RP 143
SETEMBER 2004

THE DETERMINANTS OF INFLATION IN SOUTH AFRICA: AN ECONOMETRIC ANALYSIS

Oludele Akinloye Akinboade,
Franz Krige Siebrits and
Elizabeth Wambach Niedermeier

AFRICAN ECONOMIC RESEARCH CONSORTIUM

CONSORTIUM POUR LA RECHERCHE ECONOMIQUE EN AFRIQUE

The determinants of inflation in South Africa: An econometric analysis

By

Oludele Akinloye Akinboade, Franz Krige Siebrits
and Elizabeth Wambach Niedermeier

Department of Economics
University of South Africa

AERC Research Paper 143
African Economic Research Consortium, Nairobi
September 2004

Published by: The African Economic Research Consortium
P.O. Box 62882-00200
Nairobi, Kenya

Printed by: The Regal Press Kenya, Ltd.
P.O. Box 46166-00100
Nairobi, Kenya

ISBN 9966-944-44-3

Table of contents

List of tables

List of figures

List of abbreviations

cpi	Underlying consumer price index of South Africa. The index is sourced from the South African Reserve Bank for the period 1975.1–2000.2. It equals headline consumer price index excluding food and non-alcoholic beverages, homeowners' costs and value-added tax. For the period 1970.1–1974.4, the series was defined as the headline consumer price index net of housing costs.
lprsa	Log of the consumer price index of South Africa (used as an econometrics software specification)
Dppp	Dummy variable in the PPP relationship
Dmd	Dummy variable in the money demand relationship
Dwc	Dummy variable in the labour market relationship
e	Nominal effective exchange rate
ler	Log of the nominal effective exchange rate
ECMPPP	Error correction term in the PPP relationship
ECMMD	Error correction term in the money demand relationship
ECMWc	Error correction term in the labour market relationship
i	Nominal interest rate
lc	Unit labour cost (used as an econometrics specification)
llc	Log of unit labour cost
m3	Broad money
lm3	Log of broad money
pf	Index of foreign prices, weighted by the share in total imports of South Africa's four major trading partners
lpf	Log of the index of foreign prices
wc	Wage cost, same as unit labour cost
lwc	Log of wage cost
y	Real GDP at 1995 prices
lyk	Log of real GDP at 1995 prices

Acknowledgements

We wish to acknowledge, with thanks, the financial support from the African Economic Research Consortium (AERC).

We are indebted to the resource persons and researchers in Group B for providing us with invaluable comments and helpful suggestions. In particular, we wish to thank Ibi Ajayi, David Bevan, Shanta Devarajan, Mohsin Khan, Peter Montiel, Njuguna Ndungu, Steve O'Connell and Charles Soludo for their guidance at every stage of this research project.

The findings made and opinions expressed in this paper are exclusively those of the authors. They do not necessarily represent the views of AERC, the AERC resource persons or the University of South Africa. The authors are also solely responsible for any remaining errors.

Abstract

This study seeks to explain the dynamics of inflation in South Africa. It was motivated by the recent monetary policy shift towards inflation targeting and the authorities' stated objective of reducing inflation to a level commensurate with that of its trading partners.

In the study, we develop a model that relates domestic inflation in South Africa to money market, labour market and foreign exchange market conditions. We demonstrate that inflation in South Africa is largely a structural phenomenon. In the short run, there is a positive correlation between labour costs, broad money supply and domestic inflation. An appreciation of the rand or an increase in the nominal effective exchange rate will lower domestic inflation in South Africa. In the long run, rising labour costs contribute significantly to inflation. An increase in the nominal interest rate, the effect of which is insignificant in the short run, will slightly reduce inflation in the long run. On the other hand, an increase in the broad money supply will contribute to domestic inflation in the long run.

It appears as if purchasing power parity exists between South Africa and its major trading partners. The predominant source of variation in domestic inflation's forecast errors is own shocks. Innovations from labour costs and the nominal effective exchange rate are also important sources.

The largely structural nature of inflation in South Africa, coupled with the reality that the monetary authorities have limited control over its main determinants, suggests that it will be difficult to achieve the objective of the inflation targeting regime, namely inflation parity with South Africa's major trading partners.

1. Introduction

In recent times the tempo of price increases in South Africa has decreased significantly. After peaking at 18.6% in 1986, consumer price inflation dropped to 5.2% in 1999, the lowest rate of price increases since 1970. The rate of inflation in South Africa, nonetheless, remains above the rates of the country's main trading partners.[1] Both the previous and the present Governor of the South African Reserve Bank (SARB) have repeatedly stated that inflation should be reduced to the levels prevailing in these countries, inter alia to prevent excessive exchange rate and interest rate instability and continued erosion of South Africa's international competitiveness (see, e.g., Stals, 1996: 2; Mboweni, 1999: 6). The recent past has also seen the implementation of various institutional innovations aimed at strengthening the ability of the SARB to fight inflation. These include the adoption of a mission statement that defines the primary objective of the Bank as the protection of the internal and external value of the rand (1990), the inclusion of a clause in the 1996 Constitution of South Africa that charges the Bank with the obligation to fulfil this objective independently but in regular consultation with the Minister of Finance, and the adoption of formal inflation targeting in 2000.

At this juncture the monetary policy framework in South Africa raises a number of complex issues. One set of questions has to do with the appropriateness of the objective of reducing inflation to the very low levels prevailing in the countries constituting South Africa's main trading partners. How significant are the costs to the South African economy of having an inflation rate of, say, five percentage points higher than that in these countries? Viewed from a different angle, what benefits will follow from achieving and maintaining inflation parity? And what will it cost the economy in terms of output and employment to achieve the required further reduction in inflation? A second set of questions concerns more operational issues. Is inflation targeting an appropriate framework for conducting monetary policy in South Africa? Are superior alternatives perhaps available? To what extent can the SARB combat inflation with the traditional instruments of monetary policy such as the money supply and interest rates?

These questions constitute a formidable research agenda. It is not our intention to address all of them in the present paper. However, we believe that a study of the determinants of inflation in South Africa is a good starting point for investigating these issues. An understanding of the forces driving and perpetuating inflation in South Africa should shed some light on the extent of the SARB's control over the inflation process and the relative efficacy of alternative monetary policy frameworks and instruments. In turn, such knowledge should provide valuable clues about the

likely costs of further reducing inflation in South Africa and, by implication, the appropriateness of the objective of achieving and maintaining inflation parity with South Africa's main trading partners.

The following monetary and structural determinants of inflation in South Africa are investigated in this study:

- In a small open economy like South Africa, the exact nature and timing of the linkages among the nominal exchange rate, foreign prices and domestic prices (which together determine the real exchange rate) are of crucial importance. This relates to the extent of the pass-through of changes in foreign prices and the exchange rate to domestic prices. We study the significance of the pass-through of changes in foreign prices and the exchange rate to domestic prices in South Africa to shed light on the desirability, or otherwise, of the policy of achieving inflation parity with the country's main trading partners.
- We investigate the link between the growth of the money supply and price formation in South Africa. This issue is closely related to the extent of demand–pull inflation in the economy.
- We determine the extent of the wage–push inflation in South Africa. This is an important issue in the South African context, where the labour market is characterized by a powerful and highly centralized union movement, highly unequal distributions of income and wealth, and widespread poverty even among full-time workers in a number of sectors.

The determinants of inflation in South Africa have been studied before (see Section 3), but advances in econometric techniques and the availability of a longer data series make this is an opportune time to revisit the issue.

This research report comprises six sections. Section 2 provides background information on the South African economy, macroeconomic policies followed from 1960 to 1999 and macroeconomic outcomes during the same period. The theoretical and empirical literature on the determinants of inflation is reviewed in Section 3. The first part of the section reviews international studies, while the second part focuses on earlier empirical work on the determinants of inflation in South Africa. Section 4 sets out the data sources and the salient features of the model adopted in this study. The results of the study are presented in Section 5, while the final section summarizes the findings and discusses the policy implications.

2. Overview of the South African economy

South Africa has by far the largest economy in sub-Saharan Africa, but in the global context it is best described as a small, open, middle-income developing country. In 1999, the gross national income (GNI) of South Africa amounted to US$134 billion, equivalent to 2.1% of the aggregate GNI of low- and middle-income countries and 0.4% of world GNI (World Bank, 2001a).

The openness of the South African economy is indicated by the fact that the ratio of exports of goods and non-factor services to gross domestic product (GDP) and that of imports of goods and non-factor services to gross domestic expenditure (GDE) both exceed 20%. In 2000, these ratios amounted to 29.1% and 26.9%, respectively (SARB, 2001a). A combination of relatively poor economic growth and relatively rapid population growth has meant that the GNI per capita in South Africa has dropped relative to many other countries in recent times. In 1999, South Africa's GNI per capita was US$3,170 (World Bank, 2001b). In terms of this indicator, South Africa ranked 88th among the 207 countries for which the World Bank provides such data.

Macroeconomic policy, 1960–1999

Since 1960 the general approach of the South African macroeconomic policy makers has evolved through three phases. The first phase, which covered the 1960s and most of the 1970s, has been described as one of "conservative Keynesianism... characterised by active demand management and considerable state government intervention" (Moll, 1993: 237). During this period the authorities attempted to stabilize economic activity by means of fiscal and monetary measures. Direct (or non-market) measures, such as credit ceilings and liquid asset requirements, were used extensively. Except for a brief period in 1974–1975, the exchange rate was fixed or pegged during these two decades.

The second phase originated in the second half of the 1970s and lasted into the second half of the 1980s. It was marked by a reassignment of policies and a shift from direct to indirect (or market-related) policy instruments. Active and deliberate anti-cyclical fiscal policy was abandoned, and restraint of government expenditure became the main objective of the fiscal policy makers. Monetary policy was strongly influenced by the findings and recommendations of the Commission of Inquiry into the Monetary System and Monetary Policy in South Africa, chaired by Gerhard

de Kock, the Governor of the SARB at the time. Reflecting the Commission's theoretical basis, described in one of its reports as a blend of "conservative Keynesian demand management and pragmatic monetarism" (cf. Calitz and Siebrits, 1999: 223), monetary policy retained a strong focus on general economic stability. With fiscal policy increasingly oriented towards restraint of government expenditure, monetary policy became the dominant instrument of short-term macroeconomic policy. Credit ceilings and liquid asset requirements were replaced as the main instruments for controlling the monetary aggregates by indirect measures such as interest rate manipulation. The exchange rate was also subjected to market forces to a greater extent than before. In September 1979, a dual exchange rate system consisting of a controlled floating commercial rand and a freely floating financial rand was introduced. The objective of unifying the exchange rate was realized in February 1983, but in September 1985 renewed political and economic instability necessitated the reintroduction of the financial rand.

The defining characteristic of the third phase, which started in the late 1980s, was a strong focus on structural aspects of macroeconomic policy making. Fiscal discipline has become the key objective of fiscal policy. The authorities are aiming to reduce the size of the government sector in the belief that this will reduce distortions and inflationary pressure and improve the longer-term growth potential of the South African economy. The earlier broad-based approach to monetary policy has given way to an almost exclusive focus on maintaining discipline and stability in the monetary sector. In 1990, Chris Stals, who succeeded De Kock as Governor of the SARB in 1989, issued a mission statement that defined the primary goal of the Bank as "the protection of the internal and external value of the rand". This focus on price stability represents a major departure from the broad approach implied by the De Kock Commission's definition of monetary policy as "all deliberate actions by the monetary authorities to influence the monetary aggregates, the availability of credit, interest rates and exchange rates, with a view to affecting monetary demand, income, output, prices and the balance of payments" (De Kock Commission, 1985: A3). In the area of exchange rate policy, effect was given to this approach with the abolition of the financial rand in March 1995 and the subsequent gradual phasing out of exchange controls.

In 1999, Stals was succeeded as Governor of the South African Reserve Bank by Tito Mboweni. Thus far, Mboweni has also followed a fairly conservative monetary policy approach. The South African government and the South African Reserve Bank have recently adopted a monetary policy framework based on inflation targeting (see below).

The ranking of policy objectives

Table 1 gives some indication of the order in which the South African government ranked the main macroeconomic policy objectives between 1970 and 2000. The ranking is based on the annual Budget Speeches of the Minister of Finance, which

usually contain an indication of the order in which the different objectives are to be pursued during the ensuing fiscal year. Strictly speaking, the table applies to fiscal policy only. But in view of the close liaison between the fiscal and monetary authorities in South Africa, the ranking often applies to monetary policy as well.

