importance to the performance of the Zimbabwean economy.

## **2. Literature Review**

### **2.1 Zimbabwe's agricultural sector**

Most of the poor people in Zimbabwe are living in rural areas where agriculture is the main source of livelihood for them. Although men are dominating the agriculture sector, females are actively taking part. Some families have devoted to having bigger family sizes to assist with farming.

The agricultural sector is composed of large-scale commercial farming and small-scale farmers, with the latter occupying more land area but located in regions where land is relatively infertile with more unreliable rainfall. Agriculture in Zimbabwe involves crop production, animal production, forestry, and fishing. Most rural homes have a separate piece of land where they can farm on a small scale or large scale. Their farm products include maize, tobacco, groundnuts, cotton, sheep, goats, and cows. Their produce is used either for their family

consumption, domestic trade, or exporting. The main agricultural export is tobacco, which is exported to countries like the Democratic Republic of Congo (DRC), South Africa, Botswana, China, Zambia, Netherlands, and United Kingdom.

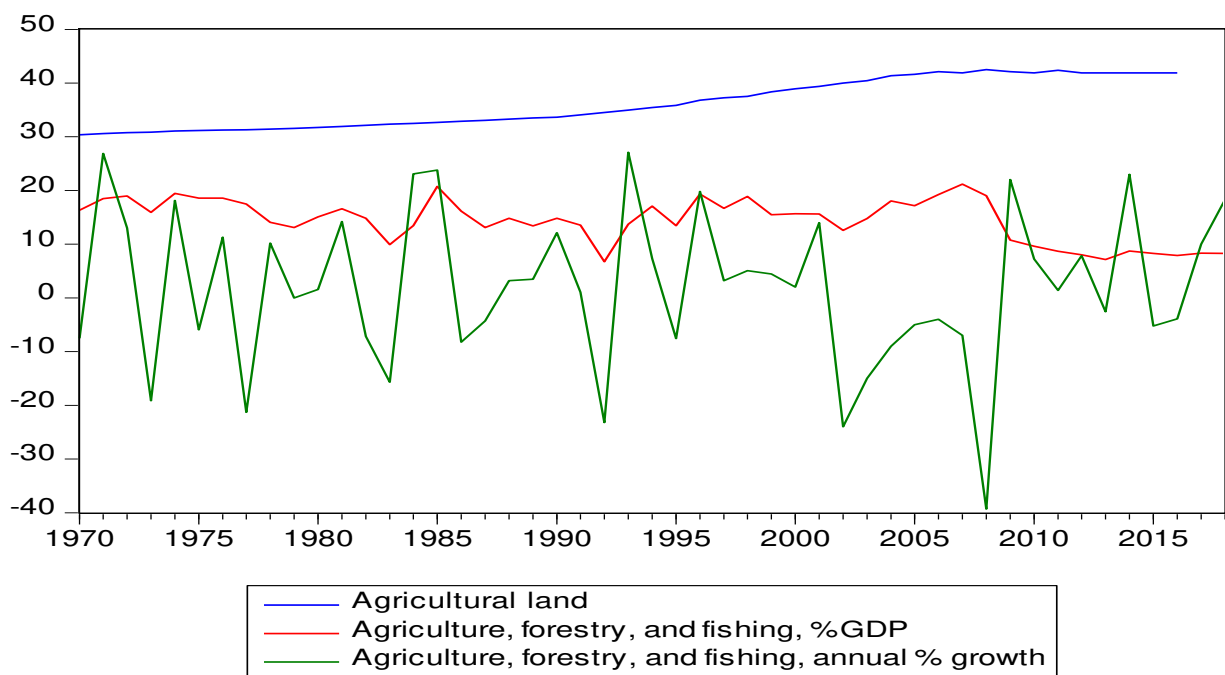
Livestock and livestock products as well contribute significantly to the economy of Zimbabwe, with cattle accounting for 35% to 38% of the GDP contributed by the agricultural sector (FAO, 2020). Every family in the rural areas owns either donkeys, cattle, sheep, goats, or chickens. Maiyiki (2010) estimated that up to 60% of rural households own cattle, 70% - 90% own goats, while over 80% own chickens. The importance of livestock in rural livelihoods and food security lies in the provision of meat, milk, eggs, hides and skins, draught power, and manure. Livestock in Zimbabwe also acts as a strategic household investment. Small ruminants (sheep and goats) and non-ruminants, particularly poultry, are an important safety net in the event of drought – they are easily disposable for cash when the need arises or during drought. Zimbabwe's smallholder system has the potential to grow and become the mainstream of the livestock sector's performance indicator. Forests cover 40% of Zimbabwe's total land area, accounting for 15,624,000 hectares (World Bank, 2020). However, according to FAO (2020), Zimbabwe has had a steady deforestation rate in the last twenty years. This rate averages 327,000 hectares lost annually since 1990 or more than 6 million hectares of forests lost in the last 2 decades.

