An Evaluation of the Effectiveness of Zimbabwean Government Maize Production Support Programmes in Ensuring Food Security

Blessing Dhokotera[#], Cinderella Dube[*]

[#,*]*National University of Science and Technology, Zimbabwe*

***Abstract*—The study looked on the effectiveness of Government maize support programmes in ensuring food security in Zimbabwe over the period 1980 to 2017. The main objective was to establish quantitative impact of Government maize production support programmes in ensuring food security and analyse if the programmes are having any significant impact on raising food security through increased maize production. Guided by literature, the study hypothesised that Government maize support programs lead to increased maize output and therefore food security. The study based its theoretical framework from the theory of production function and the sustainable livelihoods model. Secondary data obtained from various Government publications was used to solve the research problem and analysis was centred on the Gittinger Model which gives a structure to perform financial analysis of agricultural projects. The findings show that maize production respond positively to its previous output price, Government maize support price, favourable weather, major Government policy support and availability of cheap fertilisers. Output of the crop respond negatively to increase in average fertiliser price. The elasticity estimates show inelastic responses to maize output price, Government maize support price, fertiliser price and Government major policy support. The inelastic response for most of the variables show that a comprehensive policy combining both price and non-price incentives is required to raise maize output in Zimbabwe. Further the elastic responses to rainfall show that a volatile climatic environment would be devastative to food security in the country. Construction of more dams and expanding farmland under irrigation will help farmers cushion the devastating effect of adverse weather. Farmers should aim to plan ahead and purchase part of their inputs as they wait for Government inputs support. More attention should be on irrigation infrastructure to limit the effects of adverse weather. The study suggested a similar study to be conducted using same methodology on a two or more country comparison to see whether the results will be the same as a potential area for future studies.**

***Keywords*—Food security; Government Maize Support; Input Subsidy; Elastic; Inelastic**

I. INTRODUCTION

Government support in agriculture through input subsidy programs is currently gaining substantial attention as a strategy for boosting staple crop production and improving household food security in Sub-Saharan Africa (SSA). Many countries in SSA have implemented various support programmes to boost staple crop production. However, food insecurity is still evident in most countries in SSA (FAO, 2016). While emerging literature is beginning to quantify the impacts of Government support through input subsidies on maize production, it is sometimes argued that the most important welfare effects of input subsidy programs operate through the production and price of maize. However, to date there has been little quantitative evidence about how Government support programs including input subsidies affect maize prices and production. The motivation of this study is to empirically investigate and quantify this important potential general equilibrium effect based on Zimbabwe, which has implemented various programs to support maize production.

Hence, this study is premised on identifying the causes and effects of industrial disputes in the Nigerian Colleges of Education with special reference to the Federal College of Education, Zaria (FCEZ).

1.1 Background of the Study

Agriculture is the backbone of Zimbabwe's economy in as much as Zimbabweans remain largely a rural people who derive their livelihood from agriculture and other related rural economic activities (FAO, 2016). It provides employment and income for 60-70 percent of the population, supplies 60 percent of the raw materials required by the industrial sector and contributes 40 percent of total export earnings. Despite the high level of employment in the sector, it directly contributes only 15-19 percent to annual GDP, depending on the rainfall pattern (Mumvuma, 2002), and this is a statistic that understates the true importance and dominance of the agricultural industry. It is generally accepted that when agriculture performs poorly, the rest of the economy suffers. Maize enjoys the highest share in the agriculture basket of 8% highlighting its importance in the country.

The country has a total land area of over 39 million hectares, of which 33.3 million hectares are used for agricultural purposes. The remaining 6 million hectares have been reserved for national parks and wildlife, and for urban settlements (Mumvuma, 2002). The distinguishing characteristic of Zimbabwe agriculture is its dualism, i.e. the existence of two major subgroups based on the size of landholdings. The larger group is unsophisticated and comprises about 7.1 million smallholder farmers and communal farmers occupying a total of 21 million hectares ((Rukuni, 2010). In general, communal and smallholder

farmers occupy areas of lower natural potential for agriculture in terms of rainfall, soils and water for irrigation. In addition, these areas are of lower economic potential because of the distances from markets and poor communication and social infrastructure. Until recently, the other group comprised about 4,000 large-scale farmers with very sophisticated production systems and occupied about 11 million hectares of land, primarily located in the areas of high agricultural and economic potential.

Maize is the major crop and also a staple crop for the country and as such is of significant policy importance to the Government. In its drive to ensure food security, the Government has been implementing various programs to support maize production and prices. Four main policy frameworks have affected the performance of agriculture in Zimbabwe in the past three decades. First, there was the "growth with equity programme" pursued by the Government between 1980 and 1990. It sought to redress the colonial legacy in favour of communal farmers. Second, there was the "structural adjustment market-oriented reforms", the Economic Structural Adjustment Program (ESAP), adopted in 1991. Then there was the land reform with more profound implications for the sector, the "fast-track land resettlement and redistribution" which started in 2000 and currently in progress although the Government insists it has been concluded. Then finally the current Command Agriculture.

The two main features of agriculture at independence in 1980 were the duality of agriculture and the high degree of Government intervention in the sector intended to stimulate production (Pazvakavambwa, 2009). After independence in 1980, agricultural policy was directed to reducing inequality and to supporting smallholders. The supply response by smallholders was dramatic, and they became the largest suppliers of maize and cotton to formal markets within the first five years (1980-1985) of independence. The focus on stimulating and supporting smallholder agriculture was also seen as a means towards achieving food self-sufficiency and food security among communal farmers ((Rukuni, 2010). At the same time, Government instituted a land resettlement programme and charged all key public sector institutions to give a high priority to smallholder agriculture.

A. Review of Government Support Policies

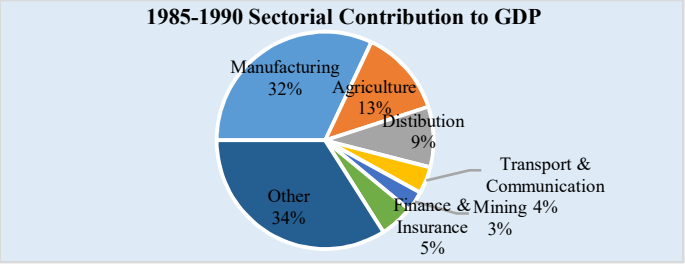
According to (Zhou, 2006) the new Government in 1980 inherited a dual economy of white large-scale farms and a stagnant impoverished communal sector. The new black Government only had one option, to prioritise socio-economic policies and adopt state led development strategies so as to address the colonial imbalances that were in existence. Anything short of this could have amounted to the state reneging on its liberation promises. To this end the black Government adopted the Growth with Equity policy in 1981 as the first post-independence economic policy statement. Growth with Equity allowed large-scale white farming to continue their dominance. The policy mainly focused on redistribution of wealth, expansion of rural infrastructure and redressing social and economic inequality including land reform (Zhou, 2006). The Growth with Equity policy was also characterized by land resettlement on a willing buyer willing seller basis. The blacks did not have resources to purchase land and as such the policy did not effectively address the land question (Pazvakavambwa, 2009).

The Government then introduced the Transitional National Development Plan (TNDP) which was supposed to run from 1982 to 1990 (Nyavaya, 2016). The TNDP in terms of maize and agriculture supports focused more subsidies and market price support. There was nothing meaningful that farmers benefitted from this policy. Drought in the 1983 to 1984 agricultural seasons also affected the plan (Makina, 2014). The TNDP was largely a failure but to its credit it created over 150,000 jobs and enhanced agricultural production of small scale communal land farmers (Mashakada, 2013). Due to the failure of the TNDP the Government embarked on another policy to try and remedy the TNDP failures.

According to Makina (2014), the First Five Year National Development Plan (FFYNDP) was formulated after comprehensive and detailed review of economic performance during the first five years of independence to run from 1986 to 1990. Under this policy, Government took measures to stimulate maize production through export incentives, introducing the Export Retention Scheme and the Export Revolving Fund and foreign exchange allocations in favour of exporters. Air transport was improved, the Horticultural Promotion Council was formed, and the communal areas management programme for indigenous resources (Operation Campfire) was established towards the end of the 1980s.

In addition, Government policy indirectly stimulated export production through the relatively low Government-set producer price for maize, which made many commercial farmers diversify into cash crops destined for the more lucrative export markets. There was also increased number of state farms and the Government intensified education of communal farmers in modern agricultural practice (Zhou, 2006). The Government however, experienced another severe drought during the 1986/1987 agricultural season that adversely reduced output for both rural and commercial farmers (Pazvakavambwa, 2009). Under this plan, the manufacturing sector was the chief economic growth driver, followed by agriculture and the retail and hotel industry as shown in Figure 1.1 below.