Table 1: Ranking of the goals of fiscal policy in South Africa

Year	1	2	3
1970	Growth	Balance of payments	Price stability
1971	Growth	Price stability	Balance of payments
1972	Balance of payments	Growth	Price stability
1973	Growth	Price stability	Balance of payments
1974	Growth	Price stability	Balance of payments
1975	Growth	Price stability	Balance of payments
1976	Balance of payments	Price stability	Growth
1977	Balance of payments	Price stability	Growth
1978	Growth	Balance of payments	Price stability
1979	Growth	Price stability	Balance of payments
1980	Growth	Price stability	Balance of payments
1981	Balance of payments	Price stability	Growth
1982	Balance of payments	Price stability	Growth
1983	Price stability	Balance of payments	Growth
1984	Balance of payments	Price stability	Growth
1985	Price stability	Balance of payments	Growth
1986	Growth	Balance of payments	Price stability
1987	Growth	Price stability	Balance of payments
1988	Price stability	Balance of payments	Growth
1989	Balance of payments	Price stability	Growth
1990	Balance of payments	Price stability	Growth
1991	Growth	Balance of payments	Price stability
1992	Growth	Balance of payments	Price stability
1993	Growth	Price stability	Balance of payments
1994	Price stability	Growth	Balance of payments
1995	Price stability	Growth	Balance of payments
1996	Price stability	Growth	Balance of payments
1997	Price stability	Balance of payments	Growth
1998	Balance of payments	Price stability	Growth
1999	Growth	Balance of payments	Price stability
2000	Growth	Price stability	Balance of payments

Sources: Calitz and Siebrits (1999, 2001).

The table shows that economic growth was the most important policy objective during the 1970s, followed by price stability. However, the balance of payments was a priority in times of shocks (such as the outflow of capital in the aftermath of the 1976 Soweto uprisings). The 1980s were marked by an unfavourable political and international economic environment, culminating in the 1985 debt crisis. During this period of instability, stabilization of prices and the balance of payments became more important objectives of short-term macroeconomic policy than economic growth. Moreover, the view that a strong balance of payments and low inflation are in any event prerequisites for economic growth was gaining many adherents. The accent on achieving macroeconomic stability with a view to

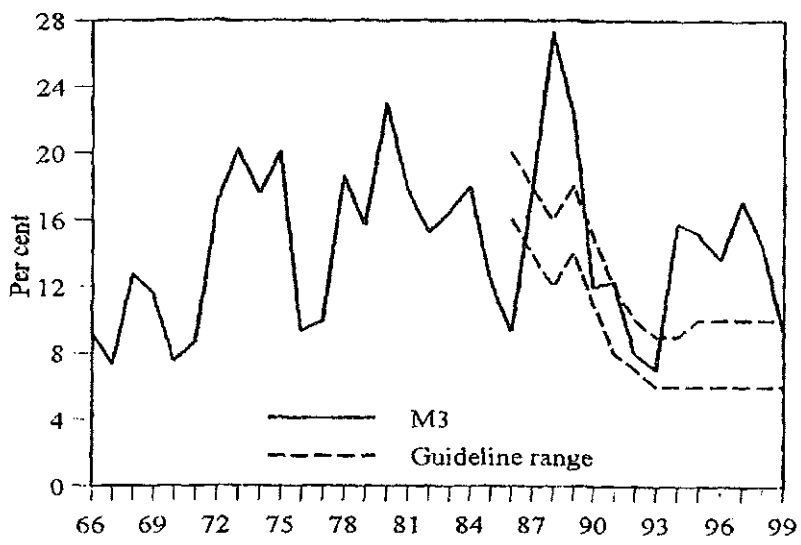
improving longer-term growth prospects continued into the 1990s. During this period the resumption of capital flows to South Africa eased the balance of payments constraint, and inflation came to be regarded as the main constraint to growth. From 1999 onwards, policy pronouncements from the fiscal authorities increasingly emphasized the direct promotion of economic growth.

It should be stressed that the normalization of South Africa's international economic relations has merely eased the balance of payments constraint. The constraint has not been eliminated. The balance of payments remains an important policy consideration in view of the openness of the South African economy. This was vividly affirmed in 1998, when high real interest levels were maintained for balance of payments reasons, despite a significant slowdown in domestic economic activity.

The evolution of monetary policy

Elsewhere in this section we explained how the South African authorities' approach to macroeconomic policy has evolved since 1960. This subsection provides more detail on developments in monetary policy. The discussion takes place against the backdrop of Figure 1, which shows the annual rates of growth in the broad money supply or M3. (M3 consists of coins and banknotes in circulation, cheque and transmission deposits, other demand deposits, other short-term and medium-term deposits, and long-term deposits.) For the period from 1986 onwards, the figure also shows the SARB's guideline ranges for M3 growth.

Figure 1: Growth in the broad money supply, 1966–1999



Source: SARB (2001a).

As indicated earlier in this section, the period from the mid 1960s to the end of the 1970s was characterized by the extensive use of direct monetary policy instruments. A system of variable liquid-asset requirements was enacted in 1965. In terms of this system, a bank's holdings of statutory liquid assets were not allowed to be less than the sum total of specified percentages of its liabilities to the public (Meijer, 1987: 62). By raising the liquid-asset requirements, the monetary authorities could reduce the upper limit of the banks' liabilities to the public and, hence, the extension of credit by the banks. The system appeared to create scope for maintaining interest rates at relatively low levels, as the authorities could in principle rely on the manipulation of liquid-asset requirements to restrict growth in bank credit and the money supply. Interest rates were relatively stable and in real terms negative for most of the 1970s (cf. Whittaker, 1992: 60–3), and were therefore not intensively used as an instrument of monetary control. Instead, various forms of credit ceilings were used to bolster the authorities' control over the monetary aggregates.

The direct controls were ineffective instruments for curbing money supply growth (see Figure 1) and for preventing the rise in inflation. Moreover, the controls had a distorting impact on measured money supply growth as disintermediation (a situation where the use of banks as financial intermediaries between lenders and borrowers was avoided) became pervasive.

It was in the milieu of rising inflation and growing dissatisfaction with the prevalent system of monetary control that the De Kock Commission was appointed in August 1977. In a series of reports culminating in a Final Report (De Kock Commission, 1985), the Commission strongly criticized direct instruments of monetary policy and argued for their replacement by market-oriented instruments. It also came out strongly in favour of flexible, market-related interest rates.

The recommendations of the De Kock Commission led to a series of monetary policy reforms from 1979 onwards. The most important reform was the replacement of the system of direct controls by a cash reserve system based on the central bank's powers to strongly influence market interest rates. Under this system, the central bank determined the price (i.e., interest rates cost) at which it provided cash reserves to banks and money market institutions by means of its accommodation procedures at the discount window (Meijer, 1988: 12). The new system differed in two important respects from the liquid-asset control system it replaced (Meijer, 1988: 12–3). First, it attempted to regulate the monetary aggregates by influencing the demand for money and credit of the non-bank public, rather than by influencing the ability of the banking system to supply money and credit. Second, it was more market-oriented in that it did not prescribe minimum or maximum holdings of cash or other assets. It attempted to influence private sector behaviour by means of price or interest rate incentives.

The accommodation system worked as follows (cf. Whittaker, 1992: 56–7): the South African Reserve Bank used open-market operations to maintain a positive money market shortage (i.e., to keep other financial institutions collectively indebted to it). It then accommodated this debt by allowing financial institutions unlimited

access to its discount window. Banks could rediscount treasury bills and other forms of financial paper, or borrow from the Reserve Bank against suitable collateral. The rate at which accommodation was granted, the bank rate, determined short-term market interest rates and became the main operational variable for the implementation of monetary policy.

The recommendations of the De Kock Commission also led to the introduction of monetary targeting in 1986. From the start, the targets were applied in a flexible manner, and in 1991 they were officially renamed "guidelines" to avoid the impression that they represented forecasts of or binding commitments to rates of monetary expansion (cf. Calitz and Siebrits, 1999: 235–6).

The framework of monetary targeting and the cash-reserve system of accommodation were initially left unchanged in the wake of the assumption of the Governorship of the Reserve Bank by Chris Stals in 1989. However, the fight against inflation was intensified by institutional means (e.g., the restatement of the mission of the Reserve Bank and the achievement of greater independence from the government) and the maintenance of high real interest rates.

The second half of the 1990s saw a comprehensive overhaul of the monetary policy framework. The accommodation system, which had been adapted several times (notably in 1993), was replaced by the so-called repo system in March 1998. Under the new system, bank rate was replaced by repo rates, which are the outcome of a process whereby banks enter into repurchase agreements in respect of various securities sold by tender to the Reserve Bank on a daily or intra-day basis for the purpose of acquiring liquidity. In principle, the main advantage of the repo system is its greater flexibility, which enables market conditions to exert a stronger influence on interest rates than under the previous system.[2] However, the Reserve Bank can still control interest rates by providing insufficient liquidity.

As was the case in many other countries, South Africa experienced two serious problems with monetary targeting. The first was the difficulty of controlling the money supply. Figure 1 shows that the targets were seldom met, and the discrepancies between guidelines and actual money supply growth increased sharply in the 1990s as South Africa's reintegration into the international financial system accelerated. Furthermore, the relationships between money supply growth and ultimate policy objectives (e.g., reducing inflation) proved to be highly unstable. In a recent empirical study, Moll (1999: 59) concluded that no "close and reliable relationship between broad money and real and nominal variables can be uncovered". The monetary authorities continued to announce guidelines for M3 growth until 1998 – when a guideline range of 6 to 10% was announced as a goal to be pursued over the next three years – but it was clear that enthusiasm for these guidelines had been lost. For a brief period, a more eclectic approach was followed whereby monetary policy decisions were guided by a broader set of indicators, which, in addition to the growth in the money supply and bank credit extension, included the production price index, the level of interest rates, money market conditions, the gross gold and other foreign exchange reserves, and the public sector borrowing requirement.[3] The decision to adopt formal inflation targeting was taken in 1999, and the new

monetary policy framework was introduced in February 2000. The target specified by the South African government and announced in Minister of Finance Trevor Manuel's 2000/01 Budget Speech is the achievement of an average rate of increase in the overall consumer price index (excluding mortgage interest cost) of between 3% and 6% for the year 2002.

Exchange rate management

The exchange rate regime has undergone a number of changes since the 1960s. These changes are summarized in Table 2. Figure 2 shows the exchange rate of the rand against the US dollar and the pound sterling (the rates are the weighted average of the banks' daily rates).

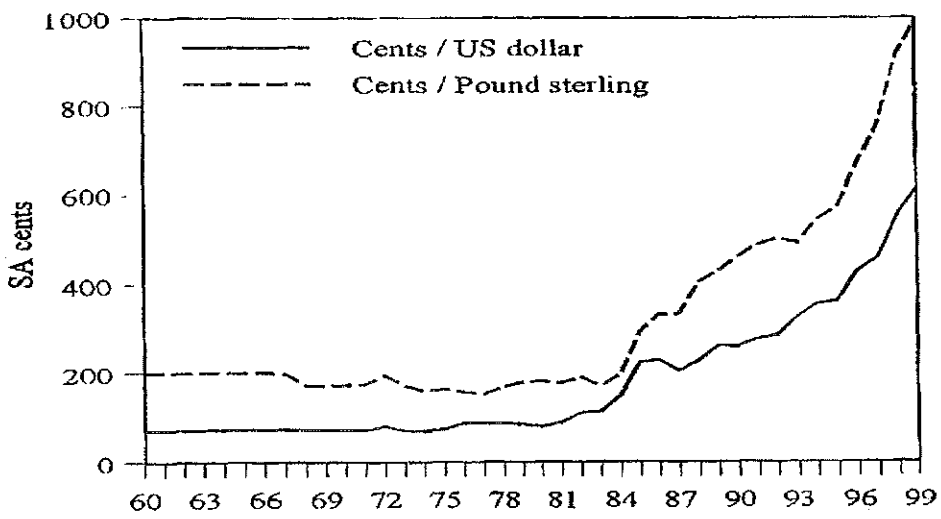
Table 2: Exchange rate regimes in South Africa, 1961–1999

Period	Exchange rate regime
61(Q1) B 71(Q2)	Fixed: pegged to the pound sterling
71(Q3) B 74(Q2)	Fixed: pegged in episodes to floating US dollar or pound sterling
74(Q3) B 75(Q2)	"Controlled independent float": devaluations every few weeks
75(Q3) B 79(Q1)	Fixed: pegged to the US dollar
79(Q2) B 82(Q4)	Dual system: controlled floating commercial rand and floating financial rand
83(Q1) B 85(Q3)	Unification to a controlled floating rand; financial rand abolished
85(Q4) B 95(Q1)	Return to a dual exchange-rate system
95(Q1) B	Unification to a controlled floating rand

Source: Aron and Ayogu (1997).

The exchange rate was pegged to the US dollar or the pound sterling during the 1960s and most of the 1970s. Foreign exchange controls were instituted in 1961 in response to the capital outflows that followed the Sharpeville shootings. The controls, which applied to residents and non-residents, insulated the capital account of the balance of payments from outflows of equity capital. Non-residents wishing to repatriate capital had to use the so-called blocked rand, sales of which could be only to other non-residents (Kahn, 1989: 252). The system of exchange controls remained in force throughout the 1960s and the 1970s, although the scope of blocked rand transactions was widened with the change to the securities rand in 1976. In 1979 a dual exchange-rate system was introduced. In line with the recommendations of the De Kock Commission, an approach of managed floating was adopted for the official or commercial rand. The securities rand was renamed the financial rand. It remained market-determined, but its uses were widened further to include foreign direct investment (Kahn, 1989: 252; Goedhuys, 1994: 157). The De Kock Commission emphasized the economic inefficiency of the dual exchange-rate system and recommended the abolition of exchange controls and a return to a unitary rand at the earliest opportunity. This objective was partly achieved in February 1983, when exchange controls on non-residents were lifted and the rand unified. However,

the new regime was short-lived. A combination of factors, including the intensification of the disinvestment campaign and trade boycott against South Africa, the severe drought of 1983/84, a slump in gold and commodity prices, and renewed political instability, led to a sharp depreciation of the rand from the end of 1983 onwards (Goedhuys, 1994: 159; see also Figure 2). These developments culminated in the debt moratorium in August 1985 and the reintroduction of the dual exchange rate system on 2 September 1985. The dual system persisted until March 1995, when the financial rand was again abolished. The gradual phasing out of exchange controls was initiated at the same time.



