The Effect of the Macroeconomic Situation on the Performance of the Agricultural Sector in Zambia

Paul C. Samboko and Fredrick M. Mushimba

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Indaba Agricultural Policy Research Institute (IAPRI)

Lusaka, Zambia
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EXECUTIVE SUMMARY

Introduction

Zambia has experienced a weakening of the macroeconomic situation since mid-2015. The Kwacha has weakened (though recently began to rebound), inflation has increased, and the national budgetary position is weaker than it was in 2011. A poor macroeconomic position is expected to stifle future growth. To mitigate against the potential adverse effects, government has responded with various policy measures including monetary policy, reduced expenditure, and new tax regimes. These are directed at stabilizing the Kwacha, generating government revenue, and strengthening the Kwacha. However, monetary policy measures have increased interest rates.

How a weakening macro economy affects the performance of the agricultural sector is of particular interest in this paper given agriculture’s role as a key driver of growth, largest employer in Zambia (48.8% of the labor force), and the need to diversify the foreign exchange earnings base away from copper mining. Therefore, this paper assesses the effect of the macroeconomic situation on the agricultural sector, focusing on agricultural exports and currency weakening.

The study’s primary objective is to ascertain the impact of the macroeconomic situation on the agricultural sector in Zambia. Specifically, it seeks to answer the following questions? (i) Is there causality between agricultural exports and the exchange rate? (ii) What is the effect of the Kwacha’s weakening on agricultural exports? and (iii) What is the effect of the Kwacha’s weakening on enterprise profitability?

Methods and Data

The study uses agricultural import and export data from the Central Statistical Office (CSO), and enterprise budgets from the Zambia National Farmers Union (ZNFU). Both econometric and descriptive analysis is used to achieve the study objectives.

Findings

1. For the period in which the Kwacha weakened, trends in the export of agricultural produce indicate that exports for months in 2016 are consistently higher than in 2015 months, however, beyond May, they are consistently lower than in 2015. This suggests that a weakening Kwacha may have reduced the value of agricultural exports only beyond May 2016.
2. Similarly, imports were consistently higher for 2015 than in 2016, except for August and September where agriculture imports in 2016 are higher than in 2015 for the same months.
3. Using export and exchange rate data from the Central Statistical Office, and the Bank of Zambia respectively, we find evidence of bi-directional causality between agricultural exports and exchange rates. This means that past values of exchange rates contain information that helps predict the value of agricultural exports. Similarly, past values of agricultural exports also help predict the exchange rate. As such, exchange rate stability is key for increased exports, in as much as exports are good for diversifying Zambia’s foreign exchange earning base.
4. The depreciation in the exchange rate affected the profitability of enterprises in different ways, wheat profitability slightly declined, while smallholder maize
profitability sharply declined. Commercially produced soyabeans also experiences a decline in profitability. However, cotton production becomes more profitable.

**Recommendations**

The results presented thus far suggest the potential for adverse effects on some enterprises and the agricultural sector as a whole. Stabilizing the macro economy is crucial for ensuring the sector’s future growth. For producer’s experiencing sharp declines in profitability, there is need to identify *a priori*, which enterprises have the highest import content and thus limit activity in terms of production, where possible, firms can budget for these in dollars to help cushion the effects, but such a budget would also require a corresponding dollar account.
# TABLE OF CONTENTS

ACKNOWLEDGMENTS ........................................................................................................ iv
EXECUTIVE SUMMARY ....................................................................................................... v
LIST OF FIGURES ............................................................................................................... viii
LIST OF TABLES ................................................................................................................. viii
ACRONYMS AND ABBREVIATIONS ................................................................................. ix

1. INTRODUCTION ................................................................................................................. 1

2. WHY WOULD THE MACROECONOMIC SITUATION AFFECT AGRICULTURAL PERFORMANCE? ........................................................................... 3
   2.1. Mechanisms Linking the Macroeconomic Situation to Agricultural Performance 3
      2.1.1. Fiscal Policy and Agricultural Performance ......................................................... 3
      2.1.2. Monetary Policy and Agricultural Performance ................................................... 4
      2.1.3. The Kwacha to Dollar Exchange Rate ................................................................. 4
      2.1.4. Trade Policy and Agricultural Performance ......................................................... 5

3. STATUS OF THE MACROECONOMIC SITUATION AND ASSOCIATED POLICY RESPONSES ................................................................................. 6
   3.1. Inflation, Commodity Prices, and the Exchange Rate .................................................. 6
   3.2. Budget Financing and Status ....................................................................................... 7
   3.3. The Monetary Policy Responses ................................................................................ 7

4. APPROACHES TO ESTIMATING THE IMPACT OF MACROECONOMIC VARIABLES ON SECTORAL GROWTH ......................................................................... 8

5. METHODS AND DATA ...................................................................................................... 9
   5.1. Methods ....................................................................................................................... 9
      5.1.1. Impact on Enterprise Profitability ......................................................................... 9
      5.1.2. Econometric Procedure ......................................................................................... 9
   5.2. Data and Sources ........................................................................................................ 10

6. EXCHANGE RATE VOLATILITY AND AGRICULTURAL EXPORTS ........................................................................................................... 11
   6.1. Latest Trends in Agricultural Imports and Exports ...................................................... 11
   6.2. Is there Causality between Agricultural Exports and the Exchange Rate? ............... 13
   6.3. The Effect of the Kwacha’s Depreciation on Enterprise Profitability ........................ 13
      6.3.1. Seed Cotton ......................................................................................................... 14
      6.3.2. Soya Beans .......................................................................................................... 14
      6.3.3. Wheat ................................................................................................................... 15
      6.3.4. Maize ................................................................................................................... 16

7. CONCLUDING REMARKS ............................................................................................... 17

REFERENCES ....................................................................................................................... 19
LIST OF FIGURES

