

## The Effects of Monetary Policy on Agricultural Output in Eswatini

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### Abstract

The agricultural sector in Eswatini is viewed as an engine to foster economic growth, reduce poverty and eradicate inequality. The purpose of the study was to investigate the effects of monetary policy on the agriculture Gross Domestic Product (GDP) in Eswatini using annual data for the period starting from 1980 to 2016. Using the Vector Error Correction model (VEC), the empirical results indicated that in the long run, agriculture GDP, exchange rate, interest rate, inflation, broad money supply, and agriculture credit have a negative effect on agriculture GDP in Eswatini. In the short run the study indicated that the variation in agriculture GDP is largely significant caused by the lagged agricultural GDP, interest rate, exchange rate as well as inflation. Money supply and agriculture credit contribute 0.46% and 0.55%, respectively to the variation in agricultural GDP. The study recommends that programs aimed at availing affordable credit to farmers should be prioritized to cushion the agriculture sector against adverse monetary policy shocks in the short to medium term, specifically interest rates, to ensure continuous production.

**Keywords:** Monetary policy; Agriculture; Vector error correction model; Eswatini; GDP.



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### 1. Introduction

The agricultural sector in Eswatini is one of the crucial sectors for the economy since it provides the raw material that is used by the other sectors and it contributes about 7% to the country's Gross Domestic Product (GDP) (World Bank, 2011). Its importance to the economy is evidenced by its inclusion in the country's main policy documents including the National Development Strategy (NDS) which is the overarching policy document and the Poverty Reduction Strategy and Action Plan (PRSAP). It is viewed as the engine for economic growth (World Bank, 2011). The Ministry of Economic Planning and Development (1999) asserts that Eswatini's comparative advantage is in agricultural products. According to the Food Agricultural Organization (2011), 75% Eswatini export's earnings is from the agriculturally based commodities. The agricultural sector also supports the livelihood of the country populace since those people that are living in the rural areas derives their income and food from this sector and about 70% of the country total population lives in rural areas (World Bank, 2011). In spite of the agriculture sector being viewed by policy makers as one of the strategic focus areas through which the country can foster economic growth, alleviate poverty and eradicate inequality (Ministry of Economic Planning and Development, 2014), its performance compared to its potential has been lacklustre over the recent years.

The joint sector review assessment report by the New Partnership for Africa's Development (NEPAD) asserts that the sector is no longer the backbone of the Swazi economy, which it used to be (NEPAD 2015). The sector has been characterized by low productivity over the past 15 years and Eswatini has shifted from been a net exporter of food to being a net importer of food, including maize which is the country's staple food (NEPAD, 2015). The country also now relies on food aid, especially in the drier regions to feed its population (Tevera *et al.*, 2012). The question therefore that lingers in mind is how the agriculture sector's performance can be resuscitated to realize its full potential. Amongst a host of challenges facing the agriculture sector, the Economic Recovery Strategy, NDS and the Government Program of Action cite lack of access to finance as one of major obstacles to the performance of the sector (Ministry of Economic Planning and Development, 2014). Through monetary policy actions, monetary policy authorities affect the level financing available in an economy. In spite of the important role of monetary policy in influencing credit to the private sector in Eswatini, minimal research work has been conducted on the effects of monetary policy on agricultural output. Hence the study objective was to examine whether there is a long-run relationship between monetary variables (i.e. interest rate, inflation, broad money supply, exchange rate and agriculture credit) to the Eswatini's agricultural growth. The study contributes by filling the knowledge gap in literature as well as providing an evidence-based policy decision to be adopted by Eswatini policy-makers in order to stimulate agricultural growth. The remaining part of the paper is structured as follows: Section 2 provides theoretical framework and reviews of relevant literature for the study. Section 3 contains the methodology that was adopted by the study. Section 4 presents the empirical results and discussions. Section 5 provides the summary, conclusions and policy implications of the study.

## 2. Literature Review

This section comprises the theoretical framework and the empirical literature review.

