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Trend Analysis and Determinants of Maize Production in Zimbabwe: (1990-2020)

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***Abstract** - The study analyzed the trend and determinants of maize production in Zimbabwe for the period between 1990 and 2020. In trend analysis, the study employed descriptive statistics, which revealed a downward general trend for the period under study. Based on the findings, maize production fell by around 35 percent between 1990 to 2020 owing to a combination of factors from prices, policies, and the climatic environment. Moreover, in analyzing the extent of the influence of price and non-price determinants on maize production, a Nerlovian supply response model was employed using time series data for the period under review. The findings indicated positive elasticities for both short and long runs of +0.72 and + 1.91 respectively. The results suggest that maize production was unresponsive to price changes in the short run but more responsive in the long run. The study recommends the setting up of a functional agricultural commodity market and liberalization of the maize market to make it attractive and eliminate efficiencies in the market and production. The study further recommends an amendment of the land tenure systems by making for instance 99-year leases transferable and bankable to attract capital from final institutions and boost agriculture production.*

***Keywords:** maize production, price, and non-price determinants, Nerlovian supply response model, Zimbabwe*

INTRODUCTION AND BACKGROUND

Mexico was the first country to grow Maize crops domestically some 10 000 years ago. As time progressed in the 16th through 18th centuries, maize became a popular gain crop around the world (Morris, 2004 cited in Chumo, 2013). The United States, China, and Brazil have become the world`s best and top maize grain producers around the world. Moreover, the growth of maize production in Africa has also been witnessed in Nigeria followed by Ethiopia, ascending as the biggest producer of maize grain in the Sub-Saharan region (Eticha, 2020). In Southern Africa Zimbabwe, among other countries has also been part of the maize-producing nations in the African Continent. In Zimbabwe, the Comprehensive Agricultural Policy Framework (2012) revealed that in the economy, agriculture is also of critical significance as it contributes around 15 to 18% to Gross Domestic Product (GDP).

Zimbabwe requires about 1 800 000 tonnes every year, with 500 000 tonnes under reserve. However, maize production and productivity have fallen short of meeting this requirement repeatedly since 1980 up to 2021. This has been partly because of various macroeconomics policies, which among others include ESAP (1991-1999), Fast Track Land Reform Programme (FTLRP) (2000-2008), Dollarization (2009-2013), and the ongoing Command Agriculture introduced in 2016 to enhance maize production. A plethora of these policies have also contributed to the sensitivity of maize production to changes in various price and non-price factors but the extent is not known. A lot of introspection in maize production has increased with the increase in global demand for maize had been projected to increase by 45% in the year 2020 from 1997 (James, 2003).

As a result of that, this study has taken a step advance in attempting to fill the empirical gap in the existing body of knowledge. This was done by including the maize producer price, maize seed price, wheat producer price, tobacco producer price, and yield per hectare, rainfall, among other variables in the analysis of determinants of maize production as well to understand their impact, relationship, and significance. A trend analysis on maize production in Zimbabwe was conducted to aid in providing a clearer picture of the varying effects of the determinants of macroeconomic policies on maize output.

Problem Statement

According to FAO (2019) Global Information and Early Warning System (GIEWS) report, about 5.5 million Zimbabweans are projected to have faced hunger between January and March 2020. Zimbabwe`s grain production and productivity have been declining early since1990s up to date. This has seen the country being a net importer of food for the past decades and failing to meet the national requirement of 1800 000 tonnes yearly. Despite government efforts to boost maize production to ensure food security, maize grain availability remains relatively low with high import bills amounted to US$ 282,5 million in 2020, averaging US$ 23.5 million per month (Mhotseka, 2021). It is also against this background that, this study further analyzes the maize production trend from 1990 to 2020, determining the sensitivity of maize production to price and non-price determinants under various macroeconomic policy paradigm shifts. This will contribute to the literature and also provide a greater significance towards policy making in the effort to address and solve food insecurity and improve productivity among other issues in Zimbabwe.

