THE IMPACTS OF MONETARY POLICY ON THE MAIZE AND BEEF SECTORS OF SOUTH AFRICA: THEORETICAL FOUNDATIONS AND MODEL SPECIFICATION

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Abstract
A general equilibrium simultaneous equations model is specified to analyze the impacts of monetary policy on the maize and beef sectors. Four key macro variables which link monetary policy to agriculture - the interest rate, exchange rate, inflation rate and real income - are studied. The exchange rate, inflation rate and real income are determined endogenously within the model which contains money and foreign exchange markets and a manufacturing sector (macro sector) and the maize and beef sectors (agricultural sector). Macro linkages whereby the impacts of monetary policy are transmitted to the maize and beef sectors and discussed are formulated.

Uritersel
Die impak van moneties beleid op die nie- en beestvoedings sektor van Suid-Afrika I: Teoretiese onderbou en modelspesifikasie

In algemene wye glykstappe-vergelykingmodel word gespreek oor die impak van moneties beleid op die nie- en bestialvoedings sektor van Suid-Afrika. Geskiedenis en relevante kennis - word ondersoek. Die nie- en beestvoedings sektor word onderbroken. Die geweers met of nie-geweers met nie- en beestvoedings sektor hou, aangesien die impak van moneties beleid op die nie- en beestvoedings sektor oorgedoen word, word bespreek en geëvalueer.

1. Introduction
Since the early 1970s, South African farmers have been ex- posed to persistent double digit inflation and fluctuating nominal and real exchange rates. As a result, the rand exchange rate has declined against major currencies and real per capita income has fallen (South African Reserve Bank). Structural changes in South African monetary policy have con­ tributed to instability and uncertainty in the agricultural sector. In January 1979, the South African Reserve Bank (SARB) implemented a managed float system for the rand exchange rate, and in January 1981, the government suspended gold operations replaced strict quantitative controls as the main instruments of monetary policy. Lack of adequate restraints on the growth of monetary aggregates by the monetary authorities has con­ tributed to general inflation (De Kock Commission, 1988).

This study attempts to address the need by specifying a general equilibrium simultaneous equations model to analyze some impacts of monetary policy on the maize and beef sectors in South Africa. The model focuses on four key macro variables: the interest rate, exchange rate, inflation rate and real disposable income. The model examines the impacts of monetary policy on maize and beef agriculture. The model is used to analyze the impacts of monetary policy on the maize and beef sectors and discuss implications for policy makers.

The first article in this two article series reviews literature on, and discusses the economic theory underlying, the behavioural equations and macrolinkages specified in the model. The second article estimates the model and compares 3SLS and 2LS parameter estimates for the maize and beef sectors. The implications for these sectors of a simulated expansionary monetary policy are also discussed.

2. Macrolinkages and key macroeconomic variables
Macrolinkages between monetary policy and agriculture as­ sociated with the interest rate, exchange rate, inflation and real disposable income are discussed in this section.

2.1 Interest rate (cost and stock effects)
The interest rate, being a cost of capital, has a direct impact on the cost of investing in short-term production loans. The 3SLS process generally produces more efficient (smaller variance) parameter estimates than 2SLS because it takes into account cross-equation correlations. Due to cross-equation correlation (Pindyck and Rubinfeld, 1981:334- 338), 3SLS could not be used in the present model due to insuf­ ficient degrees of freedom as the number of exogenous vari­ ables exceeded the number of (time series) observations. The present study ensures sufficient degrees of freedom by using only the maize and beef sectors to represent agriculture. The potential gain in efficiency is illustrated by comparing 3SLS and 2SLS parameter estimates for equations specifying these sectors in the model. Thirdly, this study emphasizes that monetary policy changes add instability to an already inherently un­ stable agricultural sector. This inherent instability is due to factors such as price inelastic aggregate food demand, changing weather patterns and rapid technological change (Rausser, 1983).

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2.2 Exchange rate (trade effects)
Considerable debate exists in the literature concerning the ef­ fects of exchange rate changes on agricultural exports, the role of monetary policy in exchange rate determination, and the choice of an appropriate exchange rate measure.

Some agricultural economists (Schuh, 1974; Chambers, 1979; Chamberlain and Just, 1981; Rausser, 1983; Deutches, 1983) sup­ port the view that exchange rate changes in the aggregate money supply will lower the value of the domestic currency and increase the volume of exports. Under a floating exchange rate regime, domestic currencies are directly influenced by forces in interna­ tional monetary markets. The effects of inflation become important in affecting changes in domestic and foreign interest rates. Higher relative interest rates cause capital inflows into a country raising the value of its currency and exports to become less competitive on world markets which reduces export demand (trade effect) and reduces domestic money demand.