### 2.1. Theoretical Framework

Monetary policy is a policy instrument that is adopted by government in order to control the supply of money as well as credit condition in an economy by manipulation the interest rate in order to achieve economic goals such as the economic growth, stability in the inflation rate as well as exchange rate stability and employment (Okwo *et al.*, 2012). The monetary policy uses different channels of transmission that are broadly examined under the classical, monetarist and Keynesian theories that demonstrates that the quantity of money in circulation goes a long way to determine the value, cost and prices of the operations and products respectively. The monetary theory of inflation suggests that money supply as a major determinant of output and prices bear strong similarity to the Fisher's theory in the strength of influence exerted by supply money on the economy (Friedman, 1968). Monetary policy can be either expansionary or contractionary. It is contractionary if it aimed at reducing the size of money supply or raising the interest rate, while for an expansionary policy the reverse is the case.

### 2.2. Empirical Literature

Ajudua *et al.* (2015), examined the effects of monetary policy variables on the agricultural gross domestic product in Nigeria by employed an Ordinary Least Squares (OLS) method. The study used time series data from 1986 to 2013. The results of the granger causality test revealed that there is a unidirectional causality relationship from interest rates to agriculture gross domestic product, indicating that interest rates do influence agriculture output. The results further revealed that there is a positive and significant relationship between money supply and agriculture gross domestic product while a negative and significant relationship was observed against the interest rates.

Chisasa and Makina (2015), investigated the relationship between bank credit and agricultural output in South Africa from 1970 to 2011 using an Error Correction Model (ECM) approach. The results revealed that there was positively relationship between bank credit and agricultural output in the long-run. A peculiar result was the negative impact of bank credit on agricultural output in the short run. The granger causality test results revealed a unidirectional causality from bank credit to agricultural output growth, and from agricultural output to capital formation. The study results reflects that there was uncertainties of institutional credit in South Africa.

Kadir and Tugaal (2015), investigated the impact of macroeconomic variables on agricultural output in Malaysia by employing the Autoregressive Distributed Lags (ARDL) approach. The study used time series data that was spanning from 1980 to 2014. The results revealed that the agricultural output is negatively influenced by the exchange rate in the long-run. The other variables that was used on the study such as lagged agriculture output, net exports, government expenditure, inflation, money supply as well as the interest rate did not have a significant impact on agricultural output in the long run. The results further revealed that the agricultural output was positively influenced by interest rate and lagged agriculture output in the short-run and negatively influenced by agriculture expenditure.

Muroyiwa *et al.* (2014), conducted a study to examine the effect of monetary policy actions on agricultural output in South Africa by employing a Vector Error Correction Model (VECM) model. The study used annual data from 1970 to 2011. The results revealed that the South African agricultural GDP was negatively influenced by the consumer price index, manufacturing index as well as the Johannesburg share index whilst the exchange rate and the interest rate influenced it positively in the long-run. The results further revealed that the South African agriculture GDP was positively influenced by the lagged agriculture output and manufacturing index in the short run.

Muftaudeen and Hussainatu (2014), investigate the effects of macroeconomic policies on agricultural output in Nigeria by using multivariate VECM approach. The study used time series data that was spanning from 1978 to 2011. The results revealed that government expenditure had a positive and significant effect on agricultural productivity while credit to agriculture had a negative significant effect on agricultural productivity in the short-run.

## 3. Methodology

### 3.1. Data Type and Sources

The data that was used to carry out the study were annual time series data spanning from 1980 to 2016. In order to achieve the study objectives the following variables were used agriculture GDP, exchange rate, inflation, interest rate, broad money supply and credit to the agriculture sector. Data on inflation and agriculture GDP were sourced from the Central Statistics Office while data for the remaining variables were sourced from the Central Bank of Eswatini.

### 3.2. Model Specification

The purpose of the study was to test the long and short-run effects of monetary policy on agricultural output in the Kingdom of Eswatini. The study adopted and modified the analysis model was used by Muroyiwa *et al.* (2014); Muftaudeen and Hussainatu (2014) in their studies. The general functional model for the study is specified as follows:

$$AGDP = f(AGDP_{t-i}, EXC, INF, INT, M2, AGCR) \dots\dots\dots (1)$$

Where:

AGDP = Agricultural GDP

EXC = Exchange rate

INF = Inflation  
 INT = Interest rate  
 M2 = Broad Money Supply  
 AGCR= Agriculture Credit.