Agriculture production has not been having good returns because of climate changes. As a tropical country, Zimbabwe generally experiences a dry savannah climate. Maiyiki (2010) shows that Zimbabwe's climate is dependent on the rains brought by the Indian Ocean monsoons (seasonal winds). Maiyiki (2010) proceeded to say that the Eastern part of the country has up to 1,000 mm of rainfall each year between the months of October and March. However, rain levels reduce to about half that amount in the dry southwest. Between March and October, there is very little if any rain falls and this is when the weather gets cold with frosts common in the mountains and central plateau areas. Since the late 1970s, rainfall has been very irregular and there have been serious droughts, which have led to soil erosion in some areas and decreased agricultural production (Mapfumo, 2013). Zimbabwe used to be not only self-sufficient but also produce surplus crops for exports. However, the situation has changed in recent years to the extent that the country can no longer feed itself and has to depend on foreign aids. Due to the previous economic crisis, the Zimbabwean agricultural system

became weak and weaker. It is, however, expected that these negative phenomena could be successfully turnaround and changed for the better.

Since 1980, Zimbabwe has introduced different agricultural policies in an effort to increase food security through the promotion of both small- and large-scale farmers. As can be seen in figure 1 below, the percentage of land used for agriculture has been increasing since 1980, while agriculture contribution to GDP has diminished after 2003. Agriculture’s annual percentage growth has been swinging between -39% and 27%.

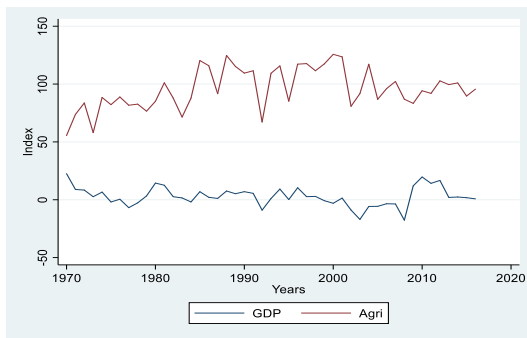
**Figure 1: Agriculture contribution to Zimbabwe’s GDP**



Source: World Bank (2020)

Zimbabwe is characterized by lots of arable lands, with some parts of the country having good rainfall patterns, and there is lots of labor in the country. These are key factors of production that are required to boost agriculture. The figure below shows that there has been no steady growth in the agriculture production in Zimbabwe as well as the economy. However agricultural production growth shows a slightly positive trend and fluctuating above the average growth of the economy. There is a significant change in the agricultural production index between 1970 and 2018, as evidenced by figure 2 below.

**Figure 2: Agriculture production growth Versus the Economy**



*Source: World Bank (2020)*

## **2.2 The empirical literature on agriculture and economic growth**

The issue of the impact of agriculture on economic growth has been controversial and mostly for developing countries that have an abundance of resources needed for agricultural growth. There is diverse research made to date to probe the impact of agricultural production on growth, but disagreements still exist. Many studies adopt the Solow-Swan neoclassical growth theory to analyze the impact of agriculture on growth. On the standard Solow-Swan growth equation, agriculture is added as an engine for growth and this is used to measure the linkages between the rural and industrial sectors of the economy (Hwa, 1988).