LITERATURE REVIEW

Models of Supply Response

Mamingi (1997) defined agricultural supply as the rate of change of agriculture production yield to change in price, presumptuous other things stay fixed. The impression reinforced by this meaning is that a price rise or reduction entails a similar complete variation in yield, leading to agricultural production supply being symmetric or reversible. Proponents of the neoclassical framework to supply-side sensitivity include the utilization of price and sacrifice cost as descriptive variables of supply-side response in the market that are competitive (Askara and Cummings, 1977). This means that state interference that alters or complements the market framework is not considered. The revised convention computation method retains the neoclassical model whereas adding the implications of the challenge of external government interference (Mamingi, 1997). State interventions or market supplements that lead to distortions are not included. The revised convention-devising method retains the neoclassical model while adding the implications of the risk of exogenous government involvement (Mamingi, 1997).

The Nerlovian Model

As of the discourse of economic theory, two general frameworks are utilized to perform supply output sensitivity examinations, specifically the supply function resulting from the Profit Function.

Approach together with Nerlove's supply output response framework (Sadoullet and De Janyry, 1995). The supply function resulting from the profit maximization background hinges on a profit function that permits price influences on input demand and supply output to be included in the analysis. In addition, it is assumed that the supply sensitivity is probable to be primarily limited to the distribution of profits between cultures or firms (Jayne and Nuppenau, 1994). Furthermore, Varian (1984) pointed out that the direct correlation between inputs and the highest output that can be attained for a given technology and time is a so-called production function.

Nevertheless, among other econometric models employed to give an estimation on agronomic supply output sensitivity that includes the Multinomial Logit and Profit Function Approach, Nerlove's model is ranked as one of the utmost leading and efficacious, as demonstrated by various research that incorporated this approach in their analysis (Braulke, 1982). Nerlove's model positions that supply output depends on anticipated price, supply output (area) alteration, and exogeneity determinants, leading it to become a more dynamic model. The dynamic model as hinted by Gujarati (1995) is pronounced as one where the time pathway of dependent factors is elucidated by their earlier values. The modified expression of the Nerlovian model remains an autoregressive model because it includes values from the previous period of the dependent factor (output) in the explanatory control variables. The equations below reflect the computations of the basic form of Nerlove's function for a yearly crop and it comprises three equational forms (Askari and Cummings, 1997).

$Ǣe_t = a_0 + a_1 P^e_t + a_2 z_t + v_t$ (i)

$Pr_t = P^e_{t-1} + \beta(Pr_{t-1} - P^e_{t-1})$ (ii)

$Ǣ_t = Ǣ_{t-1} + \delta(Ǣ^e_t - Ǣ_{t-1})$ (ii)

where:

$Ǣ_t$ = actual land area placed under farming at time ţ,

$Ǣ^e_t$ is anticipated land area to be allocated under farming at time ţ,

Pr_t is real price at time ţ,

P^e_t is anticipated price at time ţ, z_t represents more exogeneity variables influencing supply output at period ţ, and δ are referred to as the anticipation and adjustment constants correspondingly.

In the estimation of the maize output sensitivity by means of the Nerlovian model, requires the elimination of the unobserved variables connected with anticipated price and expected output from the first equation (i) through the third one (iii) Braulke, 1982). Removing stated variables leads to a reduced form of Nerlovian's equational expression. The overall procedure required to reach the transformed equational form is merely incompletely given in the literature (Nerlove, 1958) therefore, it is for this reason that it is encompassed in the research and shown below:

$Ǣ_t = ƀ_0 + ƀ_1 Pr_{t-1} + ƀ_2 Ǣ^e_{t-1} + ƀ_3 Ǣ^e_{t-2} + ƀ_4 z_t + ƀ_5 z_{t-1} + v_t$ (iv)

where;