FIGURE PAGE
1. The Linkages between Agricultural Performance and the Macroeconomic Situation ............ 3
2. Trends in the Rate of Inflation and Exchange Rate ......................................................... 6
3. Trends in the Volume of Agricultural Exports .............................................................. 11
5. Trends in Selected Horticultural Exports ...................................................................... 12

LIST OF TABLES

TABLE PAGE
1. VAR Granger Causality/Block Exogeneity Wald Tests (N=12) ........................................ 13
2. Impact on the Profitability of Cotton among Outgrowers ............................................... 14
3. Effects of the Exchange Rate on the Profitability of Commercially Produced Soyabean .... 15
4. Effect on the Profitability of Locally Traded Wheat ........................................................ 15
5. Effect of Currency Depreciation on the Profitability of Smallholder Maize Production .... 16

A 1. Augmented Dickey Fuller Unit Root Test — with an Intercept and Trend ................. 18
A 2. VAR Lag Order Selection Criteria ............................................................................. 18
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF</td>
<td>Augmented Dickey Fuller</td>
</tr>
<tr>
<td>ARL</td>
<td>Autoregressive Redistributed Lag Model</td>
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<tr>
<td>CSO</td>
<td>Central Statistical Office</td>
</tr>
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<td>HQIC</td>
<td>Hannan-Quinn Information Criterion</td>
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<td>IAPRI</td>
<td>Indaba Agricultural Policy Research Institute</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>SBIC</td>
<td>Schwarz Information Criterion</td>
</tr>
<tr>
<td>SIC</td>
<td>Schwarz Information Criterion</td>
</tr>
<tr>
<td>USD</td>
<td>United States Dollar</td>
</tr>
<tr>
<td>VAR</td>
<td>Vector Autoregressive Model</td>
</tr>
<tr>
<td>ZMW</td>
<td>Zambian Kwacha</td>
</tr>
</tbody>
</table>
1. INTRODUCTION

A deteriorating macroeconomic situation is a subject of concern for many countries as it shapes micro-level decisions, resource allocation, technologies used and ultimately economic outcomes. A subject of concern for developing countries is the effect on agriculture—a crucial sector for achieving development objectives such as poverty reduction and improved food and nutrition security (Pinstrup-Andersen 1995; Schneider and Gugerty 2011).

Typically, countries with stronger macroeconomic positions and initial conditions tend to grow faster (Fatima, Mehboob, and Rehman 2012; IFAD 2016; Son and Kakwani 2004). For primarily agrarian societies, the rate and extent of agricultural growth depend on various factors in addition to the macroeconomic situation (e.g., the level of agricultural intensification, fiscal policy, monetary policy, levels of inequality, budgetary composition and allocation, technology advancements, and adoption).

In recent times Zambia has experienced deteriorating or unstable macroeconomic conditions, the economy has come under strain due to external (slower regional and global growth) and domestic pressures (i.e., power shortages, repeat fiscal deficits, tight credit conditions, and rising inflation) (BOZ 2015; Samboko et al. 2016; IMF 2015; GRZ 2015). These macroeconomic challenges have necessitated various policy responses by the Zambian government to help stabilize the economy—with interventions visibly in the money markets to help stabilize the local currency (see Section 2 for a detailed discussion), other interventions include reduced government expenditure. The aggregate effect of a poor macroeconomic situation has manifested in form of a reduced gross domestic product (GDP) growth to 3.2%—Zambia’s lowest since 1998 and lowest compared to other countries in Sub-Saharan Africa (Credit Rating Agency 2015). At the micro-level, the Bank of Zambia business expectations survey reports (2015-2016) also showed declining capacity utilization, tobacco exports, and profitability among firms operating across various sectors owing to the poor state of the macroeconomic environment.

How a deteriorating macroeconomy has affected the performance of the agricultural sector is an important policy question that is yet to be investigated. Existing literature only shows the effect of an appreciation on the agricultural sector, or that of exchange rate volatility on macroeconomic indicators (e.g., see Fynn and Haggblade 2006; Chipili 2014). There is no record of the size of the effect on profitability levels across firms operating within agriculture. Moreover, given government’s policy responses to help stabilize the macroeconomy, it is unclear whether there is causality between the macroeconomic situation, and agricultural variables, though evidence suggests a depressed agricultural GDP growth in the period for the years 2016 and 2017 (see World Bank 2017). Currency volatility’s effect also depends on the presence/absence of appropriate hedging instruments or markets. In light of agriculture’s importance in primarily agrarian societies, it is, thus, crucial that these knowledge gaps are filled, especially at a time when southern Africa’s demographic and income trends are likely to increase trade for high-value agricultural produce in the region, in response to growing food demand (FAO 2009; Alexandratoss and Bruinsma 2012).

The main mechanisms through which agriculture is linked to the macroeconomy include inflation, interest rate, money supply, exchange rate, and the demand effect of business cycles (Choe 1989). Inflation reduces growth, in as much as it destabilizes the macroeconomy and the financial sector. Generally, where the macroeconomic situation is poor, the economy performs poorly. We further discuss the mechanisms linking the macroeconomy and the performance of the agricultural sector in Section 3.1.
Against this backdrop, we hypothesize that the combination of a deteriorating macro-
economic environment, load shedding arising from a power deficit and associated rise in
production costs, and the budget deficits have adversely affected the performance of the
agricultural sector at least in the short-run further diminishing future economic growth
prospects and agriculture’s role as a foreign exchange earner. We expect that the effect of the
Kwacha’s depreciation in recent times is positive on industries where inputs are mainly
sourced locally and exported, and negative on those with a large import content and exported.
The net effect on agricultural exports is difficult to tell *a priori*, as it is likely to depend on the
respective shares of the two industry typologies in the total value of agricultural exports. In
the long term, if the appreciation or depreciation of the Kwacha adversely impacts the growth
of processed output, Zambia may not be in a strong position to take advantage of population
and income trends across the southern African region. It is now clear that increased
urbanization and populations, coupled with income growth are inducing changes in demand
with an increasing preference for processed agricultural products, thereby, increasing their
share in the food budget in line with Bennet’s law (Alexandratos and Bruinsma 2012). From
a local perspective, there is likely to have been a reduced consumption demand from the
bottom quintile income earners, especially for processed meat products, given inflation’s
effect on their purchasing power (Chisanga and Zulu-Mbata forthcoming). And this is likely
to be reflected in reduced agricultural commodity sales, among firms that largely target the
local market.