### *The literature on Developed countries*

Most developed countries do not necessarily depend on agricultural production since they have fewer resources for farming and their weather conditions do not permit it. Developed countries are capital abundant and produce capital-intensive goods. The Heckscher-Ohlin theory states that countries with lots of labor produce labor-intensive goods while capital abundant countries produce capital-intensive goods (Markusen, 2005). Although machines are being used in agriculture, lots of labor remain the main factor. There is a handful of research

focusing on the relationship between agriculture production and growth in the developed economies. The works of Katircioglu (2006), Yao (2000), and Xuezheng *et al.* (2010) is reviewed. Katircioglu (2006) shows that there is a bi-directional relationship between agriculture production and growth in North Cyprus and the study employed the Granger causality. Yao (2000) and Xuezheng *et al.* (2010) examined the impact of agriculture on economic growth in the case of China and found that agriculture is important for China's growth.

### *The literature on Developing Countries*

The effect of agriculture on economic growth in developing countries has yielded much controversy. Most developing countries particularly African nations have a comparative advantage in agricultural products. There tend to be various research papers aimed at establishing the impact of agriculture on economic growth. Nevertheless, their results tend to be contrasting. Studies to determine if agriculture can stimulate growth in developing countries include the works of Oyakhilemen and Zibah (2014), Jatuporn *et al.* (2011), Awokuse and Xie, (2015), Odetola and Etumnu, (2013), Izuchukwu (2011), Sertoglu *et al.* (2017), Awan and Aslam (2015), Oyakhilomen and Zibah (2014), Raza *et al.* (2012), Awokuse (2009), Moussa (2018) and lastly Uddin (2015). Whether a study was investigating the impact of agriculture on growth or causal direction between agriculture production and growth, the prime conclusion for all of them was that agriculture is of paramount importance towards the economic growth of these developing countries.

Most interestingly, they are some research papers investigating the effect of agriculture production on the economic growth of Nigeria. Literature based on Nigeria includes the works of Oyakhilemen and Zibah (2014), Odetola and Etumnu, (2013), Izuchukwu, (2011), Sertoglu *et al.* (2017), and Oyakhilomen and Zibah (2014). One thing that these studies are congruent about is that agriculture production is significant towards the Nigerian economic growth. However, Odetola and Etumnu (2013) show that although agriculture contributes towards growth, growth does not increase agriculture.

In assessing this relationship, various estimation techniques were employed. The most familiar technique is the ARDL and the granger causality test. The works of Oyakhilemen and



Zibah (2014), Jatuporn *et al.* (2011), Awokuse and Xie (2015), Odetola and Etumnu (2013), Awan and Aslam (2015), Oyakhilomen and Zibah (2014), and Awokuse (2009) employed the ARDL cointegration technique and the Granger causality test to test for the directional effect. Sertoglu *et al.* (2017) and Moussa (2018) employed the Johansen test and the Vector Error Correction Model (VECM). On the other hand, Raza *et al.* (2012) employed the Ordinary Least Squares (OLS) method while Izuchukwu (2011) employed the SPSS technique.

### *The literature on Zimbabwe's Case*

Due to the insubstantial availability of studies focusing on agriculture-growth nexus in Zimbabwe, five studies were reviewed. This section includes the works of Mapfumo (2013), Bautista and Thomas (1999), Mapfumo (2011), Saungweme and Matandare (2014), and Matandare (2018). The studies by Mapfumo (2013) and Matandare (2018) employed the Johansen test while Mapfumo (2011) and Saungweme and Matandare (2014) employed the OLS estimation technique. Bautista and Thomas (1999) employed the Social Accounting Matrix (SAM) in determining the impact of agricultural production on Zimbabwe's economic growth.

Although different estimation techniques were employed, all these studies come to the same conclusion that agriculture production is vital for the economic growth of Zimbabwe. Matandare (2018) shows that agriculture has a long-run impact on Zimbabwe's growth.

## **3. Methodology and Data**

### **3.1 Model Specification**

The model used to examine the impact of agricultural production on economic growth was expressed as follows:

$$GDPGrwth_t = \beta_0 + \beta_1 Infl_t + \beta_2 Agric_t + \beta_3 GFCF_t + \beta_4 GvtExp_t + \beta_5 Pop_t + \varepsilon_t$$

Whereas  $GDPGrwth_t$  is gross domestic product growth at time  $t$ ,  $Infl_t$  is inflation rate at time  $t$ ,  $Agric_t$  is agricultural production index,  $GFCF_t$  is gross fixed capital formation as a share of GDP at time  $t$ ,  $GvtExp_t$  is general government expenditure as a share of GDP at time  $t$ ,  $Pop_t$

is the population at time  $t$ ,  $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$  are the slope coefficient to be estimated and  $\varepsilon_t$  is the white noise error term.