Figure 1.1: Sectoral Contribution to GDP 1985-1990



Source (Rukuni, 2010)

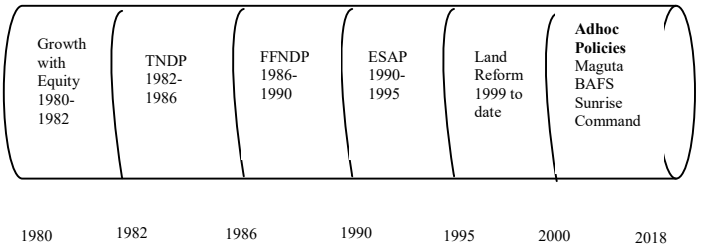
In order to address the challenges of the first decade the Government sought to stabilise the economy in the second decade. According to (Rukuni, 2010), by the early 1990s, the interventionist policies had reached their limit and could not be sustained any further, forcing Government to embark on market-oriented reforms including in agriculture. The market reforms adopted in 1991 were aimed at market deregulation, liberalization and export promotion (Government of Zimbabwe, 1991). The Economic Structural Adjustment Programme (ESAP) (1991-1995) was formulated ((Rukuni, 2010). Agricultural marketing was deregulated, and controls on domestic prices were removed except for a few commodities. The main thrust was export-oriented agricultural production, but the problem remained that of generating substantially greater farm output from smallholder farming (communal, resettlement and small-scale farming) to meet direct household consumption needs and to generate greater net farm cash incomes (Rukuni, 2010). The programme was of course also affected by exogenous factors, in particular the devastating 1991/2 drought (Makwata, 2013). According to (Mumbengegwi, 2003) the failure to consult with stakeholders was a mistake since there was no awareness about the policy reforms hence resulted in ignorance and lack of ownership on the part of many relevant interest groups including commercial farmers. To consolidate the reforms, in 1995, Government adopted a comprehensive agricultural policy for the period 1995-2020 (Makwata, 2013).

Although export incentives were phased out, the devaluation of the Zimbabwean dollar throughout the 1990s continued to stimulate exports. Because of this, agricultural producers suddenly received much higher prices in Zimbabwean dollars for their exports which encouraged production (Mumbengegwi, 2003). While trade was liberalized, importation and exportation of some goods required a licence. For example, importation of fertilizers was regulated as well as exportation of maize and other foodstuffs.

(Makwata, 2013) suggest that market liberalization reforms led to a tremendous increase in agricultural production costs particularly for seeds, fertilizer, transport costs and agricultural equipment compared with prices of agricultural produce. Interest rates swelled and constitute one of the largest components of production costs for farmers. The hoped-for diversification resulting from market reforms did not happen because of limited appropriate technology options in the various farming regions, lack of access to capital, lack of markets, and absence of any farmer advisory services and the disruptive nature of land invasions. Some diversification was noted, including ostrich production and specialized horticulture, which are capital-intensive and beyond the means of many communal farmers.

The Government then embarked on Fast Track Land Reform which was accompanied by inputs subsidies and free farm machinery in 1999 (Mumbengegwi, 2003). The country produced a record maize harvest pointing to success of the program (Makwata, 2013). However, new farmers that were resettled had limited capital and farming knowledge. In view that prices of farm inputs had soared as a result of market and economic reforms, consumer welfare as well as the strategic role of agriculture and the struggle around the land reforms (land invasions), Government in 2000 reversed some agricultural policies (Mumbengegwi, 2003). In 2000, it introduced price controls over a number of agricultural and food products. The marketing of grain was controlled by the Grain Marketing Board (GMB), and private operators were required to declare their holding of grain, or it was confiscated by the Government(Makwata, 2013). The GMB was tasked with maintaining strategic grain reserves and has the sole right to import and export maize.

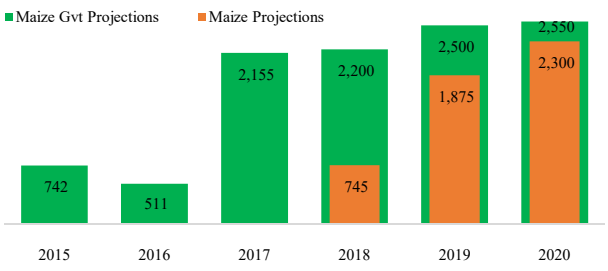
Figure 1.2: Government Support Programmes (1980-2018)



From 2000, the Government has been supplying inputs to farmers under various adhoc programmes which include Operation Maguta, Brazil-Africa Food Support, Sunrise 1, Sunrise 2 and Command Maize Programme (Rukuni, 2010). Requirements for inputs are appropriated through the Ministry of Agriculture. Over the years, the funding gap accelerated allied with the absence of industrial bank lending that stated lack of collateral protection resulting generally from the land reform program (Rukuni, 2010). Having misplaced the initiative, farmers now made no preparations for the subsequent seasons and simply waited for Government inputs (Rukuni, 2010).

Production of maize as such slumped with the country relying on imports. A number of support polices are being implemented with projections pointing to recovery of maize production. Figure 1.2 below shows maize production and projections made by the Government and a local economic research company Econometer Global Capital. Econometer Global Capital is a research firm which carries out research for all sectors of the economy.

Figure 1.3: Maize Production and Projection (000t)



Source: (Econometer Global Capital, 2018)]

Figure 1.3 shows an increase in maize production which is anchored on Government support programme Command Agriculture. Both the Government and Econometer Global Capital project an increase in maize production. It is believed that Government support programs will lead to improved production and favourable prices. However, Zimbabwe's past experience reflects slow improvement and to some extent a failed impact of Government support as the country continue to suffer from food shortages (FAO, 2016). Given such a background, this study seeks to evaluate quantitatively the impact of Government support on maize production and prices.

B. Statement of the Problem

Since 1980 to date, a series of Government programs have been introduced and implemented with the aim of reducing food shortages in the country (Maiyaki, 2010)]. However, the events so far analysed clearly outlined that problems of food shortage are still persisting. There are concerns that Government maize support programs have limited impact on both maize production and prices. In every support programme, the expectations are that both yields and prices should respond positively. This prompts the need to carry out an investigation on the quantitative impact of Government maize support programs. Although some authors such as (FAO, 2010), (Rukuni, 2010) and (Makwata, 2013) tried to investigate food security and agriculture, none has tried to evaluate quantitatively. The pertinent question to be answered by this study is "what is the quantitative impact of Government support programs on maize production and maize prices. There is need to appraise the impact of Government support programs given that they are funded from taxpayers. Given the fact that the economy is currently experiencing acute shortage of funds owing to the shrinking tax base caused by company closures and high unemployment, quantitative assessment of Government support programmes is therefore critical.

C. Research Objectives

The paper investigates the impact of Government maize production support programmes in ensuring food security from 1980 to date. It also assesses the impact of Government maize production support programmes on maize, productivity, output and prices. The focus is also to establish the socio-economic costs that arise from the Government maize production support programmes since 1980 and also identifying the socio-economic benefits that arise from the Government maize production support programmes since 1980.

D. Significance of the Study

This study is crucial to a number of stakeholders as its results may be used in developing a new model by the Government for financing food security programs in Zimbabwe. The study maybe used by policy makers to plan and allocate the available scarce resources to sectors which they will yield potential maximum returns for the society at large. The academia will also benefit as this study is going to analyze the quantitative impact of Government support programs in maize production and prices. Therefore, it shall contribute to the already existing body of literature from a Zimbabwean perspective. In addition, the results of the study shall also provide insights to policy makers on the influence of agriculture input distribution and its causality on agriculture productivity and prices.

E. Delimitation of the Study

The study examined the impact of Government support on maize price and output. Data was gathered from the various involved authorities. Secondary data was used in carrying out the study. The study was only considering a case of Zimbabwe programs from 1980-2017. This means that the results of the study cannot be generalised to other countries since a cross sectional study was used. Better results could be achieved by carrying out a longitudinal study. The study also excludes support programmes that were not targeted to maize production during the period under review.

F. Limitations of the Study

The researcher was to some extent limited by the scarcity of published articles locally and lack of cooperation by the responsible authorities due to sensitivity of some of the issues covered. In order to reduce the risk associated with that, a funnel approach of literature was adopted such that the researcher needed not to confine the study to articles from within. To increase participation by Government authorities, the researcher assured anonymity of the sources and the results of the study were solely for academic purposes only.

II. LITERATURE REVIEW

Food security, as defined by (UNDP, 2015), is the condition in which all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. In Zimbabwe, maize is the staple crop and is at the centre of food security ((Rukuni, 2010).

Since the 1980's, food insecurity due to falling per capita output of food production and recurrent droughts has been a major challenge for Zimbabwe. A number of strategies were adopted to address both chronic and transitory food insecurity and to lessen the impacts of droughts. The strategies can be put into two categories. The first were strategies adopted to stimulate increased production to improve national food security. The second type were strategies adopted to counter the impacts of droughts and to address household food and nutrition insecurity.