This paper’s primary purpose is to determine the effects of the macroeconomic situation on
the performance of the agricultural sector in Zambia. Specifically, it will provide answers to
the following questions: (i) Is there causality between agricultural exports and the exchange
rate? (ii) What is the effect of the Kwacha’s weakening on agricultural exports? and (iii)
What is the effect of the Kwacha’s weakening on enterprise profitability?

The remainder of the paper is structured as follows: Section 2 discusses the mechanisms
linking the macroeconomic sector to agricultural performance; Section 3 presents the latest
trends in key macroeconomic performance indicators in Zambia; and in Section 4 we present
the approach to answering the key research questions and the sources of data. The study’s key
findings are discussed in Section 5 and the study’s main conclusions are presented in Section
6.
2. WHY WOULD THE MACROECONOMIC SITUATION AFFECT AGRICULTURAL PERFORMANCE?

2.1. Mechanisms Linking the Macroeconomic Situation to Agricultural Performance

How the macroeconomic situation affects the agricultural sector’s performance is summarized in Figure 2 below. Overall, agricultural performance is affected by fiscal, monetary, and trade policies with the three policies interrelated and closely related. The key mechanisms linking agriculture to the macroeconomy being inflation, interest rate, availability of money, exchange rate, imports/exports, and the demand effect of business cycles. The major source of the linkage for agriculture is monetary policy through its effects on interest rates and inflation (Snell, Marchant, and Infanger 1997).

2.1.1. Fiscal Policy and Agricultural Performance

The nature of expenditure within government has an effect on short-, medium, and long-term performance of the agricultural sector. Where expenditure is mainly on wages, salaries, and programs that do not contribute to long-term growth, performance is poor. In Zambia, there is well documented evidence that expenditure in agriculture has been mainly on programs and projects that do not benefit the poor, who are the majority smallholder farmers; a large share of the agricultural budget has been towards costly and ineffective subsidy programs, at the expense of long-term growth via investments in areas such as extension, irrigation development, and research and development (Kuteya 2015).

The effect through fiscal policy results from the fact that increased government expenditure on human capital and infrastructure increases labor productivity reduces, marketing costs, and production costs. This further increases firm profitability and triggers investments by private sector.

Figure 1. The Linkages between Agricultural Performance and the Macroeconomic Situation

Source: Adapted from Snell, Marchant, and Infanger (1997).
2.1.2. Monetary Policy and Agricultural Performance

Monetary policy impacts on the availability of money in the economy and hence price stability (of inputs, land, and commodities). This works through the policy’s impact on interest rates and inflation.

The cost of borrowing (interest rates), is often negatively related to the availability of money to businesses and individuals for investments. Given that smallholder farmers’ access to commercial loans in Zambia is low, we expect this mechanism to work more through commercial farmers, agro-processors, and the large traders such as CHC commodities and AFGRI Corporation Limited. In fact, the direct link from interest rates to output and inflation has been generally weak for Zambia, but monetary aggregates play a key role in the monetary Transmission mechanism (Zgambo and Chileshe 2014).

The rate of inflation affects the cost of agricultural inputs, and may also impact on the producer profits, especially where prices of outputs do not adequately compensate for the input price rise. Agricultural exports may reduce as locally produced products become less competitive.

2.1.3. The Kwacha to Dollar Exchange Rate

The relationship between exchange rate and agricultural trade has for a long time been studied and is well understood (see Kristinek and Anderson 2002) The general consensus is that currency movements affect both the Kwacha price received for exports and the cost of inputs, implying that the net effect on exports depends on the shares of imported inputs, and the share of output exported. The Lerner-Marshall-Robinson condition suggests that the net effect of a currency depreciation depends on the sum of the absolute elasticities of import and export prices. Where a currency depreciates, the balance of payments deteriorates and then improves in line with Davies’ J-curve phenomenon (see Davies 1962). On the other hand, a currency appreciation is harmful to exports.

Drawing from Fynn and Haggblade (2006), the net impact of a currency appreciation on industries within agriculture can be summarized as follows:

- Where a producer exporting in United States dollars uses equal proportions of imported and local inputs, the dollar value of imports in local currency terms increases by a percentage larger than that of the total cost of production because the local costs remain unchanged. But where all inputs are imported and no substitution occurs, the production costs rise by a proportionate figure as that of the rise in the cost of imported inputs. For a producer who sells on the local market, with the same input structure as above, the net effect on the input cost is less than that above, because as the Kwacha cost of local inputs remains unchanged while that of imported inputs falls.\(^1\)

Using the same reasoning, one would expect that as the Kwacha weakens, the magnitude of the effect of currency depreciation on firms within agriculture is likely to depend on the shares of imported inputs, and whether the output is traded locally or exported. This means

\(^1\)The differences in the effect of an appreciation due to varying import contents is shown by Fynn and Haggblade (2006) where the negative effect of an appreciation was largest in tobacco, followed by coffee and vegetables (horticultural exports). While floricultural exports were less negatively impacted due to their low content of imported inputs.
that the direction of depreciation may benefit some industries within agriculture in as much as it may hurt others. In the same vein, some sectors may gain, while others may not.