$ƀ_0 = a\beta\delta,$

$ƀ_1 = a1\beta\delta,$

$ƀ_2 = (1 - \beta) + (1 - \delta),$

$ƀ_3 = -(1 - \beta)(1 - \delta),$

$ƀ_4 = \delta a2,\ ƀ_5 = \delta 2(1\beta)$

$v_t = \delta(v_t - (1-\beta)v_{t-1}$

Therefore, elasticity in the short-run is computed as:

$Ȩ = ƀ_1 / 1 - ƀ_2 - ƀ_3 * Pr / Ǣ$ (v)

(Braulke, 1982) states that elasticity in the long run as:

$Ȩ = ƀ_1 / 1 - ƀ_2 - ƀ_3 * Pr / Ǣ$ (vi)

where *Pr* and *Ǣ* are regarded as historical means of prices together with output correspondingly.

Specifying the Price

The decision facing this study is how to measure the producer price. Nerlovian novel model expresses real prices with respect to prices presently available from the market, while at the same time defining expected prices in respect of the historical market prices (Askari and Cumming, 1997). Therefore, Nerlovian hypothesizes that price exceptions are formed as follows:

$Pe_t = P^e_{t-1} + \beta(Pr_{t-1} - P^e_{t-1})$ (vii)

So that β, the expectation coefficient $0<\beta\leq1$. According to Gujarati (1995), the equation is identified as an adaptable expectations model and states that agents in the economy tend to review their price anticipations every farming season by a marginal β of the difference between real price from the preceding farming season and the anticipated price of the preceding farming period.

Therefore, individuals are considered to consider past producer prices experiences when forming their price expectations. Thus, utilizing the Nerlovian adaptive assumption model is viewed as excessively shortsighted. As Mamingi (1997) puts it, perhaps the main component in deciding the producer price is deciding on the deflator to be utilized. Producer price can be factored for inflation utilizing the producer price index, the consumer price indices, or the price guide for competing products. Utilizing the ostensible nominal producer price makes little economic sense when there is high inflation since farmers are more attracted by the real buying power of their proceeds money. Therefore, they base their decision on variations in actual producer price instead of variations in the face value prices. However, the limited availability of reliable data to analyze supply response or sensitivity in most developing countries, including Zimbabwe, limits the choice of deflator.

2.4.3 Specifying Quantity

Mshomba (1989) stated that literature provides a general discourse on what parameter to use for production output, given land size under production, the output produced; productivity ratio on a given area, or overall output in weight or quantity of tons produced. Askari and Cummings (1977) state that a correlation between anticipated prices and agriculture output producers' choices is better shown regarding area under production, as this is how farmers interpret their price anticipations in increasing or reducing production. Nevertheless, when considering the area under production, it is therefore presumed that growers may merely raise their production by responding to price inducements by using additional production land. This assumption was considered wrong because growers may well also upsurge their yields by cultivating their farming area through an intensive farming system. According to Leavers (2004) another explanation why the area under production cannot be a proper measure of output is that farmers can be constrained by land size area they have to increase production. In the same vein, farmers can raise production even if the producer price increase as they are limited by the land size to increase capacity and respond to price inducements.

According to Leavers (2004), using production per unit is also faulty because it presumes that farmers are sensitive to price rises merely if more output is produced, hence output per hectare rises. He goes on to claim that; this parameter is faulty because it does not address the likelihood which asserts rising prices possibly will lead to decreases in yield productivity over hectare due to lower quality boundary areas being farmed.

The best measure of production would be using actual product weight, as it recognizes that growers can be sensitive to price inducements by opting either for a highly intensive or extensive farming system. In addition, tonnage data is readily available, giving the measure another benefit (Leaver, 2004).