Schuh (1974) argued that low farm incomes in the United States (U.S.) were directly attributable to the negative impact of an overvalued dollar on the competitive position of U.S. farmers. Chamberlain and Just (1981) tested this empirically and found that U.S. corn, wheat and soybean exports are sensitive to changes in the value of the dollar, inferring that exchange rate fluctuations have significant real impacts on agricultural com­ modity markets. Where a country has a fixed exchange rate, each country adjusts differently to these fluctuations, but in the long term, real export demand for all three crops increases due to a depreciation. Increases in export prices are offset by increased demand.

Several studies have disputed the importance of the exchange rate as a determinant of agricultural exports. Kost (1975) argued that the impact of a change in the exchange rate on agricultural trade would be small, with the major effect being on price rather than quantity due to inelastic demand and supply of farm products. This price change is limited by the percentage change in the exchange rate. Vejilimos-Palma (1976), using both cross-sectional and time series regression analysis, found that the exchange rate was either not statisti­ cally significant or the sign of the coefficient did not comply with theory, indicating that agricultural export variation cannot be explained by variation in exchange rates. The general price level increases and this implies that agricultural commodities and services are viewed as the primary cause of inflation.

The monetarist approach assigns monetary policy an active role in which money supply is controlled directly by the monetary authorities. For monetarists, the equilibrium overall price level is that which induces individuals to hold the exact quantity of money that is convertible into real wealth. An excess supply, say, from an unan­ ticipated increase in money supply, shifts aggregate demand upwards, causing excess supply prices to rise and the general price level thus rises, thereby lowering the real value of nominal money supply. Equilibrium is restored when the stock of real balances again equals actual real demand.

Monetarists recognise the existence of real shocks which change relative prices, but see growth in the money supply as the direct cause of inflation. The model, therefore, acknowledges the link between real exchange rates and agricultural export demand, but argues that monetary policy can only have nominal effects. The lack of any relationship between changes in nominal

money supply and changes in the real value of the dollar therefore limits the role of monetary policy in promoting agricul­ tural export volumes in the long-run.

The debate is also complicated by discrepancies in the results obtained using different measures of real exchange rates (Ghent and Greener, 1987; Batten and Belongia, 1986; Belongia, 1986; Chui, 1986). Critics of the managed float have argued that effective rather than bilateral, exchange rate indices should be used when assessing rates of change movements on trade flows. However, difficulties arise regarding the choice of suitable weights and data availability.

In South Africa, the depreciation of the rand since 1984 has imparted positive export stimuli to a number of major South African agricultural exports (South African Wool Board, Destination Freight Board). Conversely, the lower rand exchange rate has serious implications for South African farmers facing the demand curve. Inflation and the corresponding per­ centage of the fuel, fertilizers, chemicals and capital equipment are imported, either as raw materials, or as finished goods (de Choo, 1979). A depreciated rand causes input prices to rise which impact negatively on agricultural supply.

2.3 Inflation rate (cost effects)
Inflation can be defined as the continuing or persistent rise in the average level of prices for real goods and services (Kisselgardt et al., 1988).

When investigating the causes of inflation, the distinction must be made between real and nominal effects, and relative and nominal price shifts. Failure to make this distinction results in mis­identification of the real causes of inflation (Belongia and Fisher, 1982).

The structuralist approach views inflation as being caused by real shocks such as crop failures and changes in consumption patterns. Money supply which accommodates these shocks increases real money supply and demand and moderates price increases in the non-agricultural sector. The agricultural sector is assumed to be perfectly competitive, producing homogeneous goods whose prices are completely flexible. The industrial sector is viewed as being oligopolistic, producing heterogeneous goods under increasing returns to scale. Prices are set on a cost-plus basis and lack flexibility.

If all prices were perfectly flexible with the same adjustment rates, the general price level would be unaffected by real shocks, although prices with sticky nominal components may vary in some prices would be exactly offset by declines in others. In the real world however, prices do not adjust at the same rate and tend to be inflexible downwards. Real shocks therefore affect rel­ative prices of agricultural commodities and are viewed as the primary cause of inflation.

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Abstract

A general equilibrium simultaneous equations model is specified to analyze the impacts of monetary policy on the maize and beef sectors. For key macrowebers which link monetary policy to agriculture - the interest rate, exchange rate, inflation rate and real income - are studied. The exchange rate, inflation rate and real income are determined endogenously within the model which contains money and foreign exchange markets and a manufacturing sector (macro sector) in addition to the maize and beef sectors (agricultural sector). Macrowebers whereby the impacts of monetary policy are transmitted to the maize and beef sectors are discussed and simulated.