The analysis can be divided into three periods. In the period 1980 - 1985, strategies adopted were geared to stimulate increased food production to meet the national food security needs. This was in response to a general shortfall in national food stocks because of reduced output due to the

intensification of the war of liberation during the years 1970-1980. Thus in the early 1980, the Government food security strategy was for the country to be self-sufficient. This was achieved through central storage and marketing and by maintaining a strategic maize reserve in case of drought. The thrust of the 1980-1985 agricultural strategies while well intended may not have achieved desired effects on national and household food security (Rukuni, 2010). This can be attributed to the agricultural policy formulation process:

a. The emphasis of the agricultural pricing policies has been upon the individual commodity and not based on a comprehensive nor cohesive food and agricultural policy. There was also no compatibility between rural development strategies and the commodity pricing strategies. The prices were administrative and politically set because of a "knee-jerk" reaction to political pressure brought to bear by the farming community, particularly the large-scale commercial farmers (Rukuni, 2010).
b. The establishment of commodity prices made little reference to target or desired farm income levels. It was implicitly held that increase in crop prices would contribute to raising farm incomes and rural welfare for the communal area sub-sector ((Rukuni, 2010).
c. Lack of a strategy focusing on rural and agricultural development based on improving agricultural productivity.
d. Subsidies and large stocks of certain commodities led to rise in the fiscal deficit that in turn led to reduction in resource allocation to agriculture services (Mumvuma, 2003).
e. That increased crop prices have been detrimental to those households who are net buyers of food (Rukuni, 2010).

The 1986-90 period can be characterized, as the period of re-adjustment to focus at the household food security needs as opposed to national food security needs. This was in response to the impacts of recurrent droughts at the household level and the realisation that a number of farming households were not able to meet their own food needs. Due to mounting levels of national stocks, the Government encouraged farmers to diversify from food grains to non-food cash crop production to generate household income and foreign exchange earnings.

The period 1991-1995 is influenced by the economic reform or structural adjustment programme that ushered new grain marketing arrangements and the decontrol of food price controls, and reduction in food subsidies. This brought about new marketing arrangements for food flows into urban areas. The Government, through the GMB, maintained control of maize marketing and pricing. The maize producer price was kept at lower than export parity. The intention was twofold, namely (a) reduce Government expenditure on GMB stored maize, and (b) to reduce the cost of grain for urban households. The outcome was that farmers were heavily taxed. Consequently, farmers started to shift from maize production (Pazvakavambwa, 2009).

During the 1990-1995 period the approach to agricultural policy changed considerably. For the first time the country articulated a framework for agricultural policy with a focus on commercialisation of the smallholder sub-sector (Rukuni, 2010). The framework was built upon the premises that the agricultural environment needed to be improved to perform better through reduction of Government subsidies, commercialising operations of agricultural parastatals, placing more reliance on market forces and the private sector, and cutting back the size of the civil service.

The consequences of the reform of macro-economic policy on the development of the agricultural sector of the economy and food security have been mixed. On the positive side, the liberalisation of the foreign exchange market involving the end of foreign currency allocations and the free availability of foreign exchange for import requirements, facilitated much greater availability of imported farm inputs and generated a considerably greater degree of competition among the farm input suppliers.

This has had a significant benefit both in terms of the prices and availability of imported farm production requirements, both capital and current items. This led to the expansion of tobacco production following the much-improved prices of 1991 led to a high level of investment in tobacco curing barns and other facilities for tobacco production. This was enhanced by the provision of a large special foreign exchange facility for tobacco growers, which encouraged a substantial volume of investment in the range of specific capital equipment items for which this facility could be used. There has also been a steady and significant growth in investment in horticulture - particularly in the production of flowers and citrus fruits that are of a capital-intensive nature. Even smallholder farmers responded by switching to tobacco and other cash crops (paprika, cotton, etc). This partly contributed to the reduction in maize production and erosion of maize stocks at both the national and household levels.

The period 1999 to 2017 was characterised by major policy shift including land reform and politically driven adhoc policies. The country produced a record maize harvest in 2000 pointing in part to success of the land reform program (Makwata, 2013). However, new farmers that were resettled had limited capital and farming knowledge. In view that prices of farm inputs had soared as a result of market and economic reforms, consumer welfare as well as the strategic role of agriculture and the struggle around the land reforms (land invasions), Government in 2000 reversed some agricultural policies (Mumbengegwi, 2003). In 2000, it introduced price controls over a number of agricultural and food products. The marketing of grain was controlled by the Grain Marketing Board (GMB), and private operators were required to declare their holding of grain, or it was confiscated by the Government(Makwata, 2013). The GMB was tasked

with maintaining strategic grain reserves and has the sole right to import and export maize.

From 2000, the Government has been supplying inputs to farmers under various adhoc programmes which include Operation Maguta, Brazil-Africa Food Support, Sunrise 1, Sunrise 2 and Command Maize Programme (Rukuni, 2010). Requirements for inputs are appropriated through the Ministry of Agriculture. Over the years, the funding gap accelerated allied with the absence of industrial bank lending that stated lack of collateral protection resulting generally from the land reform program (Rukuni, 2010). Having misplaced the initiative, farmers now made no preparations for the subsequent seasons and simply waited for Government inputs (Rukuni, 2010). Production of maize as such slumped with the country relying on imports.

A. Government Maize Support Programmes

Input support programmes are the most common support programmes that have been used as a major tool for increasing agricultural production in most developing countries ((Rukuni, 2010). This has seen many countries adopting a free or subsidized input programmes which have managed to contribute in overcoming production constraints on small holder farmers, thereby boosting agricultural production. According to (Zhou, 2006),input programmes play a critical role in improving the usage of necessary inputs that are critical in enhancing increased production thereby promoting food security and alleviating poverty among many rural farmers.

Many of the world's poor live in rural areas and depend on agriculture for their incomes and livelihoods, whether as farmers or agricultural labourers, according to (Rukuni, 2010). Most economies are driven by smallholder farmers who contribute significantly to national food security, economic development and rural development. It is a very basic understanding that the economic health and long-run viability of the rural economy is crucial for the well-being of the developing countries poor (Ghimire, 2001). Being the prime source of employment, agricultural production is probably the single most important factor for a thriving rural economy. Most livelihoods in rural economies are fully hinged on agriculture and in Zimbabwe about 70% of population derive their livelihoods from agriculture (Kanyeze, 2014).

B. Role of Input Support Programmes

Adequate agricultural inputs play a critical role in enhancing the production of any crop. This has been fully recognized by the African Union heads of state meeting in Abuja. This has resulted in the endorsement of the Abuja Declaration that recommends member states to devise strategies to increase fertilizer usage from average of 20kgs to 50kgs. The coming together of African heads of state to discuss on the increase of fertilizer usage by farmers in their countries brought out the importance of agriculture inputs in increasing production. This was because of the low usage of inputs in African countries especially in sub - Saharan Africa whereby fertilizer usage was below by international standards (Wharton, 2015). The hope was to increase agricultural production through the usage of these subsidies. These inputs were meant to increase agricultural development among poor rural households.

There is strong evidence to suggest that agricultural inputs raise production substantially, and that they are essential for sustaining intensive agriculture in the long term without depleting soil fertility (Sydney, 2005). This is through the growing of crops like millet and sorghum which have generally lower yield potential, but there are still possibilities for significant yield responses in the context of integrated soil fertility management, according to (Poulton, 2010).

The input support programme also plays an important role in soil fertility management which keeps the soil fertile and not depleted ((Rukuni, 2010). The maintenance of soil fertility will help in increased production of crops as well as enhance rural incomes and sustainable production of maize (Sydney, 2005). The programme helps smallholders accumulate productive and financial assets from a few years of surplus harvests, the farmers may be able to finance full-priced inputs from their own savings. This shows that the input support programme will help farmers to be self-reliant since the programme will help in enhancing rural incomes.

Input support programmes also play an important role in promoting national and household food security (Ghimire, 2001) The input support programme is in line with the millennium development goal number one which states the eradication of extreme poverty and hunger thus control of productive resources, contributing directly to the reduction of rural poverty and hunger. Though the input support programme is aimed at increasing production it is also in line with promoting food security in households and the nation at large. The Comprehensive African Agricultural Development Programme (CAADP), outlines the importance of the input programmes in promoting food security whereby most people In Africa especially in the rural areas are food insecure because of lack of inputs for agricultural production and also because of the effects of the weather on crops due to climate change. CAADP has applauded the input programme in promoting food security through the provision of inputs that are conducive to the change in weather patterns though most of African countries have not fully achieved the new breed of seeds.

Agricultural input programmes also play an important role in the effective raising of land and labour production and in driving down food staples prices which will raise the real incomes of large numbers of poor consumers as well as raise the incomes of poor producers. This expands the demand for locally produced non-staple foods like horticultural and animal products and nonfarm goods and services, driving up local labour demand and wages. At the same time increasing staple crop production can release resources for the production of non-staple foods like horticultural and animal

products and non-farm goods and services. Such growth multipliers were critical in driving growth in Asia (Mashakada, 2013) and need to be given much greater emphasis in analysis of input programmes impacts; in particular this requires more emphasis on agricultural input impact on food prices and poor consumers or net buyers. It also requires implementation of subsidies over a longer period, to achieve structural change rather than short term productivity gains.