2.4.4 Specifying Z

According to Askari and Cumming (1977), to measure the influence of a crucial off-market determinant influencing farming production, variable Z needs to be included in the model. As suggested by the literature, the furthermost regular stratum variables include climate, which in most cases is measured using precipitation together with a time variable pattern used for the representation of progress in technological advancement as well as more agricultural practices with time progress (Mamingi, 1997). In addition to other variables, precipitation is counted as a dummy variable because it is in eras where excessive precipitation causes flooding, performance decreases rather instead of going up. Seasons with ideal precipitation ought to be denoted by 1, whereas another time period of excess or deficit from average precipitation should be assigned a value of zero. Furthermore, Askari and Cumming (1977) rationalize the insertion of the variable of time than using an explicit variable to solve the problem of missing data or multicollinearity between variables. However, to capture omitted variables, the time trends are used as a last option meanwhile the main goal being to reveal the effects of explicit factor variables (Mamingi, 1997).

REVIEW OF EMPIRICAL STUDIES

In Swaziland, Dlamini et al. (2021) analyzed the supply sensitivity of maize output from pricing and non-pricing factors for the period 1968-2017. Rainfall and agricultural policy are the non-price factors considered in this study. The study used cointegration together with vector error correction modeling methods to provide an estimation for the short-run as well the long responsiveness of maize supply to pricing policy and non-pricing factors in Eswatini. The results confirm that non-pricing determinants seem to be imposing a greater impact on area response over the long run.

More so, Mesike, Okoh and Inoni (2010), employed the vector error correction model VECM, an output response on rubber in Nigeria was estimated for the period 1970-2008. Production was utilized as a mathematical function of control variables. These include producer prices, time trends, and forex exchange rate as well as lagged output. In analyzing data, Johansen`s maximum likelihood method together with the VECM was utilized. The author used this method, as it is good in overcoming false correlation challenges allied to data on time series nature. The results showed a positive relationship between price and supply output. Other control factors include advice, research, weather, and substitute were insignificant.

Moreover, Muchapondwa (2008) used a dynamic single regression to cointegration in a study to estimate the overall supply output sensitivity on tobacco for Zimbabwe under the period 19791999. The model captured equally short-term and long-term changing aspects when testing for the presence of cointegration. It noted the likelihood of inverse causation, which inferred the lack of poor exogenous variables. He concluded that output least responded to price stimulus, whereas it had a coefficient of 0.18 price elasticity, suggesting farm pricing procedure was viewed as a focused tool to induce agricultural supply growth.

Chikwaiti (2014) estimated the tobacco output sensitivity to pricing policy and non-pricing determinant factors in Zimbabwe between 1980 and 2010. In its analysis, the study adopted time series data model analysis applying the usual regression to the Nerlovian model. The results obtained showed a positive 0.41 elasticity in the short run whereas 0.81 elasticity was obtained in the long run, suggesting that growers of tobacco were so insensitivity to price inducements, implying that farm pricing policy is somewhat misdirected in targeting growth in agricultural crop production.

METHODOLOGY

Descriptive statistics

The study starts by providing descriptive statistics to analyze output, productivity, and area under-production trends. This was done to determine the maize production trend. Statistical measures of dispersion include standard deviation, average production, and lowest to highest points in yield, output, and production area shown on bar and line graphs to summarize the data and determine the trends.

Estimation of the Maize Supply Sensitivity

The study employs a typical supply sensitivity model underpinned by the Nerlovian framework model. The model is based on partial adjustment in output and adaptive anticipations. Further to that, a natural log-linear expression is adopted in a case where mass output put to the market is examined compared to the natural log of control variables, and the most common Ordinary Least squares are employed in estimating the equations.

Variable factors that do affect maize are also part of the model. These variables include average annual rainfall and temperature. These factors also contribute towards the proper growth of maize crops with an average ideal rainfall of 650 millimeters (mm) annually and above is suitable for maize production coupled with an average temperature of around 25 degrees. These variables are included in the model as time series.

The significant effect of a land reform program (FTLRP) is similarly encompassed to factor in the impacts of variations in macroeconomic policy on maize output. A dummy variable is employed where 1 represents the years in which land reform policy was in effect and 0 years that did not have a land policy.