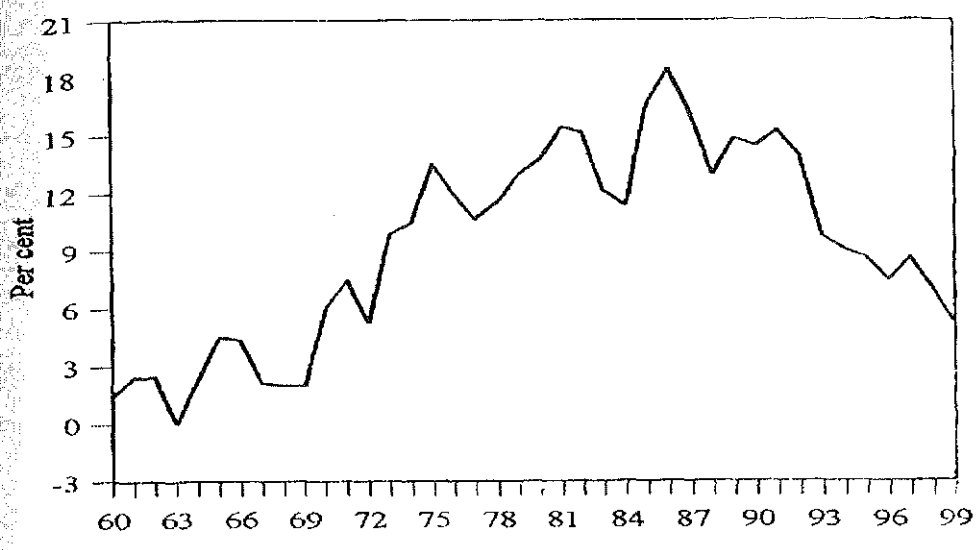
Source: SARB (2001a).

Macroeconomic performance, 1960–1999

In this section we briefly summarize the performance of the South African economy in respect of four macroeconomic objectives: price stability, economic growth, full employment and balance of payments stability. In general, the South African economy performed relatively well during the 1960s, but macroeconomic outcomes deteriorated from the mid 1970s onwards.

Figure 3 shows trends in inflation, expressed as the annual percentage change in the consumer price index (CPI). Inflation was relatively low until the early 1970s, averaging 2.5% during the 1960s. It subsequently accelerated and entered the double-digit range in 1973. During the 1970s, the average inflation rate was 10.3%. After a period of relative stability around a level of 11% in the late 1970s, inflation rose again in the early 1980s. The 1980s were characterized by high, but relatively stable rates of inflation ranging from 11.5 to 18.6%. The average inflation rate for the decade was 14.7%.

Figure 3: Consumer price inflation, 1960-1999



Source: SARB (2001c).

Inflation subsided significantly in the early part of the 1990s. After peaking in 1986, the rate of inflation began decreasing and in 1993 it dropped to beneath 10%. It subsequently decreased further to 5.2% in 1999. On average, consumer prices rose by 9.3% during the 1990s. The SARB (1996) has attributed the slowdown in inflation during the first half of the 1990s to the consistent application of conservative monetary policy since the late 1980s and the impact of the drawn out recession of 1989–1993 on inflation expectations and wage settlements. These factors were supported by the relative price stability in South Africa's main trading partner countries, a somewhat more stable exchange rate of the rand, fiscal prudence and efficiency gains from trade liberalization

During the past four decades inflation in South Africa seldom entered the moderate range, which is defined by Dornbusch and Fischer (1993: 11) as persistent annual rates of price increases ranging between 15 and 30%. Table 3 provides a comparison of inflation rates (expressed as the annual change in consumer prices) in South Africa, its main trading partners and selected middle-income developing countries. The table shows that the inflation rate in South Africa is moderate compared with those of several other middle-income countries, but remains considerably higher than the inflation rates of the country's main trading partners. As indicated earlier, the inflation differential between South Africa and its main trading partners is a key aspect of the authorities' rationale for further reducing the rate of price increases.

Table 3: Inflation rates for South Africa and selected other countries, 1980–1999

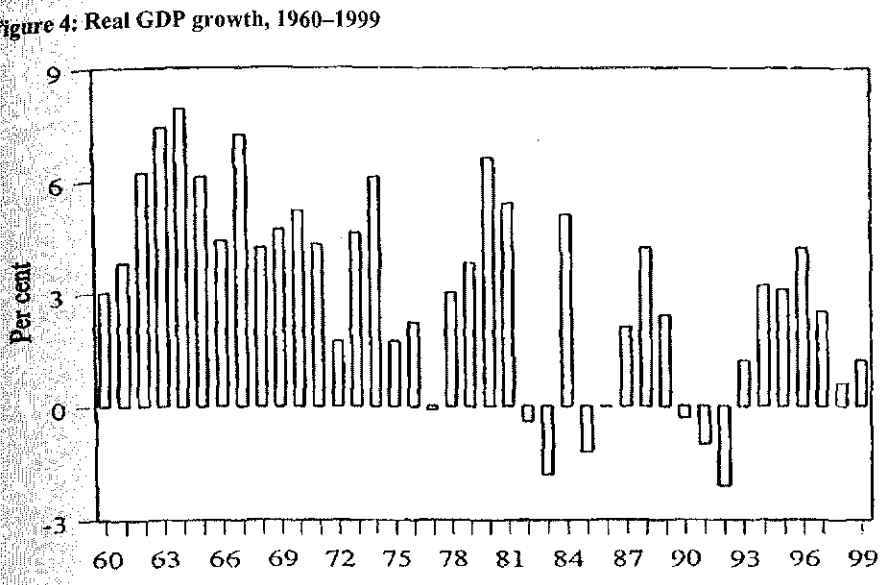
Average annual % growth	Year		
Country	1980–1990	1990–1998	1999
South Africa	14.8	9.1	5.2
Middle-income countries:			
Argentina	390.6	10.6	-2.2
Brazil	285.6	253.5	8.6
Chile	20.6	9.7	3.3
Czech Republic	-	8.5	1.0
Hungary	9.6	21.5	10.0
Malaysia	2.6	4.0	2.8
Mauritius	6.9	7.0	6.9
Mexico	73.8	19.9	16.7
Philippines	13.4	8.5	6.6
Poland	50.9	27.8	7.3
Thailand	3.5	5.1	0.3
Tunisia	7.4	4.6	2.7
Turkey	44.9	81.5	63.5
Venezuela	20.9	51.8	23.6
Trading partners:			
Germany	-	2.4	0.6
Japan	1.7	0.9	-0.3
United Kingdom	5.8	2.9	1.6
United States of America	4.2	2.7	2.2

Sources: World Bank (2001a/b).

Figure 4 shows that the annual rate of increase in South Africa's real GDP slowed and became more variable between 1960 and 1999. Average annual real GDP growth slowed from 5.8% in the 1960s to 3.0% in the 1970s, 1.7% in the 1980s and 1.4% in the 1990s. From the mid 1970s onwards, population growth often exceeded real output growth. GDP per capita at constant 1995 prices accordingly decreased from a peak of R16,347 in 1981 to R13,847 in 1999. The relatively poor growth performance of the South African economy reflects the slowdown in world economic growth since the 1960s, structural weaknesses, and a series of political and economic shocks.

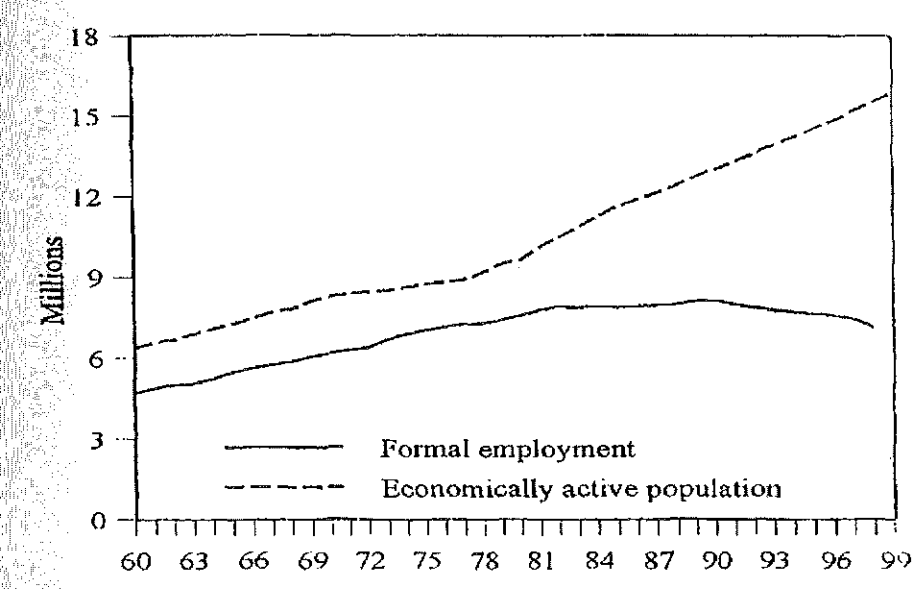
The exact extent of unemployment and underemployment in South Africa is often disputed, but analysts agree that these are large and growing problems. Figure 5 depicts the growing discrepancy between the size of the economically active population and the extent of employment in the formal sectors of the economy (including agriculture and domestic service).The average annual rate of job creation in the formal economy decreased from 2.8% during the 1960s to 2.1% in the 1970s and 0.7% in the 1980s. During the 1990s, formal sector employment decreased by 1.6% per annum. At present, less than 50% of the economically active population holds formal sector jobs. Unemployment is estimated at between 15 and 30% (depending on whether a "narrow" or "expanded" definition of unemployment is chosen), while the remainder of the economically active population is engaged in subsistence agriculture or informal activities. Activities in these sectors are generally aimed at ensuring survival and provide low incomes.

Figure 4: Real GDP growth, 1960–1999



Source: SARB (2001a).

Figure 5: Formal employment growth, 1960–1999



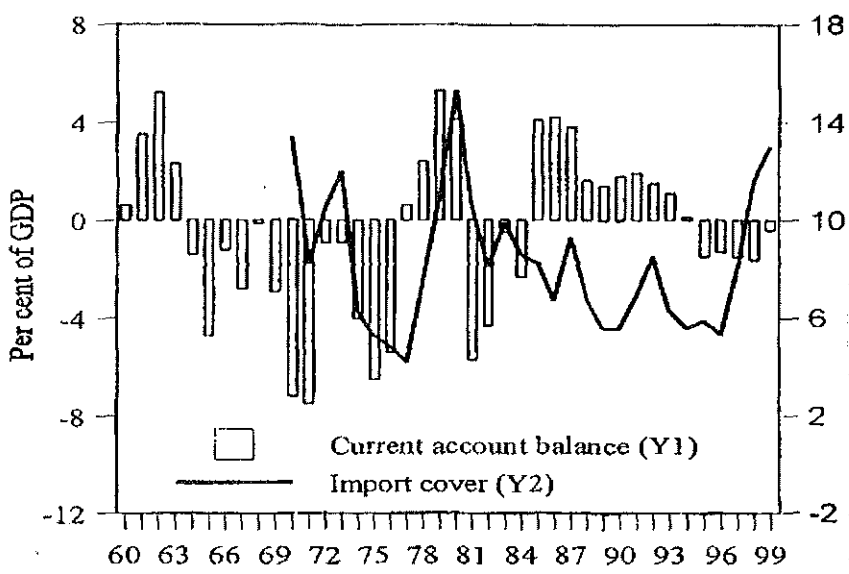
Sources: Statistics South Africa (1997); own estimates.

Figure 6 plots two indicators of the extent of balance of payments stability in South Africa: the balance on the current account and the import cover ratio (number of weeks of imports covered by gross reserves).

South Africa traditionally runs current account deficits, financed by capital inflows from abroad. The fact that surpluses were recorded in 18 of the 39 years depicted in the figure is evidence of balance of payments instability during this period. These surpluses reflect the operation of the balance of payments constraint: in the aftermath of the Sharpeville tragedy (1960–1963), the Soweto uprisings (1977–1980), and the Rubicon speech and the debt standstill (1985–1994), current account surpluses had to be maintained to finance capital outflows. The balance of payments constraint was a binding constraint on the growth potential of the South African economy between 1985 and 1994 and, although alleviated by the normalization of South Africa's access to international financial markets in 1994, remains an important structural aspect of the economy (cf. Table 1; De Wet, 1994).

The import cover ratio also exhibits considerable instability. Furthermore, it was generally low, seldom exceeding the value of three months normally regarded as prudent by international financial institutions and rating agencies.

Figure 6: Balance of payments indicators, 1960–1999



Source: SARB (2001a).