2.1.4. Trade Policy and Agricultural Performance

How trade policy affects the agricultural sector’s performance can be thought of in two ways, first through the effect on imported inputs for agricultural production, and through the effect on earnings from agricultural exports. The latter of which is of particular interest for Zambia in as far as maize is concerned. Maize as a staple is usually subject to ad-hoc policies by the Zambian government and has been shown to hurt export-oriented millers, traders, and commercial farmers (Chapoto and Jayne 2009; Davids et al. 2016; Tschirley et al. 2006).
3. STATUS OF THE MACROECONOMIC SITUATION AND ASSOCIATED POLICY RESPONSES

3.1. Inflation, Commodity Prices, and the Exchange Rate

The deterioration of the macroeconomic environment in Zambia has induced food price increases and instability, at the same time, the cost of imported inputs has risen, as acquiring the same inputs has become more costly. Figure 1 shows trends in the exchange and inflation rates since January 2013. From early 2014, increases can be observed in the rates of inflation, and the exchange rate—suggesting short-run bidirectional causality between exchange rate and inflation as has been shown in other studies (e.g., see Maswana 2005). From mid-2015, a sharp weakening of the Kwacha against the dollar was associated with a sharp rise in both food and non-food inflation, with food inflation responding more than non-food inflation. These have since stabilized with drops in inflation due to stability in the exchange rate that has been achieved through monetary policy instruments.

How the exchange rate has impacted on the performance of the agricultural sector is a key policy question. In the past, an appreciation has been associated with negative effects on firms operating in agriculture. A similar effect is expected under a depreciation. However, this is dependent on the shares of imported inputs used in production (Fynn and Haggblade 2006). Potential job losses may occur and this has implications for future growth for a sector that employs an estimated 49% of the labor force, as of 2014. Ultimately, the size of the effect depends on how prolonged the deterioration is, and if at all there is a significant effect on the whole agricultural sector (ibid).

In the long run, exchange rates cause inflation, with the relationship uni-directional. The observed rise in inflation appears to be the norm in selected countries within the Southern African Development Community (SADC), for example, more recently, inflation rates in Mozambique have increased sharply to 22.3% in September 2016.²

Figure 2. Trends in the Rate of Inflation and Exchange Rate

![Figure 2. Trends in the Rate of Inflation and Exchange Rate](http://zamstats.gov.zm/)


² [http://www.tradingeconomics.com/mozambique/inflation-cpi](http://www.tradingeconomics.com/mozambique/inflation-cpi)
3.2. Budget Financing and Status

In terms of the national budget, deficits have increased over time, from 2.4% of the GDP in 2011 to 8.1% for 2015 and 2016. To finance public spending, public debt has also increased substantially, from 21% of GDP in 2011 to 53% in 2015. How public expenditure is allocated will have long-lasting implications for growth given the relationship between growth, private investments, public investments and domestic savings. At present, indications are that private sector lending is being crowded out, and debt is being used to finance wage bills, which is likely to have a negative effect on long-term growth as previously shown in studies for Zambia (e.g., see Chongo 2013).

3.3. The Monetary Policy Responses

Between January 2012 and September 2015, the macroeconomic environment was favorable with inflation remaining stable at 7.2%. However, since mid-2015, developments in the monetary and financial sector have been characterized by rising inflation due to the weakening of the Kwacha against the world’s major currencies, reflected by an end-year outturn of above 7%. In the foreign exchange market, the exchange rate of the Kwacha against major currencies was volatile. Challenges arising from domestic and global developments caused the sharp depreciation of the Kwacha against the U.S. dollar. This ultimately resulted in inflationary pressures, particularly during the second half of 2015.

Several monetary policy measures have been taken to tighten liquidity such as:

i. Raising the Policy Rate to 15.5% from 12.5%;
ii. Further raising the statutory reserve ratio to 18% from 14% to counter inflationary pressures (Bank of Zambia 2015);
iii. Caps on lending rates were removed to allow financial institutions price credit at appropriate levels;
iv. The increase in the overnight lending facility rate to 25.5% from 18.5% as well as restricting access to this lending facility to once a week; and
v. Limiting the amount of money that can be withdrawn through checks to Zambian Kwacha (ZMW)25,000 per day.

These measures have helped moderate inflation (Figure 1), but at a cost. Commercial bank liquidity has tightened leading to sharp increases in interbank lending rate, thereby, increasing the cost of borrowing. This is likely to decrease the value of loans and advances to agriculture, with negative implications for agricultural investments.

4. APPROACHES TO ESTIMATING THE IMPACT OF MACROECONOMIC VARIABLES ON SECTORAL GROWTH

In order to determine the effect of macroeconomic variables on sectoral performance, several approaches exist. For example, computable general equilibrium modeling for the whole economy, or input-output analysis for specific sectors. Other widely used approaches include time series econometric techniques such as: (i) the autoregressive redistributed lag model (ARL); and (ii) vector autoregressive model (VAR) (or Granger causality test) (Granger 1969). The ARL and VAR provide answers to the question regarding whether there is causality between two variables and the direction of causality. However, they cannot answer the question relating to the magnitude of the impact of an explanatory variable on a response variable as they do not control for the effect of other variables.

The econometric approach to testing causal relations between variables is attributed to seminal work by Granger (1969). The test checks how past values of a variable (say Y), and past values of another variable X, and a vector of other explanatory variables (say Z) help predict future values of Y.

Other approaches involve panel econometric methods while controlling for initial conditions. In some cases, the impact on specific industries within agriculture has been established through changes in the enterprise budgets for producers and a sample of agro-processors (e.g., Barichello 2000; Fyn and Haggblade 2006). However, sampled processors only give an indication of the true effect of currency volatility on firms as it is impractical to sample all. The idea behind the partial budget approach is that for exported products, changes in currency volatility will impact on input costs and revenues received with the size of the impact dependent on the shares of imported inputs in total inputs used. While this approach may not entirely represent the true total effect on the agricultural sector, it gives an idea of the size of the impact. More data-intensive approaches such as general equilibrium modeling and panel data models would be useful to achieve this.