The supply response model gets to be computed as;

$$\mathbf{lnOutput_t = b_0 + b_1 lnRMP_{t-1} + b_2 lnOutput_{t-1} + b_3 lnRTP_{t-1} + b_4 lnRWP_{t-1} + b_5 ARF_{t-1} + b_6 Y/hat + b_8 lnINF_{t-1} + b_7 Landpolicy_t + Time_t + u_t}$$

where lnOutputt = natural log of maize supply output production year t, quantified in tons; $lnOutput_{t-1}$ = natural logarithm of maize output produced in year $_{t-1}$;

$lnRMP_{t-1}$ = natural logarithm of real maize price, quantified in US cents for each 1000grams at time $_{t-1}$;

$lnRTP_{t-1}$ = natural logarithm of real tobacco price quantified in US cents for each 1000grams at time $_{t-1}$;

$lnRWP_t$ = natural logarithm of wheat seed price, shown in US dollars at time t;

$lnRWP_{t-1}$ = natural logarithm of real wheat price, shown in US dollars for each tons at time $_{t-l}$

ARF_{t-1} = average annual rainfall, expressed in millimeters (mm) at time $_{t-1}$

Land policy = dummy variable is employed where 1 represents years in which land reform policy was in effect and 0 years that did not have land policy.

$\ln INF_{t-1}$ = natural log of general price level (cpi) at time $_{t-1}$

Time = Time movement (t = 0 for 1990 up to t = 30 for 2020)

U_t = error term

Elasticity in the short run is interpreted as of real price parameter b1 whereas in the long run, it is calculated by $b_1/ 1- b_2 – b_3$. The regression model has overall challenges of yielding estimates that are not biased only beneath certain particular circumstances and depend on quantitative data. It therefore, poses a challenge for researchers to identify factors that are not tangible yet influence supply output. More so, more often than not, these models of regression find it difficult to separate causal relationships and correlations between or among variables.

On the other hand, the benefit of using the log-liner specification is seen in that it gives elasticities and these estimates are consistent by the mark where they are measured. More so, short-run elasticities are just coefficient estimates of price variations. Production lagged once reflect a positive influence and substantial at 5% level significant, signifying that a rise in production in period one is trailed by a rise in production in the upcoming farming season. It is happening because farmers are motivated by the commitment to cover their overheads expense.

RESULTS AND DISCUSSION

Aggregate Maize Production performance 1990-2020

Table 1 displays a brief containing four descriptive statistics revealing the total production patterns.

Table 1: Descriptive statistics overview for maize production

Variables	Mean	Maximum	Minimum	Standard deviation
maize production (tonnes)	1,280 456.16	2, 357 152	361 900	550698.588
maize yield (tonnes/ha)	0,96	1.72	0.29	0.38
Maize area planted (ha)	1, 350 952.29	2, 043 941	447 926	332421.273
Price of wheat (us$/kg)	4,00	11,01	1.49	2,24
Tobacco producer price	2.36	3.67	1.24	0.67
Inflation (%)	568.87	24411.03	0.36	24411.03
Rainfall (mm)	652.71	974.87	411.52	137.09

Source: Own Computation

The four statistics for the period 1990-2020, namely mean, standard deviation, maximum, and minimum for maize production trends are summarized in Table 1 above. As revealed in Table 2, the overall production area planted with maize averaged 1,350,952.29 hectares given the highest mark of 2,043,941 hectares and the lowest mark of 447,926 hectares for the period 1990 to 2020

Table 2: Four policy phases averages and percentages (%) changes maize area harvested, Yield and Output

	Maize Area planted (ha)	Yield (tons/ ha)	Output (tonnes)
ESAP era (1991-1999) **National Average**	1, 331 276	1,1033	1, 491 719.44
FTLR era (2000-2008) **National average and** % changes	1, 628 576 **+ 22,3**	0,8548 **-22,5**	1, 380 567.77 **-7,4**
Dollarization era (2009-2015) **National average and** % changes	1, 411 039 **- 13,4**	0.7064 **-17.4**	987 621.6 **-28,5**
Command Agriculture era (20162020) **National average and** % changes	1, 005 683 **-28.7**	1.0017 **+41.8**	990 558 **+0.30**