1. Introduction

Since the early 1970s, South African farmers have been exposed to persistent double digit inflation and fluctuating nominal and real exchange rates. As a result, the real exchange rate has declined against major currencies and real per capita incomes have fallen (South African Reserve Bank). Structural changes in South African monetary policy have contributed to instability and uncertainty in the agricultural sector. In January 1979, the South African Reserve Bank (SARB) implemented a managed float system for the rand exchange rate, and in April 1979 the Exchange and Marginal Rates and the Reserve Rate System (EMRRS) replaced ad hoc quantitative controls as the main instruments of monetary control. Lack of adequate restraints on the growth of monetary aggregates by the monetary authorities has contributed to general inflation (De Kock Commission, 1988). Increased awareness of the need to establish and understand the nature and strength of linkages between the macro sector and agriculture (Groenewald, 1982; 1985; Nieuwoudt, 1986; van Zyl, et al., 1987). These macrowebers are often expressed in terms of their impacts on the maize and beef sectors in South Africa. The model focuses on four key macrovariables: the interest rate, exchange rate, inflation rate and real disposable income. These macrowebers are important determinants of the impacts of monetary policy on the maize and beef sectors.

The first article in this two article series reviews literature on, and discusses the economic theory underlying, the behavioural equations and macrolewebers specified in the model. The second article estimates the model and compares 3SLS and 2L2 parameter estimates for the maize and beef sectors. The implications for these sectors of a simulated expansionary monetary policy are also discussed.

2. Macrolewebers and key macroeconomic variables

Macrolewebers between monetary policy and agriculture are associated with the interest rate, exchange rate, inflation and real disposable income are discussed in this section.

2.1 Interest rate (cost and stock effects)

The interest rate, being a cost of capital, has a direct impact on production costs and savings (De Prinsen, 1979). An interest rate cost effect impacts the interest rate of the farm debt approaching 13,6 billion rands (Directorate Agricultural Economics, 1987). Both loan and non-loan agricultural debt are expected to be highly elastic with respect to the interest rate. High nominal interest rates lead to large real rate of interest repayment capacities and create cash-flow problems.

Stock effects of interest rate changes capture the impact of monetary policy on inventory behaviour. Higher interest rates reduce the cost of investing in credit risky stocks to be run-down. In the livestock sector, slaughters increase as higher interest rates raise the cost of feeding livestock. Conversely, the lower the real rate of exchange rate has serious implications for South African farmers facing the demands of foreign creditors. A significant percentage of the rand is non-vaIuta bearing assets rise (Rausser, 1985).

2.2 Exchange rate (trade effects)

Considerable debate exists in the literature concerning the effects of exchange rate changes on agricultural exports, the role of monetary policy in exchange rate determination, and the choice of an appropriate exchange rate measure.

Some agricultural economists (Schuh, 1974; Chambers, 1979; Chambers and Just, 1981; Rausser, 1985; Davidson, 1985) support the view that changes in the rand's real exchange rate is a dominant influence in setting long-term real domestic prices. The impact of a change in the exchange rate on yields is limited by the price change relative to the exchange rate. The value of rand is directly influenced by forces in international money markets, the most important being relative price shifts.

When investigating the causes of inflation, the distinction must be made between real and nominal effects, and relative and nominal price shifts. Failure to make this distinction results in mis-identification of the real causes of inflation (Belongia and Fisher, 1982).

The structuralist approach views inflation as being caused by real shocks such as crop failures and changes in consumption patterns. Money supply shocks which accommodate price increases in the non-agricultural sector. The agricultural sector is assumed to be perfectly competitive, producing homogeneous goods whose prices are completely flexible. The industrial sector is viewed as being oligopolistic, producing heterogeneous goods under increasing returns to scale. Prices are set on a cost-plus basis and lack flexibility.

If all prices were perfectly flexible with the same adjustment rates, the general price level would be unaffected by real shocks, although prices with infrequent, large or infrequent, large or infrequent price increases. Failure to make this distinction results in some prices would be exactly offset by declines in others. In the real world, however, prices are sticky and tend to be inflexible downwards. Real shocks therefore affect relative prices, agricultural commodites and are viewed as the primary cause of inflation.

Monetary flows are adjusted to supply monetary policy as an active role in which money supply is controlled directly by the monetary authorities. For monetarists, the equilibrium overall price level is that which induces individuals to hold the exact quantity of monetary assets that is adequate for the given level of income. An excess supply, say from an unanticipated increase in money supply, shifts aggregate demand upwards, causing excessive aggregate demand. Excess demand raises the general price level thus rises, thereby lowering the real value of nominal money supply. Equilibrium is restored when the stock of real balances again equals the demand for money.