### 3.2 Stationarity test

The unit root test/ stationarity test was done using the Augmented Dickey-Fuller (ADF) unit root test to determine the order of integration of the variables and the ADF is specified as follows:

$$y_t = \mu + \beta t + \gamma_0 y_{t-1} + \sum_{i=1}^p \gamma_i \Delta y_{t-i} + \varepsilon_t$$

Whereas  $y_t$  is the variable under consideration,  $\mu, \beta, \gamma_0, \gamma_i$  are parameters of the model,  $\varepsilon_t$  is the white noise error term,  $\Delta y_t$  denotes lag differences of the variable under consideration with lag  $p$ . The ADF test is an extension of the Dickey-Fuller test for it accommodate some form of serial correlation (Green, 2003). If  $\gamma_0$  is statistically significant, then the series is stationary, otherwise, the series must be differenced  $d$  times to be stationary such that is integrated of order  $d$ .

### 3.3 Autoregressive Distributed Lag (ARDL) Cointegration

In order to analyze the impact of agricultural production on economic growth, the study used the Autoregressive Distributed Lag (ARDL), model by Pesaran and Shin (1998) and Pesaran *et al.* (2001). The ARDL approach is preferred over other traditional cointegration models such as the Engle-Granger cointegration test and the Johansen and Juselius cointegration test for these apply to series that are integrated of the same order  $I(d)$  only. The ARDL model can be applied to series that are integrated of order one  $I(1)$ , order zero  $I(0)$ , or mutually cointegrated. Thus, the ARDL model is appropriate regardless of the integration of the variables, whether are stationary in levels  $I(0)$  or after first difference  $I(1)$  or both of mixed order of integration. The ARDL model also takes small sample size and simultaneity biases in the relationship between the variables in the model. The ARDL approach to cointegration was specified as follows:

$$\begin{aligned}\Delta GDPGrwth_t = & \beta_0 + \sum_{i=0}^p \beta_1 \Delta Infl_{t-1} + \sum_{i=0}^q \beta_2 \Delta Agric_{t-1} + \sum_{i=0}^r \beta_3 \Delta GFCF_{t-1} \\ & + \sum_{i=0}^s \beta_4 \Delta GvtExp_{t-1} + \sum_{i=0}^t \beta_5 \Delta Pop_{t-1} + \alpha_1 Infl_{t-1} + \alpha_2 Agric_{t-1} \\ & + \alpha_3 GFCF_{t-1} + \alpha_4 GvtExp_{t-1} + \alpha_5 Pop_{t-1} + \varepsilon_t\end{aligned}$$

The F test was used to test the existence of a long-run relationship between the variables in the model. The null hypothesis that there is no cointegrated was stated as follows:

$$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$$

The alternative hypothesis that there is cointegration between the series was specified as follows:

$$H_1: \alpha_1 \neq 0, \alpha_2 \neq 0, \alpha_3 \neq 0, \alpha_4 \neq 0, \alpha_5 \neq 0$$

If the null hypothesis is rejected, then the variables are cointegrated and the error correction model (ECM) must be estimated. The error correction model is used to show the speed of adjustment towards the long-run equilibrium and was expressed as follows:

$$\begin{aligned}\Delta GDPGrwth_t = & \beta_0 + \sum_{i=0}^p \beta_1 \Delta Infl_{t-1} + \sum_{i=0}^q \beta_2 \Delta Agric_{t-1} + \sum_{i=0}^r \beta_3 \Delta GFCF_{t-1} \\ & + \sum_{i=0}^s \beta_4 \Delta GvtExp_{t-1} + \sum_{i=0}^t \beta_5 \Delta Pop_{t-1} + ECM_{t-1} + \varepsilon_t\end{aligned}$$

Whereas  $ECM_{t-1}$  is the error correction term,  $\beta_0$  is the intercept,  $\beta_s$  represent the short-run dynamics of the variables while  $\alpha_s$  represent the long-run coefficients, and  $p, q, r, s, t$  are the lag length which is determined automatically using the Akaike Information Criterion (AIC). Several model diagnostic tests were done. The serial correlation test was done using the Breusch-Godfrey LM test while the Breusch-Godfrey-Pagan test was used to test for heteroscedasticity. Test for normality of residuals was done using the Jarque-Bera test while the Cumulative Sum of Squares (CUSUMSQ) was used to test for model parameter stability. The Ramsey Regression Specification Error Test (RESET) was used to test for model misspecification.