Among the approaches highlighted above, the vector autoregression is among the most widely used tools in macro-econometric analysis. It allows one to estimate the joint determination of a set of variables. And is the preferred estimator for testing causality. To ascertain the impact of currency volatility on enterprise profitability, the partial budget approach is more attractive.
5. METHODS AND DATA

5.1. Methods

5.1.1. Impact on Enterprise Profitability

To be able to estimate the impact of a Kwacha depreciation on enterprise profitability, we adjust pre-depreciation enterprise budgets for changes in the currency exchange rate. This is done for crops that are increasingly becoming important, and for an important staple (i.e., Seed cotton, maize, soya beans, and wheat) (Johnson-Mwenda 2006; ECA Consulting 2012). We make the following key assumptions based on Fynn and Haggblade (2006):

i. Zambia is a small country in the world markets, meaning that world prices of exported Zambian produce remains constant while the corresponding Kwacha value of exports increases in direct proportion to the Kwacha depreciation.

ii. The prices of imported inputs in dollar terms remain unchanged while the production costs in Kwacha will depend on the shares of imported to local inputs in the total.

iii. The input-output ratio among firms has not been adjusted following the Kwacha’s depreciation.

iv. Wage rates have remained fixed during the study period owing to government’s minimum wage restriction.

v. The exchange rate is assumed to vary between 9.5 and 10 Kwacha per dollar.

For production to be sold on the local market:

- Adjust upwards the cost of all products with an import content. It is assumed that 25% of the costs with an import component are to be adjusted by the proportionate price rise due to the Kwacha’s depreciation against the dollar.
- All costs relating to locally sourced products do not change in Kwacha terms. Labor is not adjusted upwards, as there is unlikely to have been any increases in wages.

For commercial production to be sold on the local market, typically, soyabean and maize that is commercially produced gets absorbed by the local market. During the 2015/16 marketing season, most trade was informal, prices were above normal due to the effects of El-Nino on southern Africa’s maize production. The picture presented is only for changes in profitability owing to the currency movements.

- It is assumed that 25% of the cost of imported inputs is to be inflated by the proportionate change in the exchange rate to reflect the increasing cost of acquiring these inputs.
- Locally purchased inputs stay constant.

The category of local inputs include items such as labor, electricity, and tillage services. While the imported inputs include costs involving items chemicals, fuel, and machinery repair and maintenance which is usually taken as a percentage of fuel costs.

5.1.2. Econometric Procedure

To establish if there is a causal relationship between agricultural exports and exchange rates, we perform a simple Granger causality test. The estimation equations are as specified in 1 and 2 below.
\[ X_t = \sum_{j=1}^{m} \alpha_j X_{t-j} + \sum_{j=1}^{m} \beta_j Y_{t-j} + \varepsilon_t \]  

(1)

\[ Y_t = \sum_{j=1}^{m} c_j X_{t-j} + \sum_{j=1}^{m} \beta_j Y_{t-j} + \omega_t \]  

(2)

Where:

- \( Y_t \) is the dollar value of agricultural exports at time period \( t \).
- \( X_t \) is the Kwacha to dollar exchange rate at time \( t \).
- \( X_{t-j} \) denotes past values of the Kwacha to dollar exchange rate at time \( t-j \), where \( j \) is the optimal lag length.
- \( Y_{t-j} \) denotes lagged values of the value of agricultural exports at time \( t-j \), where \( j \) as the optimal lag length.
- \( \varepsilon_t \) and \( \omega_t \) are uncorrelated random error terms.

For test validity, we ensure (i) stationarity of the exchange rate and agricultural export series (ii) an appropriate lag length is selected given the test’s sensitivity to the choice of lag length. Where stationarity means that the vector auto regression’s first and second moments are independent of time (Becketti 2009). The Augmented Dickey-Fuller (ADF) (unit root) and Schwarz Information Criterion (SIC) tests provide means of establishing if the series is stationary and choosing an appropriate lag length respectively. We use Stata’s `varsoc` command to identify the appropriate lag length (ibid). Test results are discussed in Section 6.2.

5.2. Data and Sources

Data used for this analysis is from the 2015 Zambia National Farmers Union Enterprise Budgets. This covers both small- and large-scale farmers operating in Zambia for both crop and livestock sub-sectors. However, no enterprise budget data is publicly available for specific processors operating within agriculture, with private acquisition often problematic to enable such an analysis. Agricultural export and import data is from the Zambia Central Statistical Office (CSO). This data is collected monthly, but for our analysis, we aggregate this for each year.
6. EXCHANGE RATE VOLATILITY AND AGRICULTURAL EXPORTS

6.1. Latest Trends in Agricultural Imports and Exports

Since 2001, the volume of agricultural exports has been increasing, it was highest in 2015, despite this coinciding with a period of the sharp weakening of the Kwacha—an expected result since the export response is expected to delay for not less than two years (Figure 3).

More recent trends (Figure 4) show that for months in 2015, exports were consistently higher than corresponding months in 2016. This suggests that some exported commodities may have been adversely affected by a deteriorating macroeconomic situation (including currency) in the period in consideration. However, other factors such as reduced prices for exported commodities such as tobacco could have contributed.

The observed trend may have also been induced by export bans for maize and maize products, and by weakening macroeconomic situations in neighboring countries such as Mozambique and the Democratic Republic of Congo (DRC), which could have reduced demand from those countries. The DRC in particular also experienced a weakening currency due to falling copper prices on the world market. Testing for causality between the exchange rate and agricultural export is the only way of establishing if trends in agricultural exports can be predicted by past values of exchange rates, this would have to be done across several years.

Figure 5 shows trends in the export of flowers and vegetables since 1998. Exports have generally declined over time, with the decline partly driven by the exit of many firms since the late 1990’s owing to challenges within the industry. However, currency volatility (and deteriorating macroeconomic conditions) undoubtedly also played a role. From 2012, flower exports increased and declined sharply between 2015 and 2016—a period in which the Kwacha weakened sharply against the dollar.