3. Review of relevant literature

The determinants and economic impact of inflation are discussed widely in the literature. Some of the most often cited factors influencing inflation are connected with the exchange rate regime, or are monetary in nature and highlight the importance of the money supply and of policies to control money supply growth. Other models emphasize structural factors, such as market imperfections and cost pressures (including those of import prices), whereas yet others focus on demand pressures (these include the cost of government services and expenditures, the amount of revenue collected, debt and debt servicing, etc.).

Some authors, including Evans (1985) and Wasserfalen (1985), have suggested relevant theoretical frameworks. However, their empirical verifiability is weak. Greene (1989) has reviewed a number of empirical models used to explain inflation in African countries. He has categorized them into: (a) monetarist models, (b) those based on the fiscal approach, which identifies large fiscal deficits as the underlying cause of monetary expansion, and (c) those that emphasize the role of exchange rate depreciation either in conjunction with monetary policy or as an influence on other factors feeding into inflation. In the first part of this section we briefly elaborate on some of these theoretical approaches and discuss recent empirical studies on inflation determinants, including some that do not focus specifically on African countries. These studies provide guidance regarding research methods and modelling techniques. Pertinent studies on inflation in South Africa are reviewed in the second part of the section.

The purchasing power parity approach

The simplest approach to price determination in an open economy is that of purchasing power parity (PPP). Absolute purchasing power parity (APPP) implies that price levels in different countries move towards equality in common currency terms. This approach stems from the Law of One Price, which states that any commodity in a unified market has a single price. In the absence of transport and other costs, arbitrage will ensure that the same price will prevail in two countries for any commodity that can be traded between them. Therefore, if the foreign (world) market price for a commodity is denoted as P, and the exchange rate between the domestic currency and the foreign currency as E, then the domestic price (P) for that commodity will be captured by the following expression:

$$P = E.P^{\omega} \tag{1}$$

The PPP theory is an extension of this law, from one commodity to a basket of commodities that determines the average price level in a given country.

Equation 1 suggests that inflation results either directly from higher import prices or indirectly through increased demand for domestic goods, the prices of which will increase with the increased domestic price for imports until equilibrium is restored.

The APPP theory has been criticised for excessive simplicity and its incorporation of a number of unrealistic assumptions including: (a) the absence of natural barriers to trade; (b) the absence of artificial barriers such as tariffs and/or quotas; (c) that all goods are internationally traded; and (d) that the domestic and foreign price indexes are composed of the same commodities, with identical weighting across countries (Sachs and Larrain, 1993; Atta et al., 1996, 1999).

A less restrictive version of the APPP theory is the relative PPP theory, which implies that even when there are barriers to trade, as long as these barriers are stable over time, the percentage change in the nominal spot exchange rate between two currencies should equal the inflation differential between the respective countries. This can be represented as follows:

$$(\Delta P / P_{-1}) = \Delta((E.P^{\omega})/(E.P^{\omega})_{-1}) \tag{2}$$

This can be re-written as

$$(\Delta P / P_{-1}) - (\Delta E / E_{1}) = (\Delta P^{\omega} / P^{\omega}{}_{-1})$$

In other words, domestic inflation is equal to the sum of currency depreciation and the rate of foreign inflation. Put differently,

$$(\Delta P / P_{-1}) - (\Delta P^{\omega} / P^{\omega}{}_{-1}) = (\Delta E / E_{1})$$

that is, the percentage change in the nominal spot exchange rate between two currencies should equal the inflation differential between the respective countries.

The evidence on the validity of the PPP theory for less developed countries (LDCs) is mixed (McNown and Wallace, 1989; Frenkel, 1978, 1981; Mahdavi and Zhou, 1994). The PPP theory tends to perform better for countries that are geographically close to each other and where trade links are strong. It also appears to work well for high inflation countries such as many in Latin America that have witnessed rapid exchange rate depreciations.

Agenor and Montiel (1996: 305) point out that the exchange rate may also have a short-term impact on inflation in small, open developing countries. Exchange rate depreciation directly affects the prices (in domestic currency units) of tradeable goods, but may also indirectly affect the general price level if pricing decisions are affected by the cost of imported inputs. Moreover, if nominal wages are explicitly or implicitly indexed, exchange rate depreciation may lead to higher nominal wages.

Bodart (1996) explores the inflationary implications of exchange rate reforms in a small open economy by combining the public finance view of inflation with multiple exchange markets. In many developing countries, a system of multiple exchange rates was adopted initially as a temporary measure but maintained over a long period of time owing to difficulties in eliminating the system. The author examines the inflationary implications of policy reform under the two alternative systems of a fixed crawl of nominal official exchange rates and a continuous adjustment of the official rates towards the parallel exchange rate. He finds that the short- and long-run adjustments of inflation differ under the two systems. Whereas a fixed crawl of the official exchange rate has only temporary effects on inflation, a depreciation of the official exchange rate under the second system has a more permanent impact on inflation. Also, when policy reforms are permanent and associated with a long-run increase in quasi-fiscal deficits, the economy will experience permanently higher inflation.

De Broeck et al. (1995) analyse inflation dynamics in Kazakstan. Following the breakdown of the Soviet Union, the newly independent Kazakstan inherited a price system that was still largely administered. A reform programme was initiated in the country in 1992; the price liberalization process, which continued till 1994, entailed large relative price shifts and an increase in the overall price level towards those observed in market economies. This liberalization programme was pursued against a background of macroeconomic instability and double-digit inflation. The authors show that the piecemeal manner in which prices were liberalized resulted in strong relative price variability over a prolonged period of time, against a background of high inflation. Though convergence towards international relative and absolute prices progressed, it was incomplete as the prices for energy and services remained below the market economy levels.

Holmes (2000) uses panel data to examine whether the PPP theory holds in 27 African LDCs. Using quarterly data for the period 1974–1997, he confirms the PPP theory with additional evidence to support its prevalence in the case of high inflation LDCs.

The monetarist approach to the determinants of inflation

According to the monetarists, inflation is a domestic monetary phenomenon that comes about when the central bank increases the money supply in excess of the demand for money. This overly large increase in the money supply can be caused by the monetary financing of fiscal deficits or by extending too much credit to the private sector. Monetarists see the short-term solution to inflation as the implementation of a contractionary or restrictive monetary policy.

The monetarist approach to modelling the determinants of inflation can be explained with the aid of the IS-LM model. Starting from equilibrium at potential national income, governments can create temporary or sustained demand inflation by temporary or sustained bouts of excessive monetary expansion. Also, increases in demand owing to an investment boom and bond-financed expansionary fiscal

policy could raise prices substantially. The modern literature on inflationary financing of budget deficits builds on the work of Cagan (1956) and Bailey (1956). Recent contributions include the model by Dornbusch and Reynoso (1993) and a review of the literature by Dornbusch and Fischer (1993).

It is asserted that the money supply is exogenous and under the control of the authorities. In simple terms, the monetarist model of the determinants of inflation can be expressed as follows:

$$P = k + M - \beta Y + \delta C \quad (3)$$

where M is the supply of money, Y the real income, and C the opportunity cost of holding money (all the variables being expressed as rates of growth or changes). Changes in velocity are captured by the constant term k.

Equation 3 is based on Harberger's (1963) model of inflation in Chile and has been popular in the empirical literature. It is derived from the money demand function and is based on the hypotheses that inflation will vary positively with the rate of change of the money supply and negatively with the rate of change of real income, ceteris paribus. It is not uncommon for monetarist models of inflation to be amended to incorporate the effects of a lagged adjustment process. The rate of interest (i) could be used in models focused on developed countries as a measure of the cost of holding money (C), but it is widely accepted that this measure might be inappropriate in developing countries with highly underdeveloped financial markets. As such, it is argued that changes in past inflation rates should be used as a measure of the cost of holding cash. If these are incorporated into the previous equation, the monetarist model becomes:

$$P_t=\alpha_0 + \alpha_1 M_t + \alpha_2 M_{t-1} + \alpha_3 Y_t + \alpha_4(\Delta P_{t-1} / P_{t-1}) \quad (4)$$

where ($\hat{i}P_{t-1} / P_{t-1}$) is the rate of inflation in the previous period.

In practice, inflationary financing of budget deficits and exchange rate depreciation may interact to produce a devaluation–inflation spiral. Following Rodriquez (1978), Agenor and Montiel (1996: 305) show how efforts by the central bank to finance fiscal deficits by means of money creation may raise prices and erode foreign reserves. This may lead to devaluation if the central bank has limited access to borrowing in the international capital markets, thus initiating a devaluation–inflation spiral.

Structuralist models of the determinants of inflation

Adherents of the orthodox view acknowledge the existence of structural bottlenecks in developing countries, but reject the structuralist view that such rigidities are the key causes of inflation. Structuralists distinguish between basic (or

structural) inflationary pressures and mechanisms that transmit or propagate such pressures (see Kirkpatrick and Nixson, 1987: 176-177). Key structural bottlenecks identified in structuralist analyses include distorting government policies, the conflicts between capitalists and workers over the distribution of income between profits and real wages (Agenor and Montiel, 1996: 298–9), the inelastic supply of foodstuffs, the foreign exchange constraint and the government budget constraint. In this view, the bottlenecks lead to price increases, which are converted into a process of inflation by distributional struggles. The mechanism that propagates inflation is therefore the efforts by social classes and/or sectors to maintain their relative positions in the face of price increases (Kirkpatrick and Nixson, 1987: 177). One of the best-known structuralist models of inflation was developed by Cardoso (1981).

Structuralists believe that inflationary financing of budget deficits is an expression of the struggle over the distribution of resources between the public and private sectors. They therefore argue that the factors that the orthodox view regards as the causes of inflation should rather be seen as symptoms of underlying structural rigidities in developing countries.

Greene (1989) applies post-Keynesian models to African economies, where inflation is viewed as being caused by exogenous shocks, such as a sudden rise of imports, wage hikes over and above price rises, and a sudden increase in fiscal deficits or other cost increasing factors. These "real" shocks automatically induce an increase in the money supply so that price increases that started in one part of the economy spill over to the rest of the economy. The central bank is thus unable to implement an independent monetary policy. For the post-Keynesians, wage and price controls would help reduce inflation.

Structuralist-monetarist (or hybrid) models of the determinants of inflation

Fundamental omissions from the monetarist models are structural or cost–push elements that cause inflation. The monetarists explain cost increases in terms of changes in the money supply, especially if the monetary authorities adopt an accommodation policy that seeks to prevent real output from falling. Cost–push inflation, which is absent in monetarist models, is a potentially serious problem in many small open developing countries where increases in foreign prices may be an important cause of domestic inflation.

In recent years, several authors have developed models with monetarist and structuralist features by directly augmenting the monetarist approach with cost–push factors. Some of the approaches have been to model the fiscal deficit as the original force and the propagating mechanism in the inflationary process (e.g., Aghevli and Khan, 1978), to introduce structuralist considerations into monetarist models (e.g., Chhibber, 1992; Jha, 1994: 224–7) and to account for money supply dynamics in structuralist models (e.g., Agenor and Montiel, 1996: 311–4).

Saini (1982) sought to decompose inflation into those factors dependent on domestic developments and those dependent on external factors. As such, the author included the growth rate of import prices (*Pm*) into the monetarist model to obtain a hybrid model of inflation specified as follows:

$$P_t = \alpha_0 + \alpha_1 M_t + \alpha_2 M_{t-1} + \alpha_3 M_{t-2} + \alpha_4 Y_t + \alpha_5 P_{t-1} + \alpha_6 \Delta Pm_t \quad (5)$$

Saini's model was applied to six moderate inflation Asian economies over the 1953–1980 period. The author finds that monetary discipline may not be an effective tool for controlling inflation in moderate-inflation countries. The addition of the import price variable improves the results and is significant in five of the six countries.

Corbo (1985) explains the dynamics of inflation in Chile from 1976 to 1982, a period when the country eliminated most domestic price controls and all quantitative restrictions on commodity trade, while progressively reducing and unifying tariffs. During this period, Chile witnessed a number of exchange rate management episodes. The exchange rate policy started with an active crawling peg geared towards balance of payments objectives. In 1977, the government used exchange rate policy as a stabilization device, first reducing the crawl below the previous month's inflation rate; from June 1979 to June 1982, the exchange rate was fixed, followed by a devaluation and a short period of floating exchange rates. In September 1982 a new exchange rate regime with a passive crawling peg was established. Corbo develops a model that incorporates the distinction between tradeables and non-tradeables and allows for differentiated tradeables. The model also allows for a drop in the relative price of tradeables that usually follows an increase in aggregate expenditures. A distinction is also made between domestic and foreign goods. The implication of Corbo's model is that the consumer price index (CPI) basket price dynamic responds not only to movements of international prices, but also to other cost components and to internal demand. As such, the model does not assume the law of one price. Corbo finds that stabilization does not affect the relative price between tradeables and non-tradeables. However, inflation adjusts slowly to a change in the rate of devaluation. A stabilization policy based on a pre-announced devaluation with a decreasing rate of crawl is bound to generate a long process of (temporal) appreciation of the Chilean currency (the peso), which could jeopardize the entire stabilization effort.