The values for most of the independent variables in the model has a large magnitude hence to solve that the variables were transformed into natural log before they were applied in the model except for inflation and interest rate. A three-step procedural was employed by the study. The first step was to determine the stability of the variables to be used in the model hence the need to perform a preliminary test for stationarity since the use of non-stationary data has an effects of spurious regression, high R<sup>2</sup> and low Dublin Watson statistics. Augmented Dickey-Fuller (ADF) test was used to test for the unit root problem. The second step involves the selection of the optimal lag length among the variables in the system by using different lag length criterion such as the Akaike information criterion (AIC), Schwarz information criterion (SC), final prediction error (FPE) and Hannan Quinn (HQ) information criterion before conducting the Johansen co-integration long-run test using the maximum eigenvalue and trace statistics that determines the number of co-integration vectors in the model. Lastly the test on the Vector Error Correction Model (VECM) was conducted to check for the short run relationships or dynamics between variables as specified as in equation 2:

$$\Delta \ln AGDP_t = \alpha_0 + \beta_1 \ln AGDP_{t-1} + \sum_{i=1}^p \beta_2 \Delta \ln EXC_{t-i} + \sum_{i=1}^p \beta_3 \Delta INF_{t-i} + \sum_{i=1}^p \beta_4 \Delta INT_{t-i} + \sum_{i=1}^p \beta_5 \Delta \ln M2_t + \sum_{i=1}^p \beta_6 \Delta \ln AGCR_{t-i} + \alpha ECM_{t-1} + \varepsilon_t \dots\dots\dots (2)$$

Where Δ is the first difference operator, α<sub>0</sub>, β<sub>1</sub>, β<sub>2</sub>, β<sub>3</sub>, β<sub>4</sub>, β<sub>5</sub>, β<sub>6</sub> are the coefficients to be estimated in the equation. ECM mechanism tells us how much of deviation from the long run is being corrected. Variance decomposition analysis as according to Brooks (2008), was employed to provide the proportion of movements in the dependent variables that are due to its own shocks, against shocks to other variables. The study further conducted some post estimation in order to confirm the validity and robustness of the regression model. The test that were performed includes the portmanteau test for serial correlation and the Jarque-Bera normality test.

### 4. Results and Discussions

The study used time series data in order to achieve its objective, hence the need to do preliminary stationarity test of all the variable that will be used in the model in order to avoid spurious regression. This study used the ADF unit root test and the results for the ADF test are presented in Table 1 and it indicates that all the variables are non-stationary at their levels but stationary at their first differences, being integrated of order one, I(1). Given that all the variables are integrated in order of at unity, the appropriate estimation technique to be employed is the Johansen co-integration test method that requires the selection of an optimal lag length to be conducted.

Table-1. ADF unit root test

Variable	At Levels			At First Difference		
	Intercept	Trends & Constant	None	Intercept	Trends & Constant	None
ln AGDP	-0.34	-2.51	-1.21	-8.36***	-8.32***	8.21***
ln EXC	-1.56	-5.86	-1.23	-4.37***	-4.38***	-3.51***
INF	-3.12	-4.75	-1.76	-9.43***	9.38***	-9.47***
INT	-2.59	-4.29	-0.61	-4.64***	-4.61***	-4.71***
ln M2	-0.31	-1.98	-3.24	-6.18***	-6.17***	-4.66***
ln AGCR	-1.82	-3.82	-0.13	-9.17***	-0.904***	-9.30***

Notes: \*\*\*/\*\*/\* indicates that the null hypotheses are rejected at 1%, 5% and 10% level of significant.

Source: Authors computation, 2019

There are different criterion that are used to investigate the optimal lag length and for this study the optimal lag length selection was chosen by AIC, FPE, SC and HQ. The results for the optimal lag length for all the variables in the system are presented on Table 2.

Table-2. Lag Length Selection

Lag	AIC	SC	HQ	FPE
1	-1.670	-1.480	-1.606	1.813
2	-1.741*	-1.387	-1.622	3.600*
3	-1.848	-1.331	-1.674	4.464
4	-2.160	-1.980*	-1.932*	6.777

Notes: \* indicates lag order selection by the criterion.