Source: Own Computation

Table 2 divides phases into four periods, namely 1990-1999, 2000-2008, 2009-2015, and 2014-2020. For the period of the ESAP era 1990- In 1999 the planted area averaged 1,331,276 hectares, but from 2000 to 2008 (FTLRP) it increased to 1,628,576 hectares, a growth rate of 22.3 percent. In addition, the maize acreage took a knock from the (FTLR) era to the dollarization era of 20092015 to 1, 411 039 hectares reflecting a 13.4 percent decline. For the period 2014-2020, the Command Agriculture era maize planted area took a further significant knock to 1, 005 683 hectares reflecting a 28,7 percent decline.

The average yield for the period fell from ESAP to FTLR era by 22.5 percent from 1.1033 to 0.854 tons per hectare and then took a sharp upward trend from -17.4 percent to 41.8 percent as the Production transitioned from dollarization to the Command Agriculture phase. Maize yield appears to correlate mainly with annual rainfall levels, reflected in the lowest 1992 figure of 0.41 tons per hectare, which matches the lowest precipitation number of 1991-92, which also resulted in the lowest maize production figure of 362,900 tons still in the same period.

The characterization of the maize production trend has shown that maize production has indeed fluctuated and generally shown a downward trend. This is attributed to various determinants that include among others decreased output per hectare, government macroeconomic policies such as Economic Structural Adjustment Program (ESAP), dollarization, and an unstable macroeconomic environment, as well as agricultural and pricing policies. National maize production fell 28.4%, driven by a 17.4% drop in productivity.

Regression results are described in Table 3. The outcomes above reflect a comparatively good fit for the model estimated as shown by an R-squared of 0.76, while the adjusted R squared is 0.67. The results revealed in Table 3 above reflect that the measure of expectation one period lagged price, lagged output together first and second season, rain, and time movement coefficient are showing a substantial effect on maize supply. Wheat and Tobacco real prices were not significant, hence not presented in the table 3. The actual price variable constant shows a positive sign and is substantial at the 10% significant level, indicative of the effect of price on maize output. Therefore, a price upsurge is likely to be accompanied by a rise in maize yield in the subsequent year. These findings advocate that most farmers mainly consider information from the previous year's prices when making decisions to increase production.

Table 3: Nerlovian Regression results for the Maize Supply Response 1990-2020

Dependent variable lnOutput		
Independent Variable	coefficient	t- statistic
Constant	6.650806	.116
$LnRMP_{t-1}$	.7176067	.060*
$lnOutput_{t-1}$	.582925	.016**
$lnOutput_{t-2}$	-.12062599	.037**
$Land\ Policy_t$	- .6693	.0316**
Time	1.911103	.088*
$Rain_t$	-.000466	.025**
R squared = 0.76		
Adjusted R = 0.67		
Durbin Watson = 1.9	Observation = 31	

** significant level **5% and * 10%*

Source: Own Computation

In addition, yield padded once and two times have a positive influence on maize production at a 5 percent significant level; this suggests that a surge in yield in one year will be trailed by raised yield in the next farming year. This is due to the farmer's income earned in one period and being utilized in the next period as capital hence an increase in the production capacity more than the previous period. For the precipitation variable, once annual precipitation gets below 610 millimeters or over 1000 millimeters, maize output declines hence the inverse relationship parameter of the precipitation determinant that was substantial at 5 percent. In the same vein, Gwara (2011) found a positive link between maize supply output and the amount of rainfall, the insinuation hence according to findings was that rainfall is of critical importance in determining maize production in Zimbabwe. In the same vein, both excess and too little rain cause a downward maize output trend. The constant of the time variable reflects that progressive technology through time movement influenced maize supply estimate to an increase of 19.1 percent each year.