### 3.4 Data Sources

The study used annual data for the period 1970 to 2018 from the World Development Indicators (WDI). The variables are described in table 1.

**Table 1: Description of the Variables and their Source**

Variable	Explanation	Data Source
GDPGrwth	GDP Growth	WDI
Infl	GDP Deflator	WDI
Agric	Agricultural Production Index	WDI
GFCF	Gross Fixed Capital Formation as a share of GDP	WDI
GvtExp	Government Expenditure as a share of GDP	WDI
Pop	Population	WDI

In this study, GDP growth was a proxy for economic growth, GDP deflator was a proxy for inflation, and agricultural production index was a proxy for agricultural production.

### 4. Econometric Results

The ADF unit root test was done and the results show that all the variables were non-stationary in levels except agricultural production index, inflation, and GDP growth. Thus, gross fixed capital formation as a share of GDP, government expenditure as a share of GDP, and population were found to be non-stationary in levels while inflation, GDP growth, and agricultural production index were found to be stationary in levels  $I(0)$ . The ADF unit root test results are shown in table 2.

**Table 2: Augmented Dickey-Fuller unit root test results**

Variable	ADF test statistic	Critical value at 1%	Critical value at 5%	Critical value at 10%	Decision
<b>ADF Unit root test results in levels</b>					
GDPGrwth	-4.646134	-3.57131	-2.922449	-2.599224	Stationary in levels $I(0)$
Infl	-6.183588	-3.57131	-2.922449	-2.599224	Stationary in levels $I(0)$
Agric	-4.74446	-3.57131	-2.922449	-2.599224	Stationary in levels $I(0)$
GFCF	-2.577659	-3.57131	-2.922449	-2.599224	Non-stationary
GvtExp	-2.895072	-3.57131	-2.922449	-2.599224	Non-stationary
Pop	-1.630153	-3.584743	-2.928142	-2.602225	Non-stationary
<b>ADF Unit root test results after first difference</b>					
GFCF	-8.689209	-3.574446	-2.92378	-2.599925	Stationary $I(1)$
GvtExp	-7.404313	-3.574446	-2.92378	-2.599925	Stationary $I(1)$
Pop	-3.828276	-4.219126	-3.533083	-3.198312	Stationary $I(1)$

The series that were non-stationary in levels were differenced once and became stationary. Thus, gross fixed capital formation as a share of GDP, government expenditure as a share of GDP, and population were found to be integrated of order one  $I(1)$ , and the results are shown in table 2. Since some of the variables were  $I(0)$  and others were  $I(1)$ , there is a possibility of a long-run relationship between the variables, and the ARDL bounds test was done to examine if the variables are cointegrated. The optimum lag length was determined using the Akaike Information Criterion and the model with lags (3, 3, 1, 4,0, 3) was chosen. The ARDL bounds test results are shown in table 3.

**Table 3: ARDL bounds test results**

	<b>Significance</b>	<b>Lower Bound</b>	<b>Upper Bound</b>
<b>F-statistic</b>			
7.6116	10%	2.26	3.35
	5%	2.62	3.79
	1%	3.41	4.68

If the F-statistic is below the lower critical bound values, then the null hypothesis that there is no cointegration between the variables is failed to be rejected. However, if the F-statistic is above the upper bound critical values, the null hypothesis is rejected and concludes that there is cointegration among the variables. If the F-statistic falls between the lower bound critical values and the upper bound critical values, then the test is inconclusive. The ARDL bounds test shows that there is cointegration among the variables since the F-statistic (7.6116) lies above the upper bound critical value (4.68) at a 1% significance level. Since the F-statistic is statistically significant at a 1% level, there is a long-run equilibrium relationship among the variables and the short-run model and the long-run model must be estimated.