Source: Authors computation, 2019.

FPE: Final prediction error  
 AIC: Akaike information criterion  
 SC: Schwarz information criterion  
 HQ: -Hannan- Quinn information criterion

The test criteria (FPE, AIC, SC and HQ) selected different lag lengths. The results of Schwarz information criteria and Hannan-Quinn information criterion depicting lag order length of four (4) for the model is selected whilst the Akaike information criterion and the Final prediction error have selected lag order length of two (2). Therefore for the model we selected the optimal lag length using the AIC hence the two (2) lags was used in model. The result of the Johansen co-integration test are presented in Table 3 and they are divided into two namely the Eigenvalue and Trace statistic tests.

Table-3. Long Run Johansen Co-Integration Test

Null Hypothesis	Alternative Hypothesis	Test Statistic	10 %	5%	1%	Results
<b>Trace Statistic</b>						
$r \leq 5$	$r > 5$	2.27	7.52	9.24	12.97	Fail to Reject $H_o$
$r \leq 4$	$r > 4$	13.41	17.85	19.96	24.60	Fail to Reject $H_o$
$r \leq 3$	$r > 3$	33.26	32.00	34.91	41.07	Fail to Reject $H_o$
$r \leq 2$	$r > 2$	54.18	49.65	53.12	60.16	Reject $H_o$
$r \leq 1$	$r > 1$	91.39	71.86	76.07	84.45	Reject $H_o$
$r = 0$	$r > 0$	150.39	97.18	102.14	111.01	Reject $H_o$
<b>Max-Eigen Value</b>						
$r = 5$	$r = 6$	2.27	7.52	9.24	12.97	Fail to Reject $H_o$
$r = 4$	$r = 5$	11.13	13.75	15.67	20.20	Fail to Reject $H_o$
$r = 3$	$r = 4$	19.85	19.77	22.00	26.81	Fail to Reject $H_o$
$r = 2$	$r = 3$	20.92	25.56	28.14	33.24	Fail to Reject $H_o$
$r = 1$	$r = 2$	37.21	31.66	34.40	39.79	Reject $H_o$
$r = 0$	$r = 1$	59.00	37.45	40.30	46.82	Reject $H_o$

Source: Authors computation, 2019

The Johansen co-integration test results are presented on Table 3 revealed that the independent variables exhibited long run association with the dependent variable based on the satisfaction of the decision criteria. The Trace test criterion revealed the presence of two co-integrating equations ( $r \leq 2$ ) in the model ( $P < 0.05\%$ ) while using the maximum Eigen value criterion it reveals that there was at most one co-integration equation ( $P < 0.01\%$ ). The null hypothesis ( $H_o$ ) of no co-integration equations or vectors between the variables was therefore rejected in favour of the alternative ( $H_1$ ) which states that the variables are co-integrated which then suggests that there is a long-run relationship that exists between the dependent and independent variables.

After determining that the long-run relationships exists the study then used the VECM model to capture both the long run and the short run dynamics in the model. The long run results are presented in Table 4.

Table-4. Long run co-integration equation

Variable	Coefficient	Standard error	P-value
Constant	8.828	2.477	0.002***
LAGDP	1.000	-	-
LEXCH	0.382	0.066	0.000***
INFL	0.055	0.009	0.000***
INT	0.093	0.010	0.000***
LM2	0.325	0.133	0.020**
LAGCR	0.707	0.075	0.000***

Notes: \*\*\*/\*\* / \* indicates that the null hypotheses are rejected at 1%, 5% and 10% level of significant.

Source: Authors computation, 2019.

The long run results presented on Table 4 revealed that all the variables under consideration had positive and significant coefficients. A 1% increase in the exchange rate would increase agriculture output by 0.38% whilst a 1% increase in inflation would result in a 0.06% increase in agriculture GDP. The results further revealed that a 1% increase in interest rates, money supply and credit to agriculture would increase agriculture GDP by 0.09%, 0.33% and 0.71%, respectively. The positive coefficients for exchange rate, inflation, broad money supply and agriculture credit are in line with a priori expectation. However, the positive coefficient for interest rate is against economic theory. This could be explained by the lack of alternative sources of capital for agriculture producers which means that even if interest rates can increase farmers would still seek credit from financial institutions.