Input support programmes also play a major role in increasing rural incomes amongst the beneficiaries of the programme. This is through increased production of the crops due to the support given. The increase in production of crops will help most of the beneficiaries get surplus that they sell in markets to get incomes that will help in the enhancement of rural livelihoods. The enhancement of rural incomes through increased production is very important for it creates a better society for most rural areas whereby the dependency syndrome that has been adopted by most rural people will be eradicated. This is because people will be in a position to plan ahead for successful outcomes in terms of production and also have better livelihoods since they will be in a better position to know what has to be addressed. A case in point is the Tanzanian input programme whereby through increased production by the input programme most of the smallholder farmers managed to sell surplus and purchase goods that enhanced their livelihoods (Rukuni, 2010).Most of the smallholders managed to provide themselves social services such as health services, education for their children as well as support their families with the incomes.

C. Factors Affecting the Effectiveness of the Government Support Programmes

The study of assessing the contribution of Government input support programme in enhancing sustainability of maize production and ensuring food security has been done using various methods. It is important to note that the studies of the impact of the input support programmes that have been done, especially in the African continent tend to have a number of data limitation problems and tend to limit the value of the data ((Rukuni, 2010). Apart from factors in the sustainable rural livelihoods framework they are other external factors that affect the effectiveness of input support programmes in increasing maize production amongst smallholder farmers. These factors include climate change, which has greatly affected the agricultural sector because of the change of weather patterns; another is land degradation which has affected the fertility of soil and has greatly affected the production of crops.

Zimbabwe's agriculture is currently facing serious challenges of production (Pazvakavambwa, 2009). In recent years, production has declined drastically and the country is unable to feed itself. Maize as the key crop for the country, production has declined drastically and has threatened the livelihoods of many rural farmers. Among some of these challenges that include, climate change, persistent droughts, lack of mechanization, poor seed varieties, lack of adequate training, access to inputs has remained topical in being blamed as the main cause of low production. Prohibitive prices of inputs has made the agricultural sector suffer because prices of most inputs especially fertilizers is beyond the reach of many rural farmers (Pazvakavambwa, 2009).

Previous studies have identified numerous factors that limit the effectiveness of the input support programme in boosting production. According to (FAO, 2016), growth with equity is one of the main factors because agricultural inputs when they target the right group to benefit from the programme means of production will be fully achieved by all farmers including smallholders. The programme should target the most vulnerable groups going up to the group in less need of inputs support. This will help in the development of all people equally without leaving a group out of the development and enhancement of livelihoods circle. The enhancement of rural incomes will be achieved since the programme would have tackled one major problem of targeting which will ensure growth with equity. Some scholars suggest that an objective of increasing national self-sufficiency in grain production will require the programme to target the most productive households, who may be somewhat less-poor. However these can mislead the actual goal of the programme in increasing production among the poorest smallholder farmers who are the main group meant to benefit from the programme, a study by (BBC, 2000), in Malawi stated that the inputs were disproportionately allocated to households with relatively more land, more assets and to male headed households. The most vulnerable and female headed households were less likely to receive vouchers.

D. Physical and Social Structure

Physical and social infrastructure, such as road conditions, access to telephone and mobile phone service, access to extension service, etc., have also been mentioned for their role in rural development and farm production. (FAO, 2010) examined the benefits of rural roads to Nepal farms and suggests that providing road access to markets would confer substantial benefits through higher farm profits. Results showed that distance to the nearest motorable road and access to extension services have positive effects on maize production in Kenya. More developed infrastructure would help in the distribution of inputs whereby they will reach the farmers in time for planting. Availability of the above factors will help in the boosting of maize production since they will be communication between farmers and the suppliers of inputs.

The availability of good roads in the areas to receive the inputs is an added advantage to the receiving of inputs in time. Good roads do improve the delivery of inputs rather than roads that have been bad which will comprise the faring of inputs in time.

E. Financial Constraints

Financial constraints within the Government can also affect the purchasing of farm input whereby the purchasing of inputs can be constraining for the Government(Makwata, 2013). The Government of Zimbabwe with the overarching challenges in the economy cannot fully purchase the inputs to benefit every smallholder farmer. Financial constraints within the Government's economy, has led to food insecurity of most smallholder farmers since the prohibitive prices of inputs has led to decrease in maize production. Most smallholder farmers in the country cannot afford inputs because of little incomes. This has led to the decrease in maize production whereby inputs reach farmers late for the planting season. Timing of input usage is important for yields. The farms that face financial constraints may not be able to optimize production.

F. Distribution of Inputs

Distribution of resources is another overlapping factor that affects intended goals of development in Africa. This can also be attributed to the input support programme whereby the unfair distribution of these inputs has seen most smallholder famers lagging behind in increased production. The distribution of inputs has to be done in a fair manner whereby the group in need of this support has to benefit first going down to well off farmers. A case in point is that of Ghana whereby the input programme benefited farmers who were politically connected and left out many peasant farmers who were in need of inputs for production (FAO, 2010). This shows that distribution is a factor that has affected the effectiveness of the input support programme because the distribution of these inputs has not been done in a fairly manner that gives every farmer the opportunity to produce. Fair distribution will remain a challenge.

G. Corruption

Corruption is another factor that affects the distribution of inputs to farmers. Corruption has remained a major underdevelopment factor in most African states and it has remained unsolved and leading to less development of other sectors that have been lagging behind. The practice of the input programme in other countries has been not very much transparent (FAO, 2016). The results of the programme have brought out a negative performance of the programme's exercise whereby inputs have been diverted to suit political interests rather than to address the actual problem on the ground. When resources are diverted to suit political interests the distribution of these inputs becomes biased whereby not all receive. A case in point is the input support programme in Ghana. The supply of inputs between districts was formally based on vague notions of “farmers' need”.

However, (AfDB, 2009), argues that the actual regional allocation of inputs was more closely correlated with political factors than efficiency or equity considerations. Specifically, he shows that districts, which the incumbent party lost in the previous election in 2004, received more vouchers than districts it won. Further, the number of vouchers allocated to a district increases with the vote margin, with which the district was lost.

Corruption can be viewed in another aspect whereby not all available resources are distributed to farmers. A case in point is that of the Ghana input support programme whereby vouchers meant to be distributed to farmers were not available for distribution. According to (Zimbabwe Independent, 2016) initially, the Government planned to issue 600,000 vouchers in 2008, each redeemable for the specified rebate on one 50 kg bag of fertilizer, but in the end more than 1.1 million vouchers were printed, although less than 50% of those were eventually redeemed. The reasons for the overrun of the number of vouchers and subsequent low redemption rate are not entirely clear. However, it appears that lack of clear criteria for the distribution of vouchers and general uncertainty about how many vouchers were available in each district generated an initial shortage of vouchers during the critical late summer months where fertilizers are most effectively applied.

H. Climate Change

Natural causes are another factor that have affected the effectiveness of the input support programme. The International Institute for Environment and Development (IIED) paper on climate change in Zimbabwe by (Brett, 2005), outlined that the effects of climate change have been noted and these include rainfall variability and extreme events. These conditions combined with warning trends are expected to render land increasingly marginal for agriculture which poses a threat to the economy and livelihoods of the poor due to their dependence on rain fed agriculture. This has negative impacts on the input support programme whereby its effectiveness in enhancing rural incomes through increased production is challenged by the effects of climate change. However though the sub Saharan region increased its use in inputs to increases production climate change has rendered the programme to yield fewer results because of its harsh weather conditions unfavourable to the agricultural sector.

Climate change has affected the rain patterns especially in the sub Saharan region. In sub Saharan region the input support programme has been recognized in countries like Malawi, Zambia and Zimbabwe to boost agricultural production among smallholder farmers. However the region faces a very harsh rainy season whereby rainfall patterns in the region have been characterized by shifts in the onset of rains, increase in the frequency and intensity of heavy rainfall events, increase in the proportion of low rainfall years, decrease in low intensity rainfall events, and increase in the frequency and intensity of mid-season dry spells (Zhou, 2006).

Moreover extreme weather events namely tropical cyclones and drought have also increased in frequency and intensity (Pazvakavambwa, 2009). This clearly brings out the negative impacts of climate change on the input support programme

which is meant to boost production and enhance rural livelihoods. Rainfall is a major component needed in production but because of climate change it has become a scarce resource to farmers and most cannot have alternative measures like irrigation because of low incomes to purchase. This is evidenced among smallholder farmers who are more vulnerable to the effects of climate change.

I. Theoretical Review

This study is going to base its argument on the economic theory of production function and sustainable livelihoods.

J. Theory of Production Function

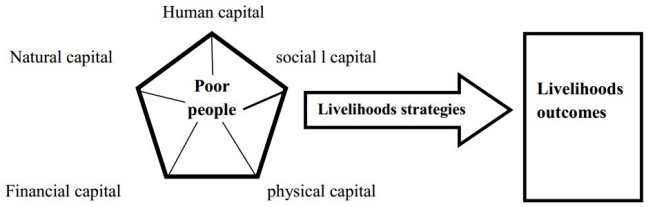
The theory of production function points out that production of a crop(maize) depends on a number of factors that include seed, fertilizer, labour, land, rainfall etc. A production function is described in terms of maximum output that can be produced from a specified set of inputs, available to the farm (Chasi, 2003). The theory further alludes that an increase in usage of any single input results in increase in output of the crop. However, continuous application of that input will result in decrease of output at certain level and is referred as diminishing rate of returns.