Monetarists recognise the existence of real shocks which change relative prices, but see growth in the money supply as the dominant determinant of inflation (Belongia and Fisher, 1982). Other stimuli, such as wage demands, cannot occur continuously.
Agriculture's role in monetary policy

Agricultural earnings contribute to nominal income, which influences consumption and savings. Increased disposable income leads to higher demand for goods and services, stimulating economic activity. However, expansionary policies may lead to inflation if demand pressures exceed supply constraints.

Monetary policy

Central banks influence interest rates and money supply to achieve price stability and economic growth. Through Open Market Operations (OMO), they purchase or sell government securities to adjust the money supply.

1. **Monetary Policy Instruments:**
   - Open Market Operations
   - Changes in Bank Reserve Requirements
   - Discount Rate
   - Interest Rate on Reserve Requirements

2. **Impact on Agriculture:**
   - Lower interest rates increase borrowing and investment in agricultural projects.
   - Higher interest rates temper inflation, reducing consumer spending.
   - Money supply growth affects exchange rates and import prices.

3. **Inflation and Agriculture:**
   - Inflation erodes purchasing power and affects real income levels.
   - Agricultural prices are sensitive to demand and supply shocks.
   - Inflationary expectations can influence producers to hold onto inventories, impacting supply and demand.

4. **Inflation in South Africa:**
   - South African farmers are exposed to variability in monetary and exchange rate policies.
   - Monetary policy instruments aim to contain inflation and support economic growth.

5. **Macroeconomic Approach:**
   - Analyzing the role of inflation in aggregate demand and supply.
   - Macroeconomic models integrate monetary and fiscal policies.

6. **Agricultural Sector:**
   - Agriculture contributes significantly to GDP and employment.
   - Policies affecting agricultural inputs and outputs can influence inflation and exchange rates.

7. **Model Specifications:**
   - Incorporating agricultural sector dynamics into macroeconomic models.
   - Simulating the impact of monetary and fiscal policies on the agricultural sector.

8. **Policy Recommendations:**
   - Balancing monetary and exchange rate policies for sustainable growth.
   - Strengthening policy coordination to address inflationary pressures.

9. **Conclusion:**
   - Understanding the agricultural sector's role in monetary policy is crucial for effective policy formulation.
   - Collaboration among policymakers is essential to navigate economic challenges.

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**References:**

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Agricultural activities in the maize and beef sectors are fundamental to the income-generation process of the African economy. The need to purchase inputs produced off-farm is reflected by estimating input prices as functions of the Consumer Price Index (CPI) and exchange rate. The input price linkages are simulated by estimating input prices as functions of the CPI and exchange rate. The input price linkages are simulated by estimating input prices as functions of the CPI and exchange rate.
Real personal disposable income is defined as real gross domestic product less real taxes and deductions (Devadoss, 1985). The income received by households is simulated real per capita disposable income in the real per capita maize, beef and manufactured goods demand equations.

4. Conclusion

Review of available literature identifies four key macrovariables which link changes in monetary policy to agriculture: the exchange rate, interest rate, inflation and real income. A general equilibrium simultaneous equations model is therefore specified to simulate the macrolinkages associated with these macrovariables through which monetary policy changes are transmitted to the maize and beef sectors in South Africa. The exchange rate, general price level and real income are determined endogenously within the model.

The endogenous interest rate linkage is simulated by including the real interest rate in the real maize supply, real beef supply and real agricultural investment equations. This captures cost and stock effects of interest rate changes on maize and beef. General equilibrium simultaneous equations model is therefore to analyse demand, prices and incomes to be analysed. This will give on the two sectors. The potential gain in efficiency from domestic product less real taxes and deductions (Devadoss, 1985).

Note

1. This work was carried out in the Agricultural Policy Research Unit, University of Natal, which is supported by the HSRC. The views of the authors do not necessarily reflect those of the HSRC.

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The exchange rate linkage is simulated by including the real interest rate in the real maize supply, real beef supply and real agricultural investment equations. This captures cost and stock effects of interest rate changes on maize and beef supply respectively. The CPI and exchange rate are specified as determinants of both real per capita personal disposable income as a determinant of both real personal disposable income and as a determinant of both real per capita personal disposable income and real per capita beef demand.

The simulated macrolinkages enable the impacts of changes in monetary policy on real maize and beef supply, per capita demand, prices and incomes to be analysed. This will give policy makers greater insight into the possible impacts of monetary policy on the maize and beef sectors. The second article provides this insight by reporting model estimation results of the effect of exchange rate and monetary fluctuation on U.S. agriculture. Unpublished Ph.D. thesis, University of California, Berkeley, California.


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