Chhibber (1992) incorporates cost–push components into the monetarist model and applies this to a number of African economies. In his model, inflation is a weighted average of inflation in the prices of traded goods (P^t), non-traded goods (P^{nt}) and controlled-price goods (P^c). Inflation in traded goods prices is determined according to the absolute purchasing power parity model, whereas non-traded goods prices are determined according to a mark-up applied to unit wage cost (*W*) and the cost of imported inputs (*Mc*). The mark-up is not fixed but is modelled as a function of excess demand in the economy, proxied by the excess real money balances (*EMB*). Chhibber's final model identifies the basic sources of inflation in an African

context as (a) imported inflation, (b) inflation due to the cost–push effect of devaluation, wage–push inflation, demand–pull inflation, and (c) inflation stemming from the control and subsequent decontrol of prices. This model is then applied to four types of policy regimes in Africa that vary according to the type of exchange rate regime, openness of the capital account and the degree of price control. The author finds a direct cost–push effect from exchange rates to prices and that the degree of devaluation pass-through varies widely, implying no evidence of a unique relationship between devaluation and inflation.

Sowa and Kwakye (1993) study inflationary trends and control in Ghana. They build upon an earlier study by Chhibber and Shafik (1990) who suggest that monetary growth is instrumental in determining the pace of inflation in Ghana and that exchange rate and wage–push variables are not significant explanatory variables. Chhibber and Shafik also find only a limited role for fiscal policy in determining current inflation. Sowa and Kwakye find that supply factors constitute a much stronger inflationary force than monetary factors in Ghana and that the influence of exchange rate adjustments is not strong.

Adam (1995) develops a simple model to explain the dynamics of inflation in Zambia in terms of the fiscal reform and financial liberalization measures taken in 1992 and early 1993. The study argues that the direct fiscal costs of financial liberalization were exacerbated by the removal of controls that supported the real monetary base and, as a result, liberalization served to reduce the demand for real kwacha balances and thus the seigniorage revenue capacity of the economy before fiscal balance was achieved. This resulted in a fiscal squeeze ensuring non-inflationary domestic deficit financing greater than would have been necessary in the absence of the early liberalization. There was rapid domestic money flight such that the only fiscal mechanism that guaranteed domestic price stability was a cash budget, which eliminated money creation as a means of financing the deficit.

Durevall and Ndung'u (1999) model inflation dynamics for Kenya over the period 1974–1996 using quarterly data. They develop a parsimonious single-equation error correction model, finding that the exchange rate, foreign prices and terms of trade have long-run effects on inflation, whereas the money supply and interest rate only have short-run effects. In addition, they find that inflation dynamics are influenced by food supply constraints. Whereas inertia was important up to 1993, when about 40% of current inflation was transmitted to the next quarter, inertia dropped to about 10% in later years.

Ndung'u and Ngugi (1999) analyse the impact of liberalization on the financial and foreign exchange markets in Kenya. They show that the inflation profile changes with exchange rate policy, that interest rates have not been market determined even after liberalization, and that interest rate spreads have increased with liberalization, reflecting inefficiency in the financial market. The policy conflict of targeting a competitive exchange rate and low inflation with the interest rate as the only management instrument is shown to lead to a policy dilemma and to complicate macroeconomic management in the 1990s especially under an environment in which fiscal adjustment has not taken place in the country.

Ross (1998) investigates the inflation process in Slovenia. A review is made of the institutional and historical legacies of Slovenia's previously centrally planned state in order to derive the determinants of the inflationary process in a transition economy. Granger-causality tests and analyses of unrestricted VAR models suggest a strong linkage between both the growth in broader monetary aggregates and the changes in the exchange rate on retail price inflation. While the growth in wages affects inflation, it appears that both the changes in the exchange rate and the growth in monetary aggregates provide the initial impulse.

Earlier work on the determinants of inflation in South Africa

Attempts to analyse the determinants of inflation have been made for particular regions in the developing world: South and Central America, the Caribbean, Asia, and Africa. The tendency therefore has been to examine issues and make general inferences, sacrificing policy relevant issues specific to particular countries. Each country's experience of underlying inflationary processes might be unique and not immediately replicable elsewhere. In addition to the theoretical literature reviewed previously, a number of theoretical and empirical studies on inflation in South Africa since 1970 will be summarized here.

In an early contribution, Truu (1975) emphasized the structural nature of inflation in South Africa and the causal role of imbalances between claims and resources. By contrast, Strydom (1976) and Strydom and Steenkamp (1976) attempted to clearly distinguish between demand–pull and cost–push factors. They concluded that the 1960s were characterized by demand–pull inflation accompanied by monetary expansion, whereas the acceleration of inflation during the early 1970s mainly reflected cost–push factors related to successive devaluations of the rand. In their view, the experience of South Africa during the early 1970s was an example of the familiar vicious circle resulting from inflationary devaluation of the currency. Strydom (1976) argued that other institutional factors such as wage pressures, non-competitive market structures and increases in indirect taxes were related to the inflationary process during this period, but were not the main causal factors behind the acceleration of inflation in the early 1970s.

In a controversial paper, the then Minister of Finance, Owen Horwood (1980), expressed strong reservations about efforts to determine the causes of inflation by means of quantitative methods. Horwood argued that inflation should be viewed as a process initiated and sustained by a range of inextricably linked factors. Truu (1981) and Strydom (1981) criticized this approach for its vagueness and inability to contribute to appropriate anti-inflationary policy.

Dollery (1984) and Fourie (1984) investigated the applicability of the administered price hypothesis in the South African context. At the time, interest in this issue was generated by the publication in 1977 of statistics indicating that economic activity in South Africa was highly concentrated in terms of market shares.

The authors found that prices in concentrated sectors of the economy respond at a slower or the same tempo to demand increases as in less-concentrated sectors. This finding implies that concentrated industries were no more guilty of fuelling inflation than less-concentrated ones. However, both authors pointed out another implication of their findings: the relatively concentrated nature of economic activity in South Africa and the consequent moderate responsiveness of prices to demand conditions may hamper the effectiveness of anti-inflationary demand policies. Fourie (1991) confirmed this finding in a later study using better data.

The final report of the De Kock Commission (1985) contained an extended discussion of the causes of inflation in South Africa. The Commission emphasized the monetary causes of inflation. Alternative causes such as salary and wage increases in excess of productivity growth, inadequate competition, tax increases, and imported inflation were also investigated, but were found to have had a much smaller effect on inflation. The Commission's analysis was criticized by, among others, Mohr (1986). He argued that the Commission's strong bias for monetarist views precluded an objective analysis of the determinants of inflation in South Africa. Mohr was also critical of the Commission's method of analysing the impact of each potential cause in isolation. In his view, a process approach that takes cognisance of the linkages between factors would have yielded more sensible results. In another response to the findings of the De Kock Commission, Moore and Smit (1986) provided econometric evidence to show that wage increases have had a powerful impact on inflation in South Africa.

De Wet and associates (1987) also found that wage increases contributed to the structural acceleration and cyclical upward movements of the inflation rate. In addition, they emphasized the inflationary impact of rising import prices, intersector productivity differences not reflected in relative levels of remuneration and market distortions such as administered prices, markets characterized by low levels of competition, and increases in indirect taxes. Their study indicated that fiscal and monetary factors had contributed to cyclical movements in inflation, but had not been major determinants of the secular upward trend in inflation.

A more recent paper outlining the price-formation block in the SARB's macroeconomic model (Pretorius and Smal, 1994) confirmed that changes in labour costs, largely driven by inflation expectations, are crucial elements influencing prices in South Africa. The cost of imported goods was identified as another important variable, although its importance decreased after 1989 when exchange rate movements became less volatile (Pretorius and Smal, 1994: 30).

Fedderke and Schaling (2000) used an expectations-augmented Phillips curve framework to investigate the links among inflation, unit labour cost, the output gap, the real exchange rate and inflation expectations. They found robust evidence for mark-up behaviour of output prices over unit labour costs. They estimated the mark-up to be about 30%, three times as high as was found for the United States by other authors.

Public finances are a considerably less important cause of inflation in South Africa than in many other developing countries. On the whole, the government's

financing practices have been prudent. Until 1989, insurance companies and pension funds were compelled to invest heavily in government paper by a system of prescribed asset requirements. This created a captive market for such paper that significantly reduced the government's dependence on inflationary financing options. Studies by Abedian and Abrahams (1996a/b) confirm the limited impact on inflation of fiscal policy in South Africa.

This brief review shows that most of the causes of inflation identified in economic theory were at some time or another invoked to explain the phenomenon of sustained price increases in South Africa. This is not surprising, given that the South African economy experienced various exogenous shocks and structural changes during the period under review. Moreover, some explanations probably reflect biased assessment of the evidence aimed at advancing preconceived ideas. In view of this we are of the opinion that there is scope for a fresh look at the evidence using the powerful tools of modern econometrics.

4. The main model developed in the study

The relationships among prices, money and the exchange rate in South Africa have been studied before. Recent studies include Hurn and Muscatelli (1992), Moll (1999), and Jonsson (1999a). Our study improves on these through the application of more recent analytical tools and data sets, including data on labour market conditions.

Data Sources

Quarterly secondary data series, covering the period 1970.1 to 2000.2, on nominal as well as real gross domestic product in 1995 prices (Y), the broad definition of money stock (M3), the nominal interest rate (commercial banks' lending rate), the consumer price index (CPI), unit labour costs (Wc), and the nominal effective exchange rate (E) are sourced from the electronic database of the SARB (SARB, 2001a).

The underlying consumer price index (CPI), which excludes highly volatile food prices and housing costs, is used in the study as opposed to the headline consumer price index. For the period 1970.1–1974.4, the series was defined as the headline consumer price index net of housing costs. From 1975.1 onwards, this index is defined as the headline consumer price index excluding food and non-alcoholic beverages, homeowners' costs, and value-added tax.

The nominal effective exchange rate of the rand (E) is based on trade in and consumption of manufactured goods between South Africa and its most important trading partners. Until 1999, the weights of the four major currencies were US dollar, 51.7%; British pound, 20.2%; Deutschemark, 17.2%; and Japanese yen, 10.9%. An increase in the nominal effective exchange rate is an appreciation of the South African rand. Quarterly data used to construct an index of foreign prices (P^f) were sourced from the International Monetary Fund's *International Finance Statistics* data set of the quarterly consumer price indexes of the United States, United Kingdom, Germany and Japan. These were weighted by the respective country's share, in their combined total, of South Africa's annual imports from these four countries.

The model

We derive guidance from the studies of Corbo (1985), Chhibber (1992), Ndung'u and Ngugi (1999), Durevall and Ndung'u (1999), Ross (1998), and Isaksson (1999), among others. Following Chhibber (1992), one could specify a theoretical model of inflation that distinguishes among inflation in tradeable goods prices (P^t), non-tradeable goods prices (P^n) and controlled-price goods (P^c):

$$\Delta P \quad 2 \pm_1 \Delta P^t + \pm_2 \Delta P^n + (1 - \pm_1 - \pm_2)\Delta P^c \qquad (6)$$
$$0 < \alpha_1 \text{ and } \alpha_2 < 1$$

For tradeable goods, domestic inflation is modelled in accordance with the absolute PPP model. As such, domestic inflation is equal to the change in foreign prices (P^f) plus the change in the nominal exchange rate (E).

$$\Delta P^t = \Delta P^f + \Delta E \qquad (7)$$

Non-traded goods prices could be modelled according to a mark-up applied to unit labour cost (Wc) and the cost of imported inputs (Mc). The change in the mark-up could be made a function of excess demand in the system, with excess demand being proxied by excess real money balances, which is defined as the excess real money supply over real money demand (EMB). As such, inflation in non-tradeables prices could be modelled as follows:

$$\Delta P^n = \beta_1 EMB + \beta_2 \Delta Mc + \beta_3 \Delta Wc \qquad (8)$$
$$\beta_1 > 1 \text{ and } \beta_2 + \beta_3 < 1$$

Changes in import costs are the sum of the changes in foreign prices and the exchange rate:

$$\Delta MC = \Delta P^f + \Delta E$$

Excess real money balances, given by excess real money supply over real money demand, are specified as follows:

$$EMB = \log (M / P) - \log (Md / P) = \Delta P + \log (M / P_{-1}) - \log (Md / P) \qquad (9)$$

The money demand function is specified as:

$$\text{Log } (Md / P) = d_0 + d_1 \log y + d_2 i + d_3 \Delta P^e \qquad (10)$$
where ΔP^e is the expected rate of inflation

The overall inflation equation estimated in our study combines the foregoing equations into the following (logarithms are represented as lower-case letters):

$$\Delta p = f_1 (\Delta p^f + \Delta e) + f_2 \Delta wc + f_3 \Delta (m / p_{-1}) + f_4 \Delta i + f_5 \Delta p^e + f_6 \Delta Pc_i + f_7 \Delta y + Di \quad (11)$$

In order to capture the structural breaks associated with the effects of the 1985 debt standstill, the 1987 global stock market crash and the 1998 Asian crisis, three dummy variables (*Dppp, Dmd and Dwc*) are introduced. These are determined by the respective shocks highlighted by the residuals of the variables following a recursive least squares estimation (see figures A1 to A3 in the Appendix). These shocks could have affected the real exchange rate, the nominal interest rate and the domestic price level. The dummy variables, *Di*, take the value of 1 for each quarter during the periods 1985 (for the PPP relationship), 1987 and 1998 onwards (for the money demand relationship), or zero otherwise. In the labour market relationship the dummy variable takes the value of 1 for the period 1983/84, when a series of politically inspired strikes led by the labour movement took place, and from 1998 onwards, when the rate of change in nominal unit labour costs slowed sharply as employers reacted to intensified international competition by controlling labour costs, or zero otherwise. This is consistent with the approach of Corbo (1985) and Isaksson (1999). Pc_i, the index of administered prices, although very important in the specific case of Zimbabwe for which it was applied, was dropped from our model because of its lesser relevance in the South African context.