In this case, if a farmer uses recommended seed and fertilizer rates, all other inputs held constant, will result in increase in output of maize. The theory eludes that at this stage the farmer is maximizing output subject to existing input level. Due to high cost of inputs farmers are not able to apply these recommended input levels to increase production that translate in improved incomes and livelihoods. Therefore, the inputs support by the Government through the provision of adequate inputs to maximize production of maize will therefore have impact on the production function resulting to increased output. Sustainability of production can be now achieved when the same high level of output is realized even if the Government withdraws the inputs. This means farmers will be able to save enough capital to purchase the recommended inputs levels in future so as to remove the dependence syndrome of farmers on Government.

K. Theory of Sustainable Rural Livelihood Framework

The study is also centred on the concept and theory of Sustainable Rural Livelihood Framework (SRLF).The approach draws on the main factors that affect poor people's livelihoods and the typical relationships between these factors. These factors are human capital, financial capital, physical capital, natural capital and social capital. These factors are regarded as livelihoods assets used by farmers to derive their livelihoods strategies to achieve desired livelihood outcomes. To enhance farmers to improve their livelihoods using these five capitals, there is need to boost and support key capitals that farmers lack. Mostly, farmers lack the financial capital to purchase key inputs hence the Government has boosted this capital on farmers through input support programmes to ensure sustainable livelihoods.

Figure 2.1: The Sustainable Rural Livelihood Framework



Source (Brett, 2005)

According to (Brett, 2005) most rural farmers are food insecure due to limited capital. The model above which also provides a theoretical framework to this study suggest that source of food insecurity is a result of limited human capital, financial capital, natural capital, physical capital and social capital. This results in the need of Government support programmes.

L. Review of Empirical Studies

Globally, there is a wide body of empirical research on Government maize support programmes in the developed and developing countries but are mostly limited to input support programmes (Chikukwa, 2013). While the empirical literature on input support programmes is vast in developing countries and Asian economies, few studies focus on African agriculture and particularly Zimbabwe (Cousins, 2003). These studies bring out how these programmes have been carried out and brought about changes in maize production and promoting food security and rural livelihoods. However other studies show how successful the programme was and others how it failed due to factors beyond the control of human nature such as low rainfall. Other factors include political interference, corruption as well as poor targeting of the main beneficiaries.

Inputs support programmes have been used as a major tool for increasing agricultural production in most developing countries. This has seen many countries adopting a free or subsidized input programmes which have managed to contribute in overcoming production constraints on smallholder farmers thereby boosting production. According to (Zhou, 2006), input programmes play a critical role in improving the usage of necessary inputs that are critical in enhancing increased production hence food security of many rural farmers. It is significant to note however, that despite all these Government efforts to provide incentives with a view of enhancing maize production, maize output has remained below domestic requirements in most of the countries and they continue to rely on imports to meet the deficits.

This leads us to question the responsiveness of maize production to economic incentives. Earlier studies on the responsiveness of maize production to producer prices in Kenya revealed inelastic responses to producer prices (Mumvuma, 2003). This suggests ineffectiveness of pricing policies in raising maize production. (AfDB, 2009) analysed

the influence of outputprices, rainfall, liberalisation, fertiliser prices, and time trend on maize production in Kenya using data for the period 1970 to 1998 in order to ascertain the determinants of maize production in the country and the impact of liberalisation of maize market. Results of the estimated double log function specified according tothe (Mumvuma, 2002) model, showed that 1 per cent increase in the ratio of fertiliser to maize prices reduced maize output by 0.18 per cent. The low response was attributed to a large proportion of maize production among small scale subsistence farmers being retained for home consumption. The conclusion was that producer price strategy would benefit the large scale producers more than small scale producers and therefore could not lead to significant expansion of maize production.

A study carried out by (Mumvuma, 2002) evaluated the impact of input support programmes in Nigeria to investigate the successfulness of the input support programme in promoting food security through increased production through the support programme. Results indicated that maize production increased by 49 percent after Government provided subsidized inputs to smallholder farmers. In addition, farmer household incomes significantly improved by 35%.

Food security amongst the beneficiaries increased whereby most families managed to have three meals a day though other families reported to have only two meals a day. The programme also changed the diet whereby families enjoyed nutritious meals. The study gave recommendations on the need to improve targeting of input beneficiaries to avoid inputs being taken by wrong people. Therefore the study makes targeting as a crucial point to consider since it will give the less privileged the chance to take part in the means of production in agriculture, targeting will also enable a balanced output in agriculture production hence making nations food secure. Targeting will also promote equity specifically at the poorest smallholder farmers.

A paper by (Mumbengegwi, 2003) examined the effectiveness of input support programmes carried out in Tanzania by the Government. This was in response to the high food and fertilizer prices in the country that prevailed in 2007-2008. The study was based on the concept of efficiency, whereby there was high production and sustaining intensive agriculture in the long term without depleting soil fertility through the support. The study also included the concept of equity whereby considerable resources were diverted to benefit the less-poor with good political connections though it did not fully target the rightful people in need of input support. Though the targeting criteria were not transparent the programme managed to increase national and household food security amongst the beneficiaries. Crop production increased significantly and rural incomes increased because most farmers took their supplies to the market. This also led to produces on the market to be affordable. The input support programme improved household food security and national food security. However the concept of sustainability of production was not considered since the programme was run in a short period

A study by (Pazvakavambwa, 2009) in Ghana concerning the agricultural input support programme showed that the programme is a boost in agricultural production. The study used the concept of efficiency. Though the programme was an emergency measure to mitigate the extreme impacts of high fertilizer prices within the country, it yielded positive results. The programme though run for a short period it managed to raise national and household food security in the country whereby maize production increased by 58% and rice production by 30%. This was a significant rise in crop production which brought about food security and the results of the programme were very much welcomed by the farmers in Ghana. However the authors state that there was no attempt at targeting the poorest households, and particularly large fertilizer importers appear to have benefited greatly from the programme. The issue of targeting to create equity remains an unsolved problem whereby the programme is targeting the wrong groups at most.

A study by (Zimbabwe Independent, 2016) in Malawi indicated a substantial positive effect on the use of agricultural inputs, agricultural production and food production. According (Rukuni, 2010), the programme increased maize yields of recipient farmers by 57%. The Government input programme caused some changes in cropping patterns as farmers re-allocated land from alternative food crops such as cassava or sweet potato towards maize. The Malawian input programme was one of the most successful in increasing national and household food security.

Official estimates suggest that national maize harvests increased by around 1 million tonnes in 2005/6 rising to more than 2 million tonnes in the 2008/9 season. Moreso, findings from focus group discussions, suggested that rural real wages increased continuously over the agricultural input support programme lifetime even for poor non-beneficiaries. As maize production by the agricultural input support programme beneficiaries increased, the households‟ dependence on off-farm work reduced and more jobs were available for non-beneficiaries and land-less poor.

Authors of the study state that it is difficult to judge how strong or widespread such effects were, or to which extent the reported reductions in poverty rates can be attributed to the agricultural input support programme. The Malawi agricultural input support programme had a large effect on productivity and output, but the programme was very costly, it largely failed to target the most vulnerable households and its long term sustainability is questionable.

A study carried out by (Sydney, 2005) to assess the impact of inputs support programme on household food security and welfare of the pilot Social Cash Transfer and Agricultural Input Subsidy Programmes in Mlomba TA, Machinga District, using the efficiency and targeting concept. The study found that 84.6% of surveyed households obtained subsidized

fertilizer and that the proportion of households obtaining subsidized fertilizer vouchers did not vary markedly with increase in household food security although poorer households received on average less fertilizer than better off ones. The study showed that the targeting criteria of the programme was based on the concept of the best farmers who produced more were given more inputs than the smallholder farmers. However the study showed that all farmers who received these inputs gained income through the use of these inputs, with the well-off farmers gaining more.

A study by (Brett, 2005) in assessing the effectiveness of the input support programme in increasing maize production in Hwedza noted that the programme was a success in bringing about production among smallholder farmers. The programme managed to increase maize production among the beneficiaries of the input support programme. Increase in production was significant which also increased food security amongst the beneficiaries. Most of the beneficiaries managed to produce 0.7tonnes per hectare as compared to 0.4tonnes per hectare before the support by the Government. However food security was not fully achieved since most of the beneficiaries still afforded two meals a day and others even one meal. This was because not all farmers had maximum output from the programme. Other crops were affected by harsh weather and others claimed that fertilizer was in short supply whereby some farmers got fertilizer very late which compromised maximum output. The study omits the targeting criteria used whereby not all smallholder farmers benefited from the programme. Most smallholder farmers did not get the exact inputs. Three households were to share a 50kg bag of fertilizer and two on a 10kg bag of maize seed. This however comprised the yields of many farmers who did not get the expected outputs from the input programme whereby other smallholder farmers only produced what was enough for their family consumption.