The results for the short run dynamics in the VECM model are presented on Table 5 and they indicates the presence of co-integration with both Error Correction Term (ECT) 1 and 2 carrying a negative and statistically significant ( $P < 0.01\%$ ) coefficient. ECT 1 indicates that about 48% of the deviation from the long run equilibrium is corrected in a year whilst ECT 2 indicates that only 20.7% of the disequilibrium is corrected in a year.

**Table-5.** Short run co-integration equation

	Estimate	Standard Error	t statistic	Pr (> t )
ECT 1	-0.488	0.141	-3.455	0.0019***
ECT2	-0.208	0.075	-2.769	0.0102***
Constant	14.640	4.500	3.254	0.0031***
DLGDP	-0.771	0.173	-4.452	0.00001***
DLEXCH	0.205	0.139	1.469	0.1537
DINFL	0.001	0.005	0.238	0.8137
DINT	-0.001	0.010	-0.067	0.9471
DLM2	-0.730	0.311	-2.346	0.027 *
DLAGCR	0.060	0.043	1.412	0.1699

**Notes:** \*\*\*/\*\* / \* indicates that the null hypotheses are rejected at 1%, 5% and 10% level of significant.

**Source:** Authors computation, 2019.

The results further revealed that a 1% increase in lagged agriculture GDP and broad money supply would decrease current agriculture GDP by 0.77% ( $P < 0.01$ ) and 0.73% ( $P < 0.05$ ), respectively in the short-run. An examination of the variations in Agriculture GDP in both short run and long run is further supplemented by the Variance decomposition analysis results that are presented in Table 6.

**Table-6.** Variance Decomposition

	AGDP	EXCH on	INFL on	INT on	M2 on	AGCR on
	On AGDP	AGDP	AGDP	AGDP	AGDP	AGDP
1	1.0000	0.000	0.000	0.000	0.0000	0.000
2	0.871	0.050	0.039	0.028	0.0017	0.009
3	0.830	0.068	0.029	0.053	0.012	0.007
4	0.803	0.086	0.028	0.063	0.0151	0.006
5	0.782	0.094	0.024	0.077	0.018	0.007
6	0.766	0.101	0.020	0.087	0.018	0.007
7	0.753	0.108	0.018	0.094	0.019	0.008
8	0.741	0.114	0.016	0.100	0.020	0.008
9	0.733	0.119	0.015	0.105	0.020	0.009
10	0.726	0.122	0.014	0.109	0.021	0.009

**Source:** Authors computation, 2019

The results indicate that variation in agriculture GDP is largely explained by an own shock accounting for an average of 89.99% of the variation in agriculture in the short to medium term (1-3 years) and 80% over the ten year forecast period. The second largest contributor to variation in agriculture GDP is the exchange rate, accounting an average of 3.95% variation in the short to medium term period and 8.62% over the ten year forecast period. The third largest contributor was interest rate explaining about 2.72% in the short to medium term period and increasing to an average of 7.16% over the forecast period. Inflation on average explains about 2.29% of the variation in agriculture GDP in the short to medium term period and slightly falls to an average of 2% over the forecast period. Money supply and agriculture credit were the list contributors accounting for a variation of 0.46% and 0.55% of the variation in agriculture output, respectively. Over the ten year period, money supply accounts for 1.45% of the variation in agriculture output while agriculture credit accounts for 0.69%.

We then conducted some diagnostic checks to check for some fundamental aspects of the model in terms of stability, normality and any signs of autocorrelation as these could result in some detrimental effects on the model and compromise the efficiency of the model itself. The results of the diagnostics test that were checked on the model are presented on Table 7.

**Table-7.** Diagnostic test

Test	Chi-squared	P-value
Jarque-Bera test	1.358	0.507
Portmanteau test	431.42	0.995

**Source:** Authors computation, 2019

The results from Table 7 revealed that the residuals of the model are normally distributed since the Jarque Bera test has a p-value of 0.507% therefore we failed to reject the null hypothesis of normal distribution. The Portmanteau test of serial correlation results indicate a p-value is 0.995% and the study therefore fails to reject the null hypothesis of no serial correlation therefore concluding that there is no serial correlation.