This overall model will enable us to identify the basic sources of inflation in South Africa. It is expected that the partial derivatives of price with respect to *M, E, W* and P^f will be positive. Increases in the supply of money, foreign prices and the non-agricultural wage rate as well as decreases in the exchange rate and the interest rate are expected to generate inflationary pressures. Since increases in real output ease demand pressure, however, inflation is anticipated to be a decreasing function of *Y*. It is also expected that a high inflation rate for a previous year may be built into wage negotiations, thus resulting in an inflationary spiral.

5. Presentation and analysis of results

Cointegration tests require that variables involved be integrated of order one. All the series should be stationary in first differences but not in levels. Dickey and Fuller (1979, 1981) provide one method of determining the order of integration for individual series. They suggest the following regression to test for the presence of unit roots in a given variable Y:

$$\Delta Y_t = \omega_0 + \omega_1 t + (\rho - 1)Y_{t-1} + \sum_{1=2}^{n} \omega_i \Delta Y_{t-i+1} + \varepsilon_t \qquad (12)$$

This equation is known generally as the augmented Dickey–Fuller (ADF) regression. The number of lags, *n*, is chosen to purge possible serial correlation in the error term. The results are presented in Table 4.

Table 4: Test statistics for unit root tests on variables (in logs)

Sample size	Variable	No of lags	Levels	Additional regressors	
120	cpi	1	-0.92	Constant and trend	
117	y	4	-2.37	Constant and trend	
120	e	1	-2.11	Constant and trend	
120	*i*	1	-3.01	Constant and trend	
120	m3	1	-0.83	Constant and trend	
120	p^f	1	-0.44	Constant and trend	
120	wc	1	1.22	Constant and trend	
Sample size	**Variable**	**No of lags**	**First differences**	**Additional regressors**	**Order of integration**
119	cpi	1	-4.34***	Constant	1
116	y	4	-3.59**	Constant	1
119	e	1	-8.48***	Constant	1
119	*i*	1	-5.77***	Constant	1
119	m3	1	-5.56***	Constant	1
119	p^f	1	-6.49***	Constant	1
119	wc	1	-5.68***	Constant	1

Critical values are -4.0373, -3.4478, -3.1486 at the 1%, 5% and 10% levels, respectively.

Comparing the unit root test statistics with their corresponding critical values suggests that all the variables are I(1). All the series are non-stationary in levels but stationary in first differences.

Testing for cointegration

For the absolute purchasing power parity assumption to hold, we anticipate a long-run relationship to exist between the effective nominal exchange rate and relative prices in South Africa. We also expect a long-run relationship to exist among the money supply, real income, the nominal interest rate and inflation for the money demand relationship to hold. Finally, we anticipate a long-run relationship to hold in the labour market among unit labour costs, real income and domestic inflation.

The results of the cointegration tests are presented in Table 5. The number of cointegrating vectors estimated follows from the Johansen (1991) procedure, using both the maximum eigenvalue statistic and the trace statistic, allowing for unrestricted intercepts but no trends. This procedure is quite sensitive to the lag lengths of the VAR. Since quarterly data sets have been used in our study we have included two, three and four lags in the VAR.

Owing to the non-stationarity of our data series, we used a structural vector autoregression (VAR) model and cointegration tests to examine the existence of possible long-run relationships among the variables included in our model.

Following Johansen and Juselius (1990) and Johansen (1991), a vector of endogenous variables, x, that are integrated of order 1, is analysed using the vector error correction representation (VECM). The short-run co-movements among the variables are examined by generating the impulse response functions. These are computed on the basis of the VECM representation. In the process, we are able to analyse the effect of a shock to a particular variable on the individual variables included in the model. Whereas the focus is on shocks to the nominal interest rate, money supply, the exchange rate, prices, labour costs and output, our analysis is centred around the inflationary implications of the different shocks.

All the variables included in the model are treated as endogenous except for the dummy variables, which are modelled as exogenous. The choice of the optimal lag lengths of the variables was determined by the multivariate forms of the Akaike Information Criterion (AIC) and the Schwartz Criterion (SC). In minimizing the AIC and the SC, we minimize the natural logarithm of the residual sum of squares (adjusted for sample size) and the number of parameters included in the model.

The results from our cointegration tests are summarized in tables 5 and 6. They suggest the presence of three cointegrating relations in our model. We therefore impose restrictions on the structural VAR to split the model into three as suggested by economic theory. We identify the purchasing power parity (PPP) relationship, the money demand (MD) relationship and the labour market relationship.[4]

Table 5: Johansen cointegration test results

Unrestricted structural VAR model: 1970.1 – 2000.2
Sample size: 120
Test assumption: Linear deterministic trend in data
Series: cpi, y, p^f, e, *i*, wc, m3

Eigenvalue	Likelihood ratio	Critical value	Hypothesized number of cointegrating relationships	
	5% 1%			
0.420	205.79	156.00	168.36	None**
0.296	140.96	124.24	133.57	At most 1**
0.259	99.14	94.15	103.18	At most 2*
0.184	63.39	68.52	76.07	At most 3
0.101	39.24	47.21	54.46	At most 4
0.048	20.35	29.68	35.65	At most 5
0.014	7.64	15.41	20.04	At most 6
0.102	1.74	3.76	6.65	At most 7

Likelihood ratio test indicates three cointegrating equations at the 5% significance level.
Restricted structural VAR models: 1970:1 - 2000:2
Sample size: 120
Test assumption: Linear deterministic trend in data
Series: cpi, y, p^f, e, *i*, wc, m3

Lags	Cointe-grating	vectors	cpi	e	p^f	y	m3	wc	i
2	PPP	2	1.0	1.0	-1.38	0	0	0	0
	PPP	2	1.0	1.0	-1.38	0	0	0	0
	MD	3	1.0	0	0	2.03	-1.19	0	0.02
	MD	2	-0.84	0	0	-1.70	1.0	0	-0.02
	LM	1	1.0	0	0	-0.27	0	-0.93	0
	LM	1	-0.93	0	0	-0.81	0	1.0	0
3	PPP	3	1	0.97	-1.28	0	0	0	0
	PPP	3	1.03	1.0	-1.32	0	0	0	0
	MD	3	1.0	0	0	2.03	-1.19	0	0.02
	MD	2	-0.92	0	0	-0.74	1.0	0	-0.04
	LM	2	1.0	0	0	-1.29	0	-0.76	0
	LM	2	-0.87	0	0	-1.26	0	1.0	0
4	PPP	3	1.0	0.91	-0.98	0	0	0	0
	PPP	3	1.1	1.0	-1.07	0	0	0	0
	MD	1	1.0	0	0	1.17	-1.13	0	0.03
	MD	1	-0.89	0	0	-1.04	1.0	0	-0.03
	LM	0	1.0	0	0	-0.42	0	-0.92	0
	LM	0	-0.85	0	0	-1.25	0	1.0	0

Normalizing with the coefficient for the exchange rate, the cointegrating vector for the PPP relationship is given by the following equation, which is also the long-run PPP relationship:

PPP relationship:

er = 4.78 - 1.04cpi + 0.99p^f - 0.21Dppp (13)
(18.4)*** (-31.3)*** (11.4)*** (4.0)***

Similarly, we normalize by the coefficient of the money supply, m3, to obtain the second cointegrating vector in the money demand relationship. We therefore specify the long-run money demand relationship as follows:

Money demand relationship:

MD = -4.70 + 0.003cpi + 1.06y + 0.01r - 0.06Dmd (14)
(-4.3)*** (0.2) (10.9)*** (3.9)*** (B3.6)***

This could be normalized with domestic prices to obtain the following relationship:

cpi = 2 3.3 + 1.0m3 - 1.0y - 0.01r - 0.03Dmd (15)
(2.9)*** (70.8)*** (-8.8)*** (-6.8)*** (-3.6)***

The third cointegrating vector is obtained by normalizing the labour market relationship with the coefficient of unit labour costs. A positive relationship is expected between unit labour costs and domestic prices as well as between unit labour costs and real income. We specify the long-run relationship in the labour market as follows:

Labour market relationship:

Wc = 2 -5.4 + 0.9cpi + 0.5y + 0.003Dwc (16)
(-5.7)*** (71.7)*** (5.6)*** (0.2)

In the light of the results from our cointegration tests, we develop three error correction terms to take account of the short-run adjustments in the three markets (the foreign exchange, money and labour markets), as well as the long-run relationships. The three error correction terms are specified as follows:

ECMPPP = er - 4.78 + 1.04cpi - 0.99p^f + 0.21Dppp (17)

ECMMD = md + 4.7 - 0.003cpi - 1.06y - 0.01r + 0.06Dmd (18)

ECMWc = wc + 5.4 - 0.9cpi - 0.5y - 0.003Dwc (19)

Table 6: Cointegrating coefficients for one of the cointegration tests

Unnormalized cointegrating coefficients for one of the cointegration tests

cpi	e	p^f	y	m3	wc	i
2.3209	0.0767	-1.3554	6.2534	-2.7402	0.3291	0.0286
-4.0277	-0.2155	-0.7776	1.7440	0.4572	3.5081	-0.0464
0.4295	-0.7811	0.6433	0.8447	-1.1720	0.0543	0.0142
-1.4026	-0.1001	0.4504	-1.7888	1.0163	-0.1741	-0.0314
-0.6007	-0.6549	0.5652	1.0257	0.1493	-0.4094	-0.0074
-2.0009	0.3013	-0.0042	-0.0454	0.5187	1.9746	-0.0182
0.3147	0.0794	1.2400	-0.8400	-0.4813	-0.0551	-0.0015
1.3655	0.4615	0.0322	0.1805	0.7872	-1.9451	-0.0012

Normalized cointegrating coefficients for one of the cointegration tests

Lags	Cointegrating vector	cpi	e	p^f	y	m3	wc	i
2	3	1	1.1	-0.94	-1.7	-0.25	0.68	0.01
3	3	1	0.12	-1.43	4.82	-1.98	0.94	0.08
4	3	1	0.03	-0.25	1.42	-0.82	-0.19	0.01
8	6	1	0.7	-0.65	3.1	0.4	1.13	-0.02

Results

The dependent variable in our regressions is the quarterly percentage change in domestic inflation. Results are presented in terms of both short-run and long-run dynamics.

Short-run dynamics

The short-run dynamics of the determinants of inflation are presented in Table 7. Inflation expectations (proxied by lagged cpi) are positively correlated with current inflation.

There is a positive correlation between labour costs and domestic inflation in South Africa. Labour costs lagged by one quarter appear to be more significant than when they are lagged by two quarters.

An appreciation of the rand or an increase in the nominal effective exchange rate will lower domestic inflation in South Africa. This result is significant only when the nominal effective exchange rate is lagged twice. Our time dummy variable, in the PPP relationship, is also significant at the 1% level. The error correction term picks up the magnitude of the quarterly adjustments of domestic inflation to any deviation in the PPP relationship. The estimated coefficient of the error correction term for the PPP relationship is small, negative and significant at the 5% level. Disequilibriums in the money market and the labour market do not trigger an inflation adjustment in the short run.

Table 7: OLS-method modelling of inflation in South Africa, short-run dynamics

Variable	Coefficient	Standard error	t-Statistic	Probability
C	0.009816	0.003421	2.869105	0.0049
Δicpi$_{-2}$	0.241293	0.082390	2.928676	0.0041
Δim3$_{-3}$	0.099762	0.059643	1.672665	0.0972
Δiwc$_{-1}$	0.165702	0.051276	3.231595	0.0016
Δiwc$_{-2}$	0.102631	0.054378	1.887361	0.0617
Δie$_{-2}$	-0.034571	0.019722	-1.752899	0.0824
Dppp	0.020142	0.006092	3.306401	0.0013
ecmppp$_{-1}$	-0.025360	0.010762	-2.356576	0.0202
ecmmd$_{-1}$	0.016779	0.035693	0.470076	0.6395
ecmwc$_{-1}$	0.052145	0.041608	1.253256	0.2136
R^2	0.402651			
Adj R^2	0.364638			
D-W	1.963148			
Standard error	0.011470			
RSS	0.014220			
Schwarz criterion	5.678242			
F	10.59241	Probability 0.0000		
B-G LM Test	0.157405	Probability 0.8545		
ARCH Test	0.112101	Probability 0.7384		
Ramsey reset test (2)	0.733721	Probability 0.3936		

The system includes three lags of each variable. The optimal lag length was selected on the basis of the minimum AIC criterion.

Uncontrolled money supply increases will trigger inflation. The result is significant at the 10% level. Analysis of the test statistics proved that the coefficients of foreign prices and real output were insignificant in the short run. These variables were therefore dropped from the model.