(Matutu, 2013) evaluated the effectiveness of the input support programme in the area of Hwedza as well. This study focused mainly on the yields produced after application of the inputs on smallholder farmers. The results clearly showed the failure of the programme in increasing maize production among smallholder farmers. The increase in maize production was not significantly high as expected by the aim of the programme. However the contribution of the programme in promoting food security was not fully achieved. This is because of the ineffectiveness of the programme which compromises maximum output to be achieved by farmers. Results from the study showed that inputs provided by the Government were distributed very late and sometimes targeted the wrong people. In the previous seasons other farmers even reported not to have received the full package as promised by the Government. Though farmers managed to harvest something the maize they get is not enough to carry them through the next farming season.

(Mumbengegwi, 2003) found no significant difference between maize production supply response before and after market liberalisation. The study applied co-integration analysis and error correction model (ECM) using data on small holder maize production for one of Kenya's districts in the period 1980 – 2003. The results showed that high maize and low fertiliser prices positively influenced aggregate maize supply response. Past prices were shown to estimate the observed supply response better than contemporaneous prices. The study recommended that besides price incentives, other complementary interventions such as good infrastructure, household access to information, extension and credit in addition to improved technology were necessary for the desired supply response.

M. Gaps in Literature

Although there are a number of studies on Government maize support programmes in the developed and developing countries, they are mostly limited to input support programmes. While the empirical literature on input support programmes is vast in developing countries and Asian economies, few studies focus on African maize support and particularly Zimbabwe. The existing few studies have been carried out to show how Government programmes brought about changes in maize production and promoting food security and rural livelihoods.

Some studies show how successful the programme was and others how it failed due to factors beyond the control of human nature such as low rainfall. Other factors include political interference, corruption as well as poor targeting of the main beneficiaries. None of the studies to the knowledge of the author has tried to test quantitatively the relative impact of the support programme in maize. This study therefore was carried out to investigate the relative influence of price and non-price incentives in maize production in Zimbabwe and to analyse the complementarity between them in influencing the crop's production.

N. Conceptual Framework

Conceptually, large-scale subsidy programs, such as those in Zimbabwe, Malawi and Zambia, may have direct and/or indirect effects on households. For example, recipient households directly benefit from the subsidies because they acquire fertilizer and inputs at a reduced price or for free, and in turn may use more fertilizer and inputs to produce more maize. Furthermore, by increasing maize production, input subsidies may generate the indirect effect of lower maize prices. Lower maize prices would affect all households that participate in maize markets as buyers and/or sellers but would be particularly beneficial to the rural and urban poor who are net-buyers of maize. At the same time, lower maize prices would negatively affect net-sellers of maize, including larger, better-off farmers.

Several factors influence the extent to which Government support programs affect retail maize prices. The first is the degree to which subsidies increase maize production. Increases in maize production depend in part on how much

new fertilizer and other inputs the subsidy program adds to total fertilizer use in the country, which in turn depends on how much commercial fertilizer gets crowded out by the subsidy. The empirical evidence from Africa suggests that on average, 100 additional kilograms of subsidized fertilizer add 78 new kilograms to total fertilizer use, as 22 kilograms of commercial fertilizer are displaced by the subsidy (Mumvuma, 2003).

The second is the impact of past production. It is evident that when a county produces surplus maize, it is likely to reduce production the following year. Market prices, and Government support prices also play a critical role giving us the model below as adopted from (Mumvuma, 2002):

Qt = f(Qt-1, Pt Pgt, Ft, Rt, D) where

Qt = maize output in year t

Pgt= Government price support

Pt = market price

Ft = fertilizer price

Rt = rainfall received

D = dummies for major policy support.

This form the basis model of this study as guided by literature outlined in this study.

III. METHODOLOGY

The study had its prime focus on establishing the impact of Government maize support programmes on ensuring food security. A survey design was used to obtain and analyse quantitative secondary data. The use of quantitative data is objective because it eliminates bias which arises from the use of judgments when a qualitative approach is employed. The study made use of time series data of maize production, prices and support programmes covering the period 1980 to 2017.

The researcher used quantitative methodology to accomplish the aim of the study. The reason why quantitative research approach was chosen over qualitative is because it enables a meaningful comparison of data and responses across participants. Since the study aims to quantify the impact of Government maize support programmes, quantitative method was picked over qualitative. This method assists in measuring the variables and expresses the relationship between variables using effect statistics such as correlations, regression, relative frequencies, or differences between means. It will help establish the relationship between the variables.

The population of this study consists of all maize support policies that were implemented in Zimbabwe over the period 1980 to 2017. The study used purposive sampling and selected major maize support policies that were implemented by the Government over the period 1980 to 2017. Purposive sampling was chosen to give the researcher more freedom in data selection guided by the research objectives.

On data analysis, the study adopted the use of time series in estimation. This method does not consider the differences between the individuals across the time period hence it can be taken as an ordinary least squares technique. The study employed regression on the time series data. Although the method is criticized for failure to account for heterogeneity between individual observations, the researcher assumed that the method would produce unbiased and consistent estimates.

IV. RESULTS

Time series regression analysis was used so as to determine the impact of Government maize support programs in ensuring food security. Food security was measured as growth in maize production. In this chapter, descriptive and regression analysis results will be presented as well as a discussion of the findings made.

A. Descriptive Statistics

The tables below shows the descriptive statistics of the variables used.

Table 4.1: Descriptive Statistics

	Q_t (000t)	P_t (US$/t)	P_{gt} (US$/t)	F_t (US$/t)	R_t (mm)	D_t (=1 when policy)
Mean	1433.789	268.9737	284.3421	4139.053	51.94211	0.368421
Median	1428.000	277.5000	305.0000	3339.500	53.73000	0.000000
Maximum	2952.000	510.0000	500.0000	10005.00	74.32000	1.000000
Minimum	360.0000	120.0000	120.0000	488.0000	33.20000	0.000000
Std. Dev.	721.3622	87.97435	102.1669	2936.340	10.44774	0.488852
Skewness	0.380519	0.239611	0.284195	0.417220	0.102097	0.545545
Kurtosis	1.966625	2.983936	2.624414	1.837014	2.501020	1.297619
Jarque-Bera	2.607819	0.364028	0.734874	3.243975	0.460237	6.473580
Probability	0.271468	0.833590	0.692507	0.197506	0.794439	0.039290
Sum	54484.00	10221.00	10805.00	157284.0	1973.800	14.00000
Sum Sq. Dev.	19253448	286361.0	386208.6	3.19E+08	4038.743	8.842105
Observations	38	38	38	38	38	38

From the descriptive results from Table 4-1, all variables have high standard deviations for period of the study suggesting that the variability of their values was high over time. The highest maize output (Qt) was 2,952,000t with a minimum of 360,000t and a mean of 1,433,000t resulting in high variance. High variability in maize output reflects different characteristics in each and every farming season. Market price (Pt) was also very volatile as shown by a high of US$510/t and a low of US$120/t. The same was noted for Government maize support price (Pgt) with a maximum price of US$500/t and a minimum of US$120/t as well as fertilizer price (Ft),

US$10,005/t (maximum) and US$488/t (minimum). The high variability in prices may be result in changes in production as well as high economic volatility over the study period. Rainfall (Rt) has also high variance highlighting to some extent change in climate conditions. The country recorded highest rainfall of 74mm and lowest of 32mm. These variables are however expected to have high variability as there were many changes even in the structure of the economy over the study period. Dt is a dummy variable measuring major policy support. It takes values either 1 for major policy support or 0 when there is no policy support. For detailed policies and data refer to Appendix 1.

The Jarque-Bera results suggest that all variables are statistically significantly different from a normal distribution model. However, the normality distribution assumption though necessary may be ignored as it is just for convenience. The estimators will still remain unbiased and efficient. Data diagnostic tests were done and the results are discussed in the next section.

B. Diagnostic Tests

The researcher conducted diagnostic tests to guard against the possibility of obtaining and interpreting spurious regression results. The results of the tests are presented in the tables that follow.

C. Multicollinearity Test Results

The results of check for severe multicollinearity are presented in Table 4-2 below. The results showed that the problem of multicollinearity did not exist because all the correlation coefficients were within the recommended range of no multicollinearity which is -0.8 to 0.8. Hence all the variables were retained for use in estimations.