#### **4.1 Short-run and Long-run Cointegration results**

The study results show that the variables are cointegrated and there is a long-run equilibrium relationship between the variables. The short-run and long-run model were therefore estimated.

##### **4.1.1 Short-run and Error Correction Model**

In table 4, the error correction model and the short-run coefficients of the ARDL model are presented. The estimated ARDL model passed all the model diagnostic tests.

**Table 4: Short-run results and the Error Correction Model**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDPGRWTH(-1))	0.579523***	0.193258	2.998703	0.0059
D(GDPGRWTH(-2))	0.234736*	0.131755	1.781607	0.0865
D(GDPDEFLATOR)	0.234448***	0.048842	4.800164	0.0001
D(GDPDEFLATOR(-1))	-0.075938	0.061786	-1.229046	0.2301
D(GDPDEFLATOR(-2))	-0.24091***	0.060404	-3.988277	0.0005
D(AGRICINDEX)	0.192775***	0.054634	3.528486	0.0016
D(GFCF_GDP)	0.836238***	0.279745	2.989287	0.006
D(GFCF_GDP(-1))	0.514545*	0.254052	2.02535	0.0532
D(GFCF_GDP(-2))	-0.318378	0.239998	-1.326585	0.1962
D(GFCF_GDP(-3))	-0.72994	0.244013	-2.991401	0.006
D(GEN_GVTEXP_GDP)	0.387879*	0.212857	1.822255	0.0799
D(POP)	-0.000204	0.00023	-0.886211	0.3836
D(POP(-1))	0.001022	0.000694	1.472492	0.1529
D(POP(-2))	-0.0004	0.000243	-1.647932	0.1114
CointEq(-1)	-1.41584***	0.232036	-6.101804	0.0000

\*, \*\* and \*\*\* means statistically significant at 10%, 5% and 1% level, respectively.

The short-run results show that coefficients of GDP growth with lags one and two are positive and statistically significant at 1% and 10% respectively. This implies that economic growth depends on the first period and the second period lagged values in the short run. Thus, an increase in the first period lagged and the second period lagged GDP growth by 1% result in an increase in economic growth by 0.58% and 0.23% respectively, *ceteris paribus*. The coefficient of inflation with lag zero is positive and statistically significant at a 1% level while the coefficient of inflation with lag two is negative and statistically significant at a 1% level. This shows that the current period inflation has a positive impact on economic growth but the second period lagged inflation has a negative impact on economic growth. Thus, an increase in current inflation by 1% results in an increase in economic growth by 0.23% while an increase in the second period lagged inflation by 1% results in a decrease in economic growth by 0.24% in the short run, holding other factors constant.

The coefficient of the agricultural production index was found to be positive and statistically significant at a 1% level, implying that agricultural production has a positive effect on economic growth in the short run. Thus, an increase in agricultural production by the 1-unit result in an increase in economic growth by 0.19% in the short run, *ceteris paribus*. This is because agricultural production plays a pivotal role in the early stages of economic development, supplying raw material to the industrial sector and promoting economic growth.

The results are consistent with the results of of Mapfumo (2013), Bautista and Thomas (1999), Mapfumo (2011), Saungweme and Matandare (2014), and Matandare (2018) among other studies. The coefficient of gross fixed capital formation as a share of GDP was found to be positive and statistically significant at 1% level, implying that a 1% increase in the share of gross fixed capital formation in GDP results in a 0.84% increase in economic growth, holding other factors constant. The coefficients of the one period lagged and the third period lagged share of gross fixed capital formation in GDP were found to be negative and positive respectively, and statistically significant at 10% and 1% respectively. This implies that a 1% increase in one period lagged share of gross fixed capital formation in GDP result in an increase in economic growth by 0.51% while a 1% increase in the third period lagged share of gross fixed capital formation in GDP results in a decrease in economic growth by 0.73%, *ceteris paribus*. The coefficient of share of government expenditure in GDP was found to be positive and statistically significant at a 10% level, implying that a 1% increase in the share of government expenditure in GDP results in an increase in economic growth by 0.39% in the short run, *ceteris paribus*.