The results of the short-run dynamics can be strengthened by examining the error correction model of the complete system of variables. These are shown in Table 8. The dependent variable in each regression is the quarterly percentage change in the relevant variable, whereas the independent variables are three lags of the first difference of all the variables in the system, the three error correction terms and the two time dummy variables identified earlier. The error correction terms show the adjustment of each variable to any disequilibrium in the labour market, the money market or the PPP relationship. Domestic prices adjust to temporary deviations in the long-run PPP relationship. This adjustment is also reflected in a change in the nominal interest rate and in the nominal effective exchange rate, as shown by the level of significance of the coefficient of the ECMPPP(-1) when the dependent variables are the quarterly changes in the nominal interest rate as well as the nominal effective exchange rate. The estimated coefficients of 1.9 and -0.15, respectively, imply that a deviation in the PPP relationship is mainly adjusted for by a change in the nominal interest rate, followed by a change in the effective exchange rate within one quarter. A negative shock in the PPP relationship, say a depreciation of the rand, will result in higher inflation and an increase in the short-term nominal interest rate.

Disequilibriums in the money as well as labour markets do not immediately result in an adjustment in domestic prices in South Africa. The negative sign on the coefficient of ECMMD(-1) in the Δm3 as well as Δwc equations suggests that a positive shock to real money balances leads to expansionary monetary policy by the SARB and to an increase in unit labour costs.

Long-run dynamics

The cointegration tests reported in Table 5 picked up between one and three stationary vectors, depending on the number of lags included in the model. We therefore performed a number of restricted cointegrating tests under the assumption of the presence of three cointegrating vectors in our model. The parameters in the restricted model were constrained to test whether the three stationary vectors could be represented by the three long-run relationships suggested by economic theory.

Economic theory leads us to believe that long-run relationships could be found among domestic prices, foreign prices and the nominal effective exchange rate; among domestic prices, money, real income and the interest rate; and among unit labour costs, domestic prices and real income. As such, three long-run relationships could be found among the variables included in the model.

In an open economy like that of South Africa, the exchange rate plays a crucial role in the price adjustment of real variables to monetary and fiscal policies, as it influences price formation directly. In addition, it affects aggregate demand indirectly through international competitiveness in export and import demand. An appreciation of the exchange rate has an impact on import prices; it restrains export prices and the prices of domestic goods that compete with imports. As a consequence, a depreciation (appreciation) leads to an increase (decrease) in prices in the internationally oriented sector, inducing firms to re-evaluate their production costs.

When the PPP relationship is normalized by the coefficient of domestic prices, the results show that the coefficients of the nominal exchange rate and the index of foreign prices are quite close to unity, and have the expected signs. This suggests that the purchasing power parity hypothesis holds in the case of South Africa. The joint movements of the nominal effective exchange rate and foreign prices are almost fully reflected in domestic prices in the long run. This is evident in the sense that the estimated parameters of the two variables are quite close to two. The unconstrained coefficients of the nominal effective exchange rate and the index of foreign prices are 0.86 and -1.13, respectively.

In order to estimate how the nominal effective exchange rate relates to inflation differentials between South Africa and its major trading partners in the long run, we constrained the coefficient of the index of foreign prices to be equal to unity. This yielded an estimated coefficient on nominal effective exchange rate of 0.98, which is not significantly different from unity.

An important variable in the money demand relationship is the nominal rate of interest. A negative relationship is expected between domestic inflation and the

nominal interest rate, which is a key monetary policy instrument in South Africa. Interest rate changes affect investment and consumption. Investment and consumption tend to fall when the real rate of interest rises, causing aggregate demand and hence inflation to decrease. The nominal interest rate is expected to be positively related to real money balances, however: the higher the demand for broad money, the higher the own rate of return.

The estimated coefficients of the money demand relationship have the expected signs. The coefficients of real income range between -1.04 and -1.70 and those of the short-term interest rate from -0.2 to -0.4. Constraining the coefficient of the money supply to -1 results in an estimated income elasticity of 1.02, which is not significantly different from unity.

The coefficient of real income provides information on the impact of aggregate demand on the inflationary process. An innovation in aggregate demand brings about a price change in the same direction as a shock to the system. We anticipate a positive relationship between inflation and real output. When normalized by the coefficient of domestic prices, the coefficient of aggregate demand ranges between 1.17 and 2.03, suggesting that a shock to real output could contribute significantly towards increasing domestic prices in the long run.

In the labour market relationship, unit labour costs (as a cost variable) are expected to have a positive influence on the inflationary process. When normalized with the coefficient of domestic prices, the coefficient of unit labour costs ranges from -0.76 to -0.93. This suggests that domestic price setters adjust domestic prices by a little less than unit labour cost changes. Since the coefficient of unit labour costs is very close to unity, it appears as if domestic price setters are strongly influenced by wage changes. When normalized by the coefficient of unit labour costs, the estimated coefficient of domestic prices is also quite close to -0.90. This suggests that about 90% of the changes in unit labour costs translate to domestic price increases. Under this scenario, the coefficient of real income ranges between -0.81 and -1.26.

Table 8: Error-correction model for the complete system: 1970.1 to 2000.2

Variable	Δcpi	Δe	Δpf	Δy	Δm3	Δwc	Δi
Constant	0.0	-0.0	0.0	0.2	0.02	0.0	-1.0
	(2.9)***	(-1.9)*	(1.5)	(3.2)***	(4.5)***	(0.3)	(-3.3)***
Δcpi_{-2}	0.2					0.4	
	(2.9)***					(3.1)***	
Δe_{-1}				0.1			
				(2.0)**			
Δe_{-2}	-0.03	0.2					
	(-1.8)*	(2.6)**					
Δpf_{-1}			0.3	1.0	0.3		
			(3.4)***	(5.0)***	(1.8)*		
Δpf_{-2}						0.6	
						(3.5)***	
Δpf_{-3}			0.2	-0.4			
			(2.9)***	(-2.0)**			
Δy_{-1}				-0.8		-0.1	
				(12.9)***		(-1.9)*	
Δy_{-2}				-0.7			
				(10.9)***			
Δy_{-3}				-0.7			
				(11.6)***			
$\Delta m3_{-2}$				0.3	0.2		17.2
				(2.7)***	(2.6)***		(2.9)***
$\Delta m3_{-3}$	0.1					0.3	12.8
	(1.7)*					(2.7)***	(2.1)**
Δwc_{-1}	0.2				0.1		
	(3.2) ***				(1.8)*		
Δwc_{-2}	0.1			-0.3			
	(1.9)*			(-2.8)***			
Δwc_{-3}			0.1	-0.3			
			(2.2)**	(-3.5)***			
Δi_{-1}				0.0			0.2
				(2.8)***			(2.2)**
Dppp	0.02	-0.1					-1.8
	(3.3)***	(3.6)***					(-3.2)***
Dmd							
ECMPPP_1	-0.03	-0.15					1.9
	(-2.4)* *	(-3.1)***					(1.9)*
ECMMD_1			0.1		-0.1	-0.1	
			(3.4)***		(-2.2)**	(-2.0)**	
ECMWc_1							
Adj R^2	0.36	0.20	0.30	0.71	0.10	0.17	0.25

*, **, *** denote significance at the 10, 5 and 1%, respectively.

Variance decomposition

In the long run, we anticipate a return to an equilibrium situation in the PPP, money demand and labour market relationships identified earlier. In so doing, we shift the discussion of our model from the vector error correction model, which characterized the short-run dynamics, to the VAR model characterizing the long-run situation.

Following the estimation of the reduced form VAR model, we have decomposed the forecast error variance using Sim's Recursive Choleski method in order to identify the most effective instrument to use in targeting each variable of interest. We have used the VAR model with three lags to decompose the innovations of the endogenous variables into portions that can be attributed to their own innovations and to innovations from the other variables. The results of the forecast error variance decomposition of the endogenous variables, at various quarters, are presented in Table 9.

Ordering of variables: i cpi m3 y wc e; Entry (i,j) is the percentage change in forecast error variance of variable i at different quarters attributable to innovations in variable j.

The predominant source of variation in domestic inflation's forecast errors is own shocks. Own shocks account for between 14 and 92% of the forecast errors in domestic inflation over an eight-year horizon. In the short term, own shocks account for 75 to 92% of the forecast error variance. The innovations from labour costs and nominal effective exchange rates are also important sources of the forecast error variance in domestic inflation. The least significant source of forecast error variance in domestic inflation is the rate of interest, closely followed by real GDP. Shocks to the interest rate have a minimal impact on domestic prices within an eight-year period. On the other hand, shocks to the money supply only begin to affect domestic prices marginally after 12 lags. Shocks to real output affect domestic prices only after four lags and are stable afterwards. From a purely technical point of view, the most effective mechanisms to achieve inflation targets are control over the rate of wage increases, and appreciation of the rand. In the medium term, control over excessive money supply increases will also be useful.

In explaining the short-run variation in the nominal effective exchange rate's forecast errors, own shocks and shocks to the nominal interest rate are the main sources. Labour costs become important in the medium to long term. The least significant sources of forecast error variance in the nominal effective exchange rate are foreign prices, real output and the money supply. In the short run, higher nominal interest rates are therefore required to achieve the objective of currency appreciation. In the medium term, reduced unit labour costs will boost international competitiveness and hence lead to an appreciation of the rand.

The variation in the forecast errors of labour costs is attributable to own shocks and to shocks affecting domestic inflation. The least significant sources of forecast error variance in labour costs are real output and the nominal effective exchange rate. Therefore, targeting inflation is a useful instrument for addressing possible variations in labour costs' forecast errors.

Table 9: Variance decomposition from the reduced-form VAR model

Variable	Quarters	cpi	e	pf	y	m3	wc	i
cpi	2	91.7	0.3	1.2	0.4	1.0	5.2	0.1
	4	75.3	4.4	3.3	1.1	2.5	12.7	0.7
	8	56.5	12.8	5.7	0.7	1.5	20.7	2.1
	12	40.6	22.4	7.0	1.6	3.9	22.3	2.3
	20	22.5	33.5	8.9	5.1	10.3	18.2	1.5
	32	13.9	38.3	13.3	7.2	12.6	13.3	1.4
e	2	1.7	96.4	0.0	0.0	0.1	0.1	1.6
	4	1.4	94.5	0.1	0.1	0.1	0.8	3.0
	8	1.2	92.0	0.3	0.2	0.2	2.5	3.7
	12	1.0	86.7	0.3	0.2	0.2	7.4	4.4
	20	0.7	73.7	0.2	0.1	0.2	19.9	5.2
	32	0.6	60.7	0.8	0.1	0.3	32.3	5.2
pf	2	1.2	6.3	90.2	1.5	0.5	0.1	0.2
	4	3.1	10.8	84.0	0.8	0.2	0.5	0.6
	8	4.4	14.4	73.5	0.7	0.2	2.3	4.4
	12	3.7	14.8	61.5	1.2	0.4	8.8	9.6
	20	1.9	10.4	42.1	2.4	0.9	28.8	13.5
	32	1.0	5.7	27.1	3.4	1.3	47.8	13.6
y	2	5.0	1.6	4.8	86.2	1.5	0.0	0.8
	4	4.2	4.6	6.7	67.6	11.7	1.6	3.7
	8	3.9	6.7	5.2	52.5	14.5	6.4	10.9
	12	3.5	6.0	4.9	44.2	13.3	16.2	11.9
	20	2.8	4.7	4.6	35.4	11.0	29.8	11.7
	32	2.4	5.2	4.1	30.6	9.6	36.7	11.3
m3	2	0.0	0.4	0.9	18.2	79.2	1.3	0.0
	4	0.2	0.5	1.1	26.7	69.0	2.3	0.2
	8	0.3	0.3	2.6	29.3	63.7	2.4	1.4
	12	0.2	0.5	4.4	29.6	59.7	1.7	3.8
	20	0.2	4.3	8.3	27.4	50.4	3.0	6.4
	32	0.1	12.9	11.9	23.3	38.9	5.9	7.1
wc	2	13.9	0.4	0.0	0.6	0.6	82.7	1.7
	4	16.5	1.2	2.5	0.6	0.4	75.3	3.4
	8	15.0	1.9	6.0	0.4	1.3	73.1	2.3
	12	12.7	2.3	8.8	0.9	3.6	69.9	1.7
	20	9.8	3.9	15.3	3.1	8.0	57.8	2.1
	32	7.2	5.7	23.3	5.9	10.5	43.1	4.1
i	2	1.2	5.8	0.9	0.1	1.1	2.5	88.4
	4	2.9	3.6	1.0	1.9	6.2	9.2	75.3
	8	3.4	7.1	0.7	5.5	12.9	23.1	47.3
	12	2.8	13.6	0.7	5.4	13.4	25.4	38.5
	20	2.6	20.6	1.8	4.9	12.3	23.0	34.7

The principal sources of the variation in forecast errors of the nominal interest rate are own shocks and shocks attributable to the money supply. The least significant sources of forecast error variance in the interest rate are real output and inflation.