Table 4.2: Correlation Matrix

	Q_t	P_t	P_{gt}	F_t	R_t	D_t
Q_t	1.000000	-0.6069767	-0.568144	-0.400078	0.777245	0.198193
P_t	-0.669767	1.000000	0.670417	0.630166	0.197255	-0.088379
P_{gt}	-0.568144	0.670417	1.000000	0.490468	0.094067	-0.105950
F_t	-0.400078	0.630166	0.490468	1.000000	0.169131	0.063551
R_t	0.777245	0.197255	0.094067	0.169131	1.000000	0.186643
D_t	0.198193	-0.088379	-0.105950	0.063551	0.186643	1.000000

Table 4-2 also shows that the dependent variable output (Qt) is negatively correlated to market price (Pt) and Government maize support price (Pgt). This is as expected and satisfies the law of demand which suggests an inverse relationship between output and prices. Fertiliser prices (Ft), the major cost in maize production are negatively correlated to output (Qt) implying that a rise in fertilizer prices will result in fall in maize output. Rainfall (Rt) has a positive relationship with output (Qt) supporting the notion that maize farmers in Zimbabwe depend more on natural rainfall. A rise in rainfall implies an increased maize production. Government support as measured by a dummy variable (Dt) has a positive but weak relationship with output. The relative strength of the variables will be further explained after regression results but the correlation matrix has provided the expected signs.

Multi-collinearity between explanatory variables may result in wrong sign in the estimated coefficients and biased standard errors of coefficients (Pazvakavambwa, 2009). To overcome this problem, VIF test was conducted. That means, the larger the value of VIF indicates the more collinearity of the variables with each other. According to the rule of thumb, if VIF of a variable exceeds 10, the variable is said to be highly collinear (Robertson, 2009). The variance inflation factors (VIF) was done and the results are presented in table 4-3 below.

Table 4.3: Variance Inflation Analysis

Variable	VIF	1/VIF(Tolerance)
P_t	1.84	0.542937
P_{gt}	1.71	0.584794
F_t	1.58	0.632050
R_t	1.51	0.660930
D_t	1.46	0.686811
Mean VIF	1.52	

Based on the results, there is no multicollinearity problem in this study. This is due to the fact that the mean of VIF of variables is 1.52 which is much lower than the threshold of 10. Furthermore, the VIF for each variable is also very low. This indicates that the explanatory variables included in the model were not correlated with each other. This means that the explanatory variables are the basic determinants of maize output in Zimbabwe which was used as a proxy for food security. This of course enhances the reliability of regression analysis. However, to reach such conclusion, this has to be supported by regression result after the appropriate model is applied as discussed in the upcoming sections.

D. Regression Analysis

As outlined in Chapter 3, the general to specific approach was used, eliminating all insignificant variables to come up with the final results. A time series regression model was done and the results are presented in table 4.6. All variables except the dummy variable capturing policies were first transformed to their natural logarithms since the model is in natural logarithm form.

The model is of the form below:

$$LnQt= \alpha + \beta 1 lnQt-1+ \beta 2 lnPgt + \beta 3 lnPgt-1+ \beta 4 lnFt + \beta 5 lnFt-1 +\beta 6 lnRt + \beta 7 lnRt-1 + \beta 2 lnPt + \beta 3 lnPt-1 + Dt+ \mu t$$

Where:

Qt = maize output in year t

Pgt= Government price support

Pt = market price

Ft = fertilizer price

Rt = rainfall received

D = dummies for major policy support.

μt =error term capturing unobservable factors assumed to be normally distributed.

Table 4.4: Regression Results

Dependent Variable: Qt
Method: Least Squares
Date: 08/24/18 Time: 21:51
Sample (adjusted): 1981 2017
Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.461434	2.473066	3.017078	0.0056
Q_{t-1}	0.057237	0.197423	0.289923	0.7742
P_t	-0.353695	0.691404	-1.511560	0.1133
P_{t-1}	0.329365	0.816851	4.403213	0.0001
P_{gt}	0.326580	0.680587	1.479851	0.2053
P_{gt-1}	0.653497	0.636401	3.026864	0.0139
F_t	-0.531587	0.380926	-3.395513	0.0047
F_{t-1}	-0.620230	0.391359	-1.584809	0.1251
R_t	1.336324	0.439929	3.037590	0.0054
R_{t-1}	0.859883	0.436335	2.970693	0.0495
D_t	0.007827	0.169686	2.222925	0.0253

R-squared	0.818675	Mean dependent var	7.108557
Adjusted R-squared	0.633550	S.D. dependent var	0.544594
S.E. of regression	0.444587	Akaike info criterion	1.458429
Sum squared resid	5.139087	Schwarz criterion	1.937351
Log likelihood	-15.98094	Hannan-Quinn criter.	1.627271
F-statistic	12.01758	Durbin-Watson stat	1.982851
Prob(F-statistic)	0.000926		

The table above summarises the regression results. R-squared value at 81.9% and Adjusted R-squared value of 63.4% indicates the amount of variance in the dependent variable output (Qt) explained by all explanatory variables, lagged market prices, Government support price, fertiliser price, rainfall and the dummy capturing Government major support policy. The R-square values indicate that the model is a good fit. The Durbin-Watson stat at 1.98 which is less than 2 indicates that the residuals are not serially correlated.

Using the individual t-test, previous year market price (Pt-1), previous year Government maize support price (Pgt-1), current fertiliser price (Ft), current rainfall (Rt), previous year rainfall (Rt-1) and Government policy support (Dt) are all statistically significant at 5% level whilst previous year output (Qt-1), current market price (Pt), current Government maize support price (Pgt) are not statistically significant. Using the statistics in Table 4-6 to fit in the model specified in chapter three, the following regression model was established:

$$Ln(Q_t) = 7.46 + 0.33ln(P_{t-1}) + 0.65ln(P_{gt-1}) - 0.53ln(F_t) + 1.34ln(R_t) + 0.86ln(R_{t-1}) + 0.01D_t$$

$R^2 = 0.818675$

The table and model above shows the outcome of the regression of maize output using time series data techniques and the interpretations of each statistic is discussed below.

E. Interpretation of R^2

An R2 coefficient of 0.818675obtained from the estimated model means that 81.9% variation of the independent variables used to estimate the model was able to explain variation in the dependent variable. The result makes sense because there are other factors such as managerial input and macro-economic factors that were not included in the model but could help in explaining food security. These factors were accounted for the in remaining 19.1%.

F. Interpretation of the Adjusted R^2

The adjusted R^2 measures the proportion of the dependent variable that explains the independent variables. An adjusted R^2 of 0.633550, shows that roughly 63.4% of the dependent variable variation was able to be explained by the independent variables which makes it a good model.

G. Interpretation of the F-statistic

The F-statistic tests the fitness of the model and a recommended F-statistic should be greater than 5 for it to be considered fit. The study obtained an F-statistic of 12.01758 which is greater than 5 hence the model was fit for estimation.

H. Interpretation of the Dubin Watson Statistic

The Durbin Watson test is used to check for the autocorrelation assumptions that imply zero covariance of error terms over time. That means errors associated with one observation are uncorrelated with the errors of any other observation. If the Durbin Watson computed is nearest to 2, it is assumed that there is no autocorrelation problem. Thus, as shown in Table 4-6 the computed Durbin Watson in this study was 1.98 which is nearest to 2 implying the absence of autocorrelation problem. Thus, this implies that error terms are not correlated with one another for different observations in this study.

IV. DISCUSSION

From the study, previous year market price (Pt-1), previous year Government maize support price (Pgt-1), current fertiliser price (Ft), current rainfall (Rt), previous year rainfall (Rt-1) and Government policy support (Dt) were found to be statistically significant and therefore adopted as the major explanatory variables on maize output. Previous year output (Qt-1), current market price (Pt), current Government maize support price (Pgt) were not statistically significant and therefore were discarded from the model. However, each and every variable will be discussed in this section but more emphasis will be on variables that were found to be statistically significant which makes the model.

$$Ln(Q_t) = 7.46 + 0.33ln(P_{t-1}) + 0.65ln(P_{gt-1}) - 0.53ln(F_t) + 1.34ln(R_t) + 0.86ln(R_{t-1}) + 0.01D_t$$

$R^2 = 0.818675$

From the model, the impact of each and every variable except for current rainfall (Rt) on maize output is inelastic as the coefficients are less than one. Current rainfall (Rt) has an elastic impact on maize production (β=1.34) implying that a 100% increase in rainfall received in that current year will lead to a 134% increase in maize output, the measure of food security. Inversely it also implies that a 100% decline in rainfall received will worsen the food security situation by 134%. Previous year's rainfall (Rt-1), although inelastic (β=0.86) has the second highest impact on food security. A 100% improvement/drop in rainfall in the previous year, will lead to an 86% improvement/drop in food security. Same explanation may be given to previous year market price (Pt-1, β=0.33) and previous year Government maize support price (Pgt-1, β=0.65).

Current fertiliser price (Ft) have a negative inelastic impact on food security (β= -0.53) implying that a 100% increase in fertiliser prices will worsen the food security situation by 53% whilst a 100% decline in fertiliser price will improve the food security situation by 53%.

Government major maize policy support which was captured by a dummy variable (Dt) was found significant but with the least inelastic impact closer to zero (β=0.01). This implies that availability of Government major maize support leads to a 1% increase in maize output or food security. Current market price and Government support price were found to have insignificant impact as maize production takes long and farmers are more of adaptive when making decisions.

Based on previous studies and the findings of this study, this section discussed the general result obtained via regression analysis. Referring to literature, the result of the impact of Government maize support in ensuring food security are discussed in this section. Thus, result of the finding was discussed in relation to the previous empirical and theoretical evidences.