## 5. Summary and Conclusions

The main aim of this study was to determine if there is a long run relationship between agriculture GDP and monetary policy variables Eswatini by employing the VECM approach. The results revealed that all the variables that were used has a negative effect on the agriculture GDP in the long-run while in the short run only lagged GDP

and broad money supply were statistically significant with negative coefficients. The variance decomposition results indicated that variation in agriculture GDP is largely explained by an own shock followed by the exchange rate and the interest rate. Money supply and agriculture credit were the least contributors to the variation in agriculture GDP. On the basis of the findings of the study, it can be concluded that lagged agriculture GDP, the exchange rate and interest rates are the main contributors to the variation in agriculture GDP. This indicates that interest rate as a monetary policy tool is important in improving agricultural production. Broad money supply and agriculture credit account for a small amount of variation in agriculture GDP. Since interest rates had a slightly sizable effect on agriculture production, it means positive shocks on interest rate have a negative effect on agricultural production. There is therefore a need to prioritize efforts aimed at making agriculture finance or credit easily accessible and affordable to farmers, and hence programs aimed at such should be prioritized in the country. This would ensure that negative shocks to the sector coming from positive shocks in interest rates are smoothed out and agriculture production is minimally affected as farmers would continue to have affordable credit financing through special programs.

## References

- Ajudua, E. I., Davis, O. J. P. and Okonkwo, O. N. (2015). A review of monetary policy and the nigerian agricultural sector performance. *International Journal of Academic Research in Progressive Education and Development*, 4(3): 70-86.
- Brooks, C. (2008). *Introductory econometrics for finance*. 2nd edn: Cambridge University Press: Cambridge.
- Chisasa, J. and Makina, D. (2015). Bank credit and agricultural output in south africa: Cointegration, short run dynamics and causality. *The Journal of Applied Business Research*, 31(2): 489- 500.
- Friedman, M. (1968). *The quantity theory of money Assessment*. In Milton Friedman (Ed.). *The quantity theory of money*. The University of Chicago Press: Chicago.
- Kadir, S. U. and Tugaal, N. Z. (2015). The impact of macroeconomic variables toward agricultural productivity in malaysia. *South East Asia Journal of Contemporary Business, Economics and Law*, 8(3): 21-27.
- Ministry of Economic Planning and Development (1999). *National development plan*. Government of Swaziland, Mbabane: Swaziland.
- Ministry of Economic Planning and Development (2014). *Government programme of action 2014/19. National development plan*. Government of Swaziland: Mbabane, Swaziland.
- Muftaudeen, O. O. and Hussainatu, A. (2014). Macroeconomic Policy and Agricultural Output in Nigeria: Implications for Food Security. *American Journal of Economics*, 4(2): 99-113.
- Muroyiwa, B., Sitima, I., Sibanda, K. and Mushunje, A. (2014). Monetary policy actions and agricultural sector outcomes: Empirical evidence from South Africa. *Mediterranean Journal of Social Sciences* 5(1): 613-20.
- NEPAD (2015). *Swaziland joint sector review assessment report*. NEPAD Planning and Coordinating Agency: Midrand, South Africa. [https://www.resakss.org/sites/default/files/JSR\\_SWAZILAND\\_CORRECT.pdf](https://www.resakss.org/sites/default/files/JSR_SWAZILAND_CORRECT.pdf)
- Okwo, I. M., Enekwe, C. I. and Ugwunta, D. O. (2012). Financial management as a determinant of profitability: A study of selected pharmaceutical firms in Nigeria. *European Journal of Business and Management*, 40(20): 28-36.
- Tevera, D., Simelane, N., Peter, G. and Salam, A. (2012). The state of food security in Manzini, Swaziland. *Urban Food Security*, (15).
- World Bank (2011). *Institutions, governance and growth: Identifying constraints to growth in Swaziland. African poverty reduction and economic management*. World bank report no: 81031-sz.