Figure 3. Trends in the Volume of Agricultural Exports

Source: Zambia Central Statistical Office.
Figure 4. Trends in Volume of Agricultural Exports in Metric Tons (2014-2016)

Source: Zambia Central Statistical Office.

Figure 5. Trends in Selected Horticultural Exports

Source: Zambia Export Growers Association.

Vegetables showed a continuous decline even in the period preceding the Kwacha’s dramatic weakening. The overall picture in the horticultural industry is worrying, and limits the potential contribution to export earnings to foreign exchange earnings. However, this trend points more to an exit of export-oriented commercial producers following various industry challenges. We expect that small producers who mainly produce for the local market are increasing in number.

While presented trends appear to show a relationship between exports and the exchange rate, econometrically testing for a causal relationship is imperative given that exports may be influenced by myriad other factors. In Section 6.2, we test for causality between exchange rates and agricultural exports in Zambia.
6.2. Is there Causality between Agricultural Exports and the Exchange Rate?

Currency volatility’s effect on agricultural exports takes long to manifest. Given that it is less than two years since the onset of the most recent Kwacha weakening in Zambia, econometrically testing for the exchange rate effects on agricultural variables over a longer period is necessary. Using annual export and exchange rate data from 2000-2015, we test for Granger causality between agricultural exports and the exchange rate.

We find agricultural exports (R_EXPORTS), and exchange rates to be integrated of order (0) and (2) respectively (Table A1). Further, we find the optimal lag length for this series to be 4 based on all criteria except the Final Prediction Error (FPE) (Table A2). Which implies that we have a consistent estimate of the true lag length—which is only provided by a minimization of the Schwarz Bayesian Information Criterion (SBIC); and Hannan-Quinn Information Criterion (HQIC).4

Table 1 shows the results of the Granger Causality/Block Exogeneity Wald tests in the VAR framework. Results show that there is bi-directional causality between agricultural exports and exchange rates. Explicitly, the exchange rate Granger causes agricultural exports at the 1% level, whereas agricultural exports Granger cause the exchange rate at the 5% level. This implies that past values of agricultural exports are likely to contain information that helps predict the exchange rate in addition to that contained in past values of the exchange rate alone. The opposite is also true, with past values of the exchange rate containing information that helps predict agricultural exports in addition to the present values.

6.3. The Effect of the Kwacha’s Depreciation on Enterprise Profitability

The weakening of the Kwacha against the dollar is likely to have impacted several crops, save for perennials. With the reason being that perennial crops have a longer gestation period, and as such, significant production cost changes may not manifest in the period under study. As such, we focus our analysis on the impact of the Kwacha’s weakening on the profitability of five major export crops namely maize, seed cotton, tobacco, wheat, and soya beans. Wheat and soyabeans are of particular interest given their increasing importance as inputs into the fast-growing confectionery and poultry industries respectively. In addition to sugarcane, these commodities have grown in importance as export earners since the early 2000s.5

Table 1. VAR Granger Causality/Block Exogeneity Wald Tests (N=12)

<table>
<thead>
<tr>
<th>Dependent Variable: Value of Agricultural Exports (U.S. Dollar (USD))</th>
<th>Chi-sq</th>
<th>df</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excluded</td>
<td>25.368</td>
<td>4</td>
<td>0.000</td>
</tr>
<tr>
<td>Exchange rate (ZMW/USD)</td>
<td>25.368</td>
<td>4</td>
<td>0.000</td>
</tr>
<tr>
<td>All</td>
<td>25.368</td>
<td>4</td>
<td>0.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent Variable: Exchange Rate (ZMW/USD)</th>
<th>Chi-sq</th>
<th>df</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excluded</td>
<td>12.061</td>
<td>4</td>
<td>0.017</td>
</tr>
<tr>
<td>Value of agricultural exports (USD)</td>
<td>12.061</td>
<td>4</td>
<td>0.017</td>
</tr>
<tr>
<td>All</td>
<td>12.061</td>
<td>4</td>
<td>0.017</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations using CSO Export Data.

4 http://www.stata.com/manuals13/tsvarsoc.pdf
6.3.1. Seed Cotton

Table 2 shows changes in the profitability of cotton among cotton outgrowers. Results indicate increasing profitability in cotton due to the Kwacha’s depreciation. This is mostly due to the effect of the new exchange rate on the Kwacha price received for cotton sold. Essentially, the cotton gross margins increase from USD711 to 1,451 Kwacha per hectare. This means that the depreciation created further incentives for cotton production through a positive impact on the Kwacha price received. The production costs were less affected.

Table 2. Impact on the Profitability of Cotton among Outgrowers

<table>
<thead>
<tr>
<th>Exchange rate</th>
<th>7.4</th>
<th>9.5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yield (MT/Ha)</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Price (US$)</td>
<td>378.4</td>
<td>378.4</td>
<td>378.4</td>
</tr>
<tr>
<td>Price (ZMW/MT)</td>
<td>2800.0</td>
<td>3594.6</td>
<td>3783.8</td>
</tr>
<tr>
<td>Revenue (ZMW)</td>
<td>1680.0</td>
<td>2156.8</td>
<td>2270.3</td>
</tr>
<tr>
<td><strong>Production costs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imported inputs (ZMW)</td>
<td>172.18</td>
<td>227.44</td>
<td>230.35</td>
</tr>
<tr>
<td>Local inputs (ZMW)</td>
<td>1916.43</td>
<td>1916.43</td>
<td>1916.43</td>
</tr>
<tr>
<td>Total variable costs (ZMW)</td>
<td>2088.61</td>
<td>2143.87</td>
<td>2146.78</td>
</tr>
<tr>
<td>Capital costs (30% of TVC + Interest) (ZMW)</td>
<td>1253.17</td>
<td>1286.32</td>
<td>1288.07</td>
</tr>
<tr>
<td>Total costs (ZMW)</td>
<td>3341.78</td>
<td>3430.19</td>
<td>3434.85</td>
</tr>
<tr>
<td><strong>Profit margin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross margin (ZMW)</td>
<td>-408.61</td>
<td>12.89</td>
<td>123.49</td>
</tr>
<tr>
<td>as % of turnover</td>
<td>-24.32</td>
<td>0.60</td>
<td>5.44</td>
</tr>
<tr>
<td>net profit (gross margin-capital costs) (ZMW)</td>
<td>(1,661.8)</td>
<td>(1,273.4)</td>
<td>(1,164.6)</td>
</tr>
<tr>
<td>as % of turnover</td>
<td>(98.9)</td>
<td>(59.0)</td>
<td>(51.3)</td>
</tr>
</tbody>
</table>

Source: Author’s Calculations from ZNFU Enterprise Budgets (2015).