A. Effectiveness of Government Maize Support Programs

Taking into consideration the basic aim of this study, which was to examine the effectiveness of Government maize support programmes in ensuring food security in Zimbabwe, the estimation results of the time series regression model that presents the impact of explanatory variables on maize output (measure of food security) were discussed as follows:

Maize Support Programmes

The results indicate that major Government maize support programmes have a significant but inelastic impact on maize output. Major maize support programmes that were analysed include Command Agriculture, Operation Maguta, Fast track land reform, Growth with Equity, ESAP reforms among others. Of significance is that major policy support has the least impact on ensuring food security. This result confirms the finding of study conducted by (Mumvuma, 2002) and (Cousins, 2003) in Tanzania which showed that major policy support have increased the production of the subsidised crops, and increases the agricultural productivity particularly in places where support is offered non-politically. However, of concern is the weak impact (β=0.01) it has on food security which to some extent highlight the ineffectiveness of some of the policies as also found by (Dixit, 1998) in his study in Wedza. Government major policy support may have positive impact but it can be concluded that its relatively weaker in ensuring food security.

Government Maize Support Price

The coefficient for log of Government maize support price is statistically insignificant as expected. The output in a current period is not influenced by the price prevailing in the particular period. The biological lags characterising agricultural production prevents changes in output following a price increase not be realised immediately. Output in the current period is usually as a result of decisions made in earlier periods, based on what producers' expected prices would be when the output is ready for sale. The expectations are therefore formed in the previous period based on past prices and all other information available at the disposal of producers (Mumbengegwi, 2003).

Coefficient of the first lag of log of Government maize support price is positive and significant, showing that maize production increases with output price, but the response is realised with a lag. From the estimated coefficient, the calculated elasticity value of 0.65 was obtained which implies that a 10 percent increase in Government maize support price, would raise production of the crop by only 6.5 percent. Thus maize output responds less proportionately to a price increase. However, the elasticity estimate is higher than those reported in earlier studies (Ghimire, 2001). It therefore can be deduced that Government support price is more effective than just policy.

Market Price

Just like Government maize support price, the coefficient for log of market price is statistically insignificant as expected. The output in a current period is not influenced by the price prevailing in the particular period. However coefficient of the first lag is significant (β=0.33) implying that farmers' expectations are adaptive implying that they attach more weight to the most recent prices when making production decisions. The finding supports arguments in (Matutu, 2013),(Pazvakavambwa, 2009), (Zhou, 2006), (Zimbabwe Independent, 2016) and (Zimbabwe Independent, 2016). Of interest is that farmers respond more to Government support price (β=0.65) than market price (β=0.33) highlighting to some extent the structure of the maize market which is generally Government dominated.

Fertiliser Price

The coefficient of log fertiliser price is negative and statistically significant. The computed elasticity estimate shows that in the long run, other factors held constant, an increase in the average fertiliser price by 10% would reduce maize output by 5.3%. Maize requires heavy intake of nitrogen and phosphorus for a good crop ((Rukuni, 2010). Continuous cropping heavily depletes soils of these nutrients, so that if replenishment through application of fertilisers is not possible, then yields would fall. The consequence is reduced output. The negative response could therefore be due to lower yields in the crop as a result of reduced use of fertilisers as prices go up. It could also be due to reduced acreages cultivated as profit margins on commercial production narrow down with increased costs of fertilisers. The inelastic response of maize output to fertiliser price is due to low intensity of fertilizers use by large proportion of maize growers in Zimbabwe (Mumvuma, 2002).

Rainfall

Rainfall was found to have the greatest impact on food security highlighting the reliance of Zimbabwe's farmers on natural rains. The coefficient for the log of rainfall is positive. This implies that in the period of higher rainfall, maize production increases. The response is elastic showing that maize production increases more than proportionately to increase in rainfall received. The reverse is true in times of poor rainfall when maize production falls more than the drop in rainfall pattern. The findings support the notion of (Mashakada, 2013) who advised that Government programmes should focus more on improving irrigation facilities to ensure food security.

Table 4.4: Comparison of Quantitative Finding on Maize Support

Author	Year	country	Model	Finding on Variables Used (Sign and Significance)									
				V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
Olwande et al., 2009	1976-2006	Kenya	ARD		-**		+**			+*	+*	+**	+**
Madala (2001)	1987-1998	Kenya	OLS				+*		+*				+*
Mbithi (2000)	1975-1990	Kenya	EC		-*	-*		+*	+*	-*		+*	+*
Aloyce et.al. (2014)	2004-2008	Tanzania	ARD		-*								
Kato (2013)	1998-2011	Tanzania	ARD						+*				+*
Kibarra (2005)	1995-2000	Nigeria	OLS				-*		+**		-*		+**
Yawson et.al (2010)	2007-2009	Ghana	ADR						+*				+*
Chinsinga (2010)	2002-2006	Malawi	OLS			-*	-*	-*		-*	-*	-*	
Gilbert et al (2013)	1990-2011	Zambia	ARD				+**		+*		+**		+*
Gilbert et al (2013)	1990-2011	Zambia	ARD		+*	-*	-*			-*	-*		
Mudzonga et al (2009)	2005-2008	Zimbabwe	OLS					-*				-*	

Note

-*negative and significant, -** negative but insignificant, +* positive and significant, +**positive but insignificant.	**Models** OLS – Ordinary Least Squares ARD – Autoregressive Distributed Lag Ec – Error Correction

V1,V2,V3,V4,V5,V6, V7, V8, V9, V10 represents Lag output, Market Price, Lag Market Price, Government Support price, Lag Government Support Price, Fertiliser Price, Lag Fertiliser price, Rainfall, Lag Rainfall and Major Policy support, respectively

V. CONCLUSION

The study looked on the effectiveness of Government maize support programmes in ensuring food security in Zimbabwe over the period 1980 to 2017. Basing its theoretical framework from the theory of production function and the sustainable livelihoods model, the study found that Government support has a positive but inelastic impact on maize output. The findings also show that maize production respond positively to its previous output price, Government maize support price, favourable weather, major Government policy support and availability of cheap fertilisers. Output of the crop respond negatively to increase in average fertiliser price.

The elasticity estimates show inelastic responses to maize output price, Government maize support price, fertiliser price and Government major policy support. The inelastic response for most of the variables show that a comprehensive policy combining both price and non-price incentives is required to raise maize output in Zimbabwe. Further the elastic responses to rainfall show that a volatile climatic environment would be devastative to food security in the country As such the findings suggest that Government support should also be stretched to infrastructure, dams and water reservoirs creation.

Based on the findings, the study comprehends the following conclusions.

- Major policy support has a positive but relatively weak impact on maize output. Maize output responds to Government policy support but the response is very much inelastic.
- Current prices, both market price and Government support price have no impact on maize output. This means that farmers do not respond to current prices as there is a time lag in maize production.
- Previous market price and Government support price have a positive impact on maize output with Government maize support price having greater impact than market price. This implies that farmers are adaptive when making expansion decisions. The higher relatively impact of Government maize support price in ensuring food security to some

extent highlights the structure of the market and weaker productivity.

- Rainfall has a positive and elastic impact on maize output. More rains imply better food security a sign of overreliance on natural rains in farming. When rainfall is poor, the effects are devastating.
- Fertiliser prices have a negative and inelastic impact on maize output. This means that availability of cheaper fertiliser leads to improved food security.

From the study it is clear that the Government must support maize farmers through offering irrigation infrastructure. Input support schemes have a positive but weak impact on maize output whilst rainfall has a positive and elastic impact on food security. Construction of more dams and expanding farmland under irrigation will help farmers cushion the devastating effect of adverse weather.

Furthermore, to encourage increased maize output, the Government should put in place strategies that keep fertiliser prices low such as subsidising the input whenever possible, provision of information on cheap sources of fertilisers and waiving import duties on fertiliser imports. The Ministry of Agriculture should ensure that the extension services offered to small scale producers are effective and adequate to enable increased use of improved farming technologies.

On input support, the Government should put in place efficient and effective targeting mechanisms that are followed by a monitoring and evaluation mechanisms to ensure inputs reach the rightful people. However, there is also need for an exit strategy to remove the dependence syndrome among farmers and make them contribute to their farming activities.

Operations of the GMB should be re-evaluated and redefined so that the benefits of centralised marketing of maize accrue to majority of small scale producers and that prices are attractive. The Government should ensure that more resources on infrastructure development are directed to improving rural infrastructure.

Maize remains a critical and most consumed crop in the country and across the region hence maize production will forever remain a profitable enterprise. Farmers should aim to plan ahead and purchase part of their inputs as they wait for Government inputs support. More attention should be on irrigation infrastructure to limit the effects of adverse weather.

Fertiliser prices have a negative impact on maize output and farmers should continue lobbying the Government for support. Forming cooperatives and maybe import fertiliser on their own may help farmers' lower costs. Maize prices especially that by the Government has an impact on future output. Farmers should lobby for a higher price until the market of the crop is liberal.

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