Diagnostic Tests on the Supply response model

To check the normality of residuals the study employed the Jarrque Berra statistic test, which was found to be 0.032 with a p-value of 0.98 confirming that they are indeed showing a typically normal distribution. This diagnostic result is crucial for the reason that it points to the validity of t and F. The Durbin-Watson test value of 1.9 prevents a conclusion to be made concerning the presence of autocorrelation on residuals. Hinged on the diagnostic result the employed model is regarded as satisfactory in its specification.

Supply Response Model Elasticities.

Table 4: Maize production elasticities for Zimbabwe from 1990-2020

Shot-run elasticity	.72
Long run elasticity	1.91

Source: Own computation

Maize production has positive elasticities for both long-run and short-run as displayed in Table 4 above and the short run falls in the inelastic range while the long run falls in the elastic range. This infers that Zimbabwe maize growers are comparatively less sensitive to output price changes in the short run while further sensitive in the long run. This implies a greater percentage in producer price leads to a less than proportionate change in output in the short run. Therefore, the finding further confirms that non-price determinants like land reform policy together with rainfall had a negative influence on maize output. As reflected from the findings above, it demonstrates that a ten percent increase in the real price of maize will lead to a rise in maize supply of about seven percent in the period where one factor of production is constant and nineteen percent in the long term.

As shown in Table 4, farmers are less sensitive to their producer price change in the short run compared to the long run period. The results reflect that farmers have limited time to increase production capacity to respond to price inducements in the short run and it is also because, in the short run, some factors of production are constant, whilst in the long run all factors are flexible. This inelastic response to price inducements in the short run is similar to what Gwara (2011) obtained when estimating the supply response on Zimbabwean wheat production. Chikwaiti (2014) estimated a supply response for tobacco in Zimbabwe. The results obtained, reflected a positive 0.41 in the short run and was lower than the elasticity of positive 0.81 in the long run, which proposes that farmers are more insensitive to producer price inducements meaning that the agriculture pricing procedure somehow required refocusing of the instrument to achieve growth in agricultural production.

Moreover, the high cost of factors of production such as capital, which relate to opportunity cost is associated with scarifying maize production for substitute crops such as wheat and tobacco. One more reason why the price elasticity of maize supply was more elastic in the long run could be due to it being an easy crop to grow than attractive cash crops, which are more profitable.

CONCLUSION, POLICY IMPLICATION AND RECOMMENDATION

The study`s findings shed more light on the extent of domination of the maize production in Zimbabwe. They reflect the unresponsiveness of Zimbabwean maize farmers to maize price changes in the short run due to the high fixed costs of mechanized equipment necessary to boost maize production capacity that translate into large opportunity costs associated with not growing maize production. Maize production has proved to be responsive to price changes in the long run where farmers are assumed to have raised sufficient income to purchase mechanized equipment and hence respond to price increases by increasing output. However, the land reform program between the 2000-2008 era brought about a massive increase in the maize production area, which saw the birth of the majority of smallholder farmers to redress the colonial legacy in favor of communal farmers which resulted in a decline in maize agricultural production.

Due to recurring droughts that have incurred over the period under study, the results have also revealed a rainfall deficit or excess reduces maize production. Hence in times of recurring droughts, there is a need to invest in irrigation schemes to boost national maize output. Maize production is influenced by both price and non-price determinants, thus there is a need to consider them as significant in the crafting of agricultural policies that influence agricultural crop supply. Based on the findings maize production fell by around 35% between 1990 and 2020 owing to a combination of factors from prices, policies, and the climatic environment. The study recommends the setting up of a functional commodity and liberalization of the maize market to make it attractive and eliminate efficiencies in the market and production. The study further recommends an amendment of the land tenure systems by making for instance 99-year leases transferable to attract capital from final institutions and boost agriculture production. Policies that have a narrow focus might not be an idea because crop production depends on numerous factors and some which cannot be quantified. The study was conducted using regression analysis; applied to the Nerlovian Supply response model that ignores the farmers' reaction to risk when deciding to increase output. Therefore, future studies should include indicators of risk such as standard deviations of price and yield as proxies for risk in the model estimation.

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