6.3.2. Soya Beans

In Table 3, we present the effect of the depreciation on the profitability of commercially produced soya beans meant for the local market. We use the local market in recognition that very little soyabean exports take place. The crop’s importance has grown in the region, with Zambia now emerging as a surplus producer. Its use in animal feed production makes it an essential commodity, particularly given increasing demand for it. As the Kwacha to dollar exchange rate increases to 10, the profitability of commercially produced soyabean reduces. At an exchange rate of 10 Kwacha per dollar, there is no incentive in soyabean production, with a loss of ZMW 5,800. Most of which is a result of the sharp increase in the cost of imported inputs (i.e., from 6,112 to 14,290) at an exchange rate of 10 Kwacha per dollar.
Table 3. Effects of the Exchange Rate on the Profitability of Commercially Produced Soybeans

<table>
<thead>
<tr>
<th>Exchange Rate (ZMW/USD)</th>
<th>7.4</th>
<th>9.5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (MT/ha)</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Price (ZMW/MT)</td>
<td>2850</td>
<td>2850</td>
<td>2850</td>
</tr>
<tr>
<td>Revenue (ZMW)</td>
<td>9975</td>
<td>9975</td>
<td>9975</td>
</tr>
<tr>
<td>Imported inputs (ZMW)</td>
<td>6112</td>
<td>14186</td>
<td>14290</td>
</tr>
<tr>
<td>Local inputs (ZMW)</td>
<td>1499.28</td>
<td>1499.28</td>
<td>1499.28</td>
</tr>
<tr>
<td>Interest costs @ 20% of TVC (ZMW)</td>
<td>1522</td>
<td>3137</td>
<td>3158</td>
</tr>
<tr>
<td>Total variable costs (ZMW)</td>
<td>1522</td>
<td>15686</td>
<td>15789</td>
</tr>
<tr>
<td>Capital costs (30% of TVC+Interest) (ZMW)</td>
<td>913</td>
<td>5646.8</td>
<td>5684.0</td>
</tr>
<tr>
<td>Total costs (ZMW)</td>
<td>2436</td>
<td>21332.4</td>
<td>21472.8</td>
</tr>
<tr>
<td>Gross margin (ZMW)</td>
<td>8452.69</td>
<td>(5,710.55)</td>
<td>(5,813.80)</td>
</tr>
<tr>
<td>as % of turnover</td>
<td>347.03</td>
<td>(57.25)</td>
<td>(58.28)</td>
</tr>
<tr>
<td>Net profit (gross margin-capital costs) (ZMW)</td>
<td>9061.6</td>
<td>(27,042.90)</td>
<td>(27,286.57)</td>
</tr>
<tr>
<td>as % of turnover</td>
<td>107.20</td>
<td>(271.11)</td>
<td>(273.55)</td>
</tr>
</tbody>
</table>

Source: Author’s Calculations from ZNFU (2015).

6.3.3. Wheat

With respect to commercial wheat production sold on the domestic market, results indicate decreased profitability. However, this remains almost as high under a drop of the exchange rate to either 9.5 or 10 Kwacha per dollar (Table 4).

Table 4. Effect on the Profitability of Locally Traded Wheat

<table>
<thead>
<tr>
<th>Exchange rate (ZMW/USD)</th>
<th>7.4</th>
<th>9.5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (MT/ha)</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Price (ZMW/MT)</td>
<td>2780</td>
<td>2780</td>
<td>2780</td>
</tr>
<tr>
<td>Revenue (ZMW)</td>
<td>20850</td>
<td>20850</td>
<td>20850</td>
</tr>
<tr>
<td>Imported inputs (ZMW)</td>
<td>1042</td>
<td>1077</td>
<td>1122</td>
</tr>
<tr>
<td>Local inputs (ZMW)</td>
<td>3704</td>
<td>3704</td>
<td>3704</td>
</tr>
<tr>
<td>Interest costs @ 20% of TVC (ZMW)</td>
<td>949</td>
<td>956</td>
<td>965</td>
</tr>
<tr>
<td>Total variable costs (ZMW)</td>
<td>4747</td>
<td>4782</td>
<td>4827</td>
</tr>
<tr>
<td>Capital costs (30% of TVC + Interest) (ZMW)</td>
<td>5283</td>
<td>1435</td>
<td>1448</td>
</tr>
<tr>
<td>Total costs (ZMW)</td>
<td>5283</td>
<td>6216</td>
<td>6275</td>
</tr>
<tr>
<td>Gross margin (ZMW)</td>
<td>16103</td>
<td>16068</td>
<td>16023</td>
</tr>
<tr>
<td>as % of turnover</td>
<td>305</td>
<td>258</td>
<td>255</td>
</tr>
<tr>
<td>Net profit (gross margin-capital costs) (ZMW)</td>
<td>10820</td>
<td>(1176)</td>
<td>(1193)</td>
</tr>
<tr>
<td>as % of turnover</td>
<td>204.80</td>
<td>(18.92)</td>
<td>(19.01)</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations using ZNFU (2015).
6.3.4. Maize

Smallholder maize production always faces a challenge in profitability owing to the low yield levels among farmers. Table 5 indicates that there is a large disincentive to production owing to the Kwacha’s appreciation. A shift in the exchange rate from ZMW 7.4 to 10 per dollar increases the losses by ZMW 744, pushing farmers to exit the industry.