The error correction coefficient of -1.42 measures the speed of adjustment towards the long-run equilibrium and is statistically significant at a 1% level. The results show that the system corrects the previous period disequilibrium at a speed of 142%, and this shows that the system is overcorrecting the disequilibrium to reach the long-run equilibrium steady-state position. Thus, the long-run equilibrium is reached in less than one year and error correction terms between -1 and -2 imply that the equilibrium is achieved in a decreasing fluctuating form (Narayan and Symth, 2004).

#### **4.1.2 Long-run Results**

The results from the long-run model show that inflation, the share of gross fixed capital formation in GDP, population, and share of government expenditure in GDP have a positive impact on economic growth. The long-run results are shown in table 5.

**Table 5: Long run results**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPDEFLATOR	0.432419***	0.109666	3.943056	0.0005
AGRICINDEX	0.043637	0.059365	0.735062	0.4689
GFCF_GDP	1.132376***	0.230987	4.902333	0.0000
GEN_GVTEXP_GDP	0.273957*	0.142262	1.925717	0.0651
POP	0.000001***	0.0000	3.326869	0.0026
C	-41.010543***	8.872478	-4.62222	0.0001

\*, \*\* and \*\*\* means statistically significant at 10%, 5% and 1% level, respectively.

The coefficient of inflation was found to be positive and statistically significant at a 1% level, implying that a 1% increase in inflation results in an increase in economic growth by 0.43% in the long run, *ceteris paribus*. The coefficient of share of gross fixed capital formation in GDP was found to be positive and statistically significant at 1% level, implying that a 1% increase in the share of gross fixed capital formation in GDP results in an increase in economic growth by 1.13%, holding other things constant. The coefficient of the population was also found to be positive and statistically significant at a 1% level, but the impact on economic growth was found to be almost insignificant. However, the coefficient of agricultural production was found to be insignificant, implying that in the long run, economic growth is insignificantly influenced by agricultural production. This is because in the long run as the economy is developed, it is not much dependent on agriculture but would be relying much on the manufacturing sector. Agricultural production plays a pivotal role in the early stages of economic development, supplying raw material to the industrial sector but when the economy is developed, it plays a minimal role.

## 5. Conclusion and Policy Implications

This study examined the impact of agricultural production on economic growth in Zimbabwe using data for the period 1970-2018. The ARDL bounds test was used to examine if there is a long-run equilibrium relationship between the variables in the model. The study found that agricultural production has a positive impact on economic growth in the short run, and no impact on economic growth was found in the long run. Thus, the agricultural sector plays an important role in the early stages of economic development and when the economy is developed, it contributes insignificantly to economic growth. The study found that inflation, the share of government expenditure in GDP, and the share of gross fixed capital formation in



GDP have a positive effect on economic growth in both the short run and long run. However, the population was found to have no impact on the economy in the short run but had a positive effect in the long run.

The results imply that to promote economic growth, there is a need to increase inflation to a sustainable level, increasing government expenditure and gross fixed capital formation through spending on land improvements, plant, machinery, and equipment purchases, construction of infrastructures such as roads, dams, railways, private residential dwellings and commercial and industrial buildings for this would attract investment in the country. To promote economic growth, there is also a need to boost agricultural output through various measures such as plugging the loopholes in the existing land legislation so that surplus land may be distributed among the small and marginal farmers and providing adequate credit facilities at reasonable cheap rates to farmers. With the growing effects of climate change on weather patterns, there is also a need to practice smart agriculture especially in areas receiving poor rainfall for the security of the crops. There is a need to develop high-yield crops, increased research into plant breeding, which takes into account the unique soil types of Zimbabwe, as a major requirement.

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## Appendix A

**Table 6: Model diagnostic test results**

Test	Test statistic	Calculated value	P-value	Conclusion
Autocorrelation	F-statistic	0.205468	0.8157	There is no autocorrelation
	Obs*R-squared	0.774369	0.6790	
Normality Test	Jarque-Bera	0.275072	0.8715	Residuals normally distributed
Ramsey RESET	F-statistic	0.000310	0.9861	Model correctly specified
	t-statistic	0.017616	0.9861	
Heteroscedasticity	F-statistic	0.67467	0.8099	No heteroscedasticity
	Obs*R-squared	15.19013	0.7104	

**Figure 3: Cumulative Sum of Squared Residuals (CUSUMQ)**