Table 5. Effect of Currency Depreciation on the Profitability of Smallholder Maize Production

<table>
<thead>
<tr>
<th></th>
<th>Exchange rate</th>
<th>7.4</th>
<th>9.5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yield (MT/Ha)</td>
<td></td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Price (ZMW)</td>
<td></td>
<td>1340.0</td>
<td>1340.0</td>
<td>1340.0</td>
</tr>
<tr>
<td>Revenue (ZMW)</td>
<td></td>
<td>3350.0</td>
<td>3350.0</td>
<td>3350.0</td>
</tr>
<tr>
<td><strong>Production costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imported inputs (ZMW)</td>
<td></td>
<td>1736.5</td>
<td>2451.8</td>
<td>2481.2</td>
</tr>
<tr>
<td>Local inputs</td>
<td></td>
<td>1894.5</td>
<td>1894.5</td>
<td>1894.5</td>
</tr>
<tr>
<td>Interest costs @16% ZMW</td>
<td></td>
<td>581.0</td>
<td>695.4</td>
<td>700.1</td>
</tr>
<tr>
<td>Total variable costs ZMW</td>
<td></td>
<td>3631.0</td>
<td>4346.3</td>
<td>4375.7</td>
</tr>
<tr>
<td>Capital costs (30% of TVC +Interest)</td>
<td></td>
<td>1263.6</td>
<td>1512.5</td>
<td>1522.7</td>
</tr>
<tr>
<td>Total costs (ZMW)</td>
<td></td>
<td>4894.61</td>
<td>5858.85</td>
<td>5898.39</td>
</tr>
<tr>
<td><strong>Profit margin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross margin (ZMW)</td>
<td></td>
<td>(281.02)</td>
<td>(996.33)</td>
<td>(1,025.66)</td>
</tr>
<tr>
<td>as % of turnover</td>
<td></td>
<td>8.4</td>
<td>29.7</td>
<td>30.6</td>
</tr>
<tr>
<td>net profit (gross margin-capital costs)</td>
<td></td>
<td>(1,544.61)</td>
<td>(2,508.85)</td>
<td>(2,548.39)</td>
</tr>
<tr>
<td>as % of turnover</td>
<td></td>
<td>46.1</td>
<td>74.9</td>
<td>76.1</td>
</tr>
</tbody>
</table>

Source: Authors’ Calculations using ZNFU (2015).
7. CONCLUDING REMARKS

This study sought to assess the impact of the macroeconomic situation on the performance of the agricultural sector in Zambia. Specifically establishing: (i) if there is causality between agricultural exports and the exchange rate, and (ii) the effect of currency depreciation on enterprise profitability.

Results confirm that agricultural exports Granger cause the exchange rate. Implying that past and current values of the exchange rate explain the value of agricultural exports. The impact on crop profitability is largely negative with soyabeans, maize, and wheat production showing decreases in the profitability. However, cotton production among outgrowers showed increased profitability, largely due to the effect of the currency depreciation on the local price received.

These results suggest that large shifts in the exchange rate as was observed in the period under study have potential to negatively affect the sector. As such, monetary policy should focus on ensuring the stability of the key macroeconomic variables. A key strategy among producers (mainly commercial) would be to budget in dollars, for those enterprises that have a large import component, this would then mean that they would have to maintain a foreign currency base.
## APPENDIX

### Table A 1. Augmented Dickey Fuller Unit Root Test — with an Intercept and Trend

<table>
<thead>
<tr>
<th>Variables</th>
<th>ADF test statistic</th>
<th>1% level</th>
<th>5% level</th>
<th>10% level</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log R_EXPORTS</td>
<td>-3.527</td>
<td>-4.380</td>
<td>-3.600</td>
<td>-3.240</td>
<td>0.0366***</td>
</tr>
<tr>
<td>Log EXUSDMK</td>
<td>-2.418</td>
<td>-4.380</td>
<td>-3.600</td>
<td>-3.240</td>
<td>0.37303</td>
</tr>
<tr>
<td>D(Log EXUSDMK)</td>
<td>-2.490</td>
<td>-4.380</td>
<td>-3.600</td>
<td>-3.240</td>
<td>0.3332</td>
</tr>
<tr>
<td>D(EXUSDMK,2)</td>
<td>-6.972</td>
<td>-4.380</td>
<td>-3.600</td>
<td>-3.240</td>
<td>0.0000***</td>
</tr>
</tbody>
</table>

Notes: *,**,*** denotes rejection of the null hypothesis of unit root at the 10%, 5% and 1% significance level respectively.

### Table A 2. VAR Lag Order Selection Criteria

<table>
<thead>
<tr>
<th>Lag</th>
<th>LL</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>HQIC</th>
<th>SBIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-28.5706</td>
<td>4.5415</td>
<td>0.559964*</td>
<td>5.0951</td>
<td>5.06518</td>
<td>5.17592</td>
</tr>
<tr>
<td>1</td>
<td>-26.2998</td>
<td>1.8513</td>
<td>1.38802</td>
<td>5.8957</td>
<td>5.74609</td>
<td>6.29978</td>
</tr>
<tr>
<td>2</td>
<td>-25.3742</td>
<td>1.24179</td>
<td>5.55564</td>
<td>5.55564</td>
<td>6.12136</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-19.3338</td>
<td>12.081</td>
<td>0.589255</td>
<td>4.25504*</td>
<td>3.98574*</td>
<td>4.9824*</td>
</tr>
</tbody>
</table>

* LL indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SBIC: Schwarz Bayesian Information Criterion; HQIC: Hannan-Quinn information criterion.
REFERENCES