Impulse response functions

The effects of unanticipated shocks on the stability of domestic prices, real output, money, the nominal interest rate, labour costs and deviations from the long-run equilibrium values of the nominal effective exchange rate can be ascertained from the impulse response functions of a reduced form VAR model. The impulse response functions give us an indication of the lag structure in the economy. We have implemented impulse response functions with an eight-year horizon (or 32 quarters) after shocking the cpi, nominal effective exchange rate, real output, money supply and interest rate equations. Each innovation was obtained by using the traditional Choleski decomposition method.

The impulse responses of different variables to one standard deviation shock in one of the innovations of all the endogenous variables are presented in figures A4 to A7 in the Appendix. The impulse responses of shocks to the PPP relationship are shown in figures A4a to A4c. A negative shock to the nominal effective exchange rate, say a depreciation, immediately results in higher inflation (see Figure A4a). On the other hand, a positive shock to the nominal effective exchange rate (an appreciation of the rand) immediately results in a lowering of inflation. This decrease continues till the second quarter before bottoming out. Following this initial positive shock to the nominal exchange rate, domestic prices continue their downward trend until about the twentieth quarter before establishing a new equilibrium level. A positive shock to foreign prices causes a response in domestic prices in the same direction.

A positive shock to domestic prices causes an immediate depreciation of the nominal effective exchange rate (see Figure A4b). This is small during the first two quarters, thereafter stabilizing till the sixth quarter before continuing a trend of further nominal effective exchange rate depreciation.

The impulse responses of shocks to the money demand relationship are shown in Figure A5. Figure A5a shows that a positive shock to broad money stock begins to exert an inflationary pressure from the sixth quarter. The upward inflationary trend continues thereafter until a new equilibrium level is attained beyond the thirty-second quarter. A positive shock to the nominal interest rate, like an increase in the nominal interest rate, does not immediately affect domestic prices. Prices only begin to fall after about nine quarters and continue to fall thereafter. A positive shock to real GDP results in domestic price increases only after about five quarters. The impact on prices is marginal until after the eighth quarter, by which time domestic prices rise more steeply, peaking at around the twentieth quarter.

Figure A5b shows that a positive shock to domestic prices only marginally raises the broad money stock from around the fourth quarter, peaking around the sixteenth quarter before establishing a new equilibrium level. A positive shock to the nominal interest rate begins to exert an influence on the money supply after the second quarter. The broad money supply decreases and continues this trend till about the fourteenth quarter, after which it moves to establish a new equilibrium level. A positive shock to real GDP results in an immediate increase in the demand for real

money balances, peaking at around the eighth quarter and stabilizing from the sixteenth quarter.

A positive shock to the money stock leads to a temporary increase in real output, as shown in Figure A5c. This increase peaks after about four quarters, after which the growth in real output declines. A new equilibrium is reached after about 16 quarters.A positive shock to the money stock results in the adoption of a contractionary monetary policy stance reflected in a sharp increase in the nominal interest rate, which peaks in the fourth quarter before beginning a downward trend (see Figure A5d). This sharp upward trend in the nominal interest rate is associated with an equally sharp decline in domestic prices until about the fifth quarter, after which domestic prices return to their equilibrium path from the fifteenth quarter.

The impulse responses of shocks to the labour market relationship are shown in figures A6a toA6c. A positive shock to unit labour costs causes inflationary pressure from the first quarter (see Figure A6a). This trend then continues for at least 32 quarters. A positive shock to domestic prices will initially trigger a rise in unit labour cost, after which it begins to decline (see Figure A6b). As shown in Figure A6c, a positive shock to unit labour costs will trigger an immediate decline in real GDP. This will continue until around the sixteenth quarter, by which time a new equilibrium level is established. Impulse responses of various shocks to the overall model are shown in Figure A7. Vector autoregression estimates are presented in Appendix Table A1.

6. Summary and concluding comments

This study has investigated the determinants of inflation in South Africa. We were motivated by several questions raised by the present objectives of and the framework for the implementation of monetary policy in South Africa. Our point of departure was that an understanding of the forces driving and perpetuating inflation in South Africa will shed light on the extent of the monetary authorities' control over the inflation process, the relative efficacy of alternative monetary policy frameworks and instruments, and, in a more indirect manner, the likely cost of further reducing inflation in South Africa and the appropriateness of the objective of achieving and maintaining inflation parity with South Africa's main trading partners.

To this end, we developed a model that relates inflation in South Africa to conditions in the foreign exchange market, the money market and the labour market. Dummy variables were incorporated into each of the three economic relationships. All the variables included in our model were non-stationary in levels but stationary in first differences. The presence in the model of three cointegrating relationships led us to specify three error correction terms and to partition the model to accommodate the purchasing power parity, money demand and labour market relationships, as suggested by economic theory.

Our findings on the determinants of inflation in South Africa during the period 1970.1 to 2000.1 can be summarized as follows:

- ***The purchasing power parity relationship:*** Our analysis of the short-run dynamics of the inflation process in South Africa indicates that an appreciation of the rand (i.e., an increase in the nominal effective exchange rate of the rand) will reduce inflation. In the analysis of the long-run dynamics, the coefficients of the nominal exchange rate and the index of foreign prices have the expected signs and are quite close to unity. It appears as if purchasing power parity exists between South Africa and its major trading partners. Jonsson (1999a) reached the same conclusion. There is a high degree of pass-through of foreign prices to South Africa's domestic prices. However, inflation rates in the trading-partner countries are low, and as such do not contribute significantly to South Africa's inflationary process in the short run. In the short run, only the nominal effective exchange rate is found to significantly contribute towards changes in the price level in South Africa. We have demonstrated the contribution of innovations in the nominal effective exchange rate to the forecast error variance in inflation,

and amplified this further by an analysis of the impulse response functions in the PPP relationship. On the whole, the exchange rate has been a key factor in the inflation process in SoBDh Africa.

- ***The money demand relationship:*** Increases in the broad money stock will contribute to higher inflation in South Africa in the short as well as the long run. In the short run, the impact on inflation of an increase in the nominal interest rate is insignificant, but such increases will slightly reduce inflation in the long run. The coefficient of real output, which is insignificant in the short run, is negative in the long-run model. This implies that real output growth in the long run may contribute to a decrease in domestic prices. Jonsson (1999a) also found evidence of a stable money-demand type relationship among domestic prices, broad money, real income and nominal interest rates in South Africa.
- ***The labour market relationship:*** In the short run, there is a positive correlation among labour costs, real income and domestic inflation. Innovations in labour costs are key sources of the forecast error variance in domestic inflation, and the long-run coefficient of unit labour costs is quite close to unity. Our results therefore indicate that increases in nominal unit labour costs have played an important part in the inflation process in South Africa. Pretorius and Smal (1994) and Fedderke and Schaling (2000) have also highlighted the link between increases in labour costs and inflation in South Africa.

A proper interpretation of these findings for purposes of informing monetary policy making requires due cognisance of the possible impact of structural and other changes in the South African economy. For example, South Africa's reintegration into a world economy characterized by the globalization of economic activity has subjected South African firms to fierce international competition. Such competition has stimulated the adoption of cost-containing practices (e.g., reduction of workforces and stricter control over wage increases) and new technologies, which have contributed to a sharp reduction in the growth in nominal unit labour costs.[5] An attempt was made to capture this possible structural change by means of dummy variables, but it proved to be insignificant in explaining long-term trends in inflation. In addition, the intensified import competition resulting from trade liberalization has made it more difficult for firms selling in South African markets to pass the price-increasing effects of currency depreciation on to consumers. The magnitude of the pass-through effect predicted in our PPP relationship may therefore be lower in future.

The SARB has a considerable degree of control over nominal interest rates as noted earlier. The interest rate therefore remains the principal instrument of monetary policy in South Africa, despite being subject to long outside lags (our results indicate that interest rate adjustments only affect the inflation rate after nine quarters). At present, the monetary authorities' leverage over the level of the nominal exchange rate is severely circumscribed by factors such as the modest value of South Africa's gross gold and foreign exchange reserves and the extent of the SARB's net oversold position in foreign currency. Progress has been made towards removing these

impediments to a more stable currency, but recent experience has underscored the vulnerability of emerging market economies (such as South Africa) to currency shocks.[6] The failure of monetary targeting has shown that the monetary authorities' degree of control over the monetary aggregates is also limited. This problem has been ascribed to various factors, including the possibilities that the money stock is endogenous (Nell, 2000/01) and that financial innovation has distorted the stability of the money-demand function (Moll, 1999). Finally, it is clear that the SARB cannot directly influence the rate of increase in nominal unit labour costs. This review shows that the monetary authorities' leverage over most of the key determinants of inflation in South Africa is decidedly limited.

Possible alternatives to the current monetary policy framework in South Africa of inflation targeting include targeting of a monetary aggregate or the nominal exchange rate. Our results indicate that the variables targeted by both these frameworks are important determinants of inflation in South Africa, albeit less so than growth in nominal unit labour costs. Jonsson (1999b: 17) has recently argued that neither of these frameworks is appropriate in the present South African context. Monetary targeting is unlikely to have the desired effect on inflation because of the monetary authorities' limited ability to control the monetary aggregates; moreover, such a framework will lack credibility in view of its earlier failure in South Africa. Nominal exchange rate targeting is likely to result in wide swings in interest rates, inefficient output stabilization and regular speculative attacks on the rand. In many respects, inflation targeting is also a limited framework for monetary policy in South Africa. In common with the other two frameworks, it relies strongly on the interest rate as an instrument to fight inflation, and has no direct influence on the crucial labour costs variable in the inflation equation. However, its greater transparency and more explicit focus on the reduction of inflation may eventually exert stronger downward effects on inflation expectations than those of alternative frameworks. As indicated earlier, a sustained reduction in inflation expectations will have a significant impact on the tempo of price increases in South Africa.

The largely structural nature of inflation in South Africa and the monetary authorities' limited control over the main determinants thereof suggest that it will be difficult to achieve the objective of reducing inflation to the levels prevailing in the country's main trading partners. Inflation reduction is likely to be particularly slow and costly in terms of output and employment if pursued exclusively by interest rate manipulation and continuously counteracted by depreciation of the exchange rate and wage increases in excess of productivity growth. This possibility begs the question whether the game will be worth the candle. There can be no dispute about the high economic costs of excessive inflation, but it is not at all clear that inflation rates of 6% per annum or less have a high cost in terms of reduced economic growth. Khan and Senhadji (2000) recently estimated the threshold level at which inflation significantly slows economic growth at 7 to 11% for developing countries. The findings of Ghosh and Phillips (1998) also imply that the growth costs of South Africa's current level of inflation in all likelihood are slight. Our results and these findings suggest that an investigation of the costs and benefits of further reducing inflation in South Africa may yield interesting and policy relevant insights.

Notes

1. South Africa's main trading partners are Germany, Japan, the United Kingdom and the United States.
2. In practice, the repo system has been characterized by certain weaknesses. The SARB has recently announced various proposals to improve the functioning of the system; however, the basic features of the system essentially remain as before (cf. South African Reserve Bank, 2001c).
3. This approach has been referred to as "informal inflation targeting" (cf. Van den Heever, 2001: 169).
4. The asterisks (***) show that results are significant at the 1% level.
5. The rate of growth in nominal unit labour costs slowed from 10.8% in 1994 to 2.8% in 1998 and 2.3% in 2000. See SARB (2001a).
6. South Africa's gross gold and other foreign reserves increased from US$4.105 billion at the end of 1994 to US$11.23 billion at the end of 2000. During the same period, the net open position of the SARB decreased from US$25.202 billion to US$9.051 billion. See SARB (2001a).

References

Abedian, I. and H. Abrahams. 1996a. "Is inflation a fiscal phenomenon? A theoretical and empirical study". The Budget Project Discussion Paper 8. Cape Town: University of Cape Town, The Budget Project.

Abedian, I. and H. Abrahams. 1996b. "Seigniorage as a fiscal revenue: A South African case study". The Budget Project Discussion Paper 6. Cape Town: University of Cape Town, The Budget Project.

Adam, C. 1995. "Fiscal adjustment, financial liberalization, and the dynamics of inflation: Some evidence from Zambia". *World Development*, 23,(5): 735–50.

Agenor, P-R. and P.J. Montiel. 1996. *Development Macroeconomics*. Princeton, New Jersey: Princeton University Press.

Aghevli, B.B. and M.S. Khan. 1978. "Government deficits and the inflationary process in developing countries". *IMF Staff Papers*, 25: 383–416.

Aron, J. and M. Ayogu. 1997. "Foreign exchange market efficiency tests in sub-Saharan Africa".*Journal of African Economies*, vol. 6, (3): 150–92.

Atta, J., K. Jefferis and I. Mannathoko. 1996. "Small country experiences with exchange rates and inflation: The case of Botswana". *Journal of African Economies*, vol. 5 (2): 293–326.

Atta, J., K. Jefferis, I. Mannathoko and P. Siwawa-Ndai. 1999. *Exchange Rate Policy and Price Determination in Botswana*. Research Paper No. 93. African Economic Research Consortium, Nairobi.

Bailey, M. 1956. "The welfare costs of inflationary finance". *Journal of Political Economy*, vol. 64, no. 2: 93–110.

Bodart, V. 1996. "Multiple exchange rates, fiscal deficits and inflation dynamics". IMF Working Paper WP/96/56. Washington, D.C.: International Monetary Fund.

Cagan, P. 1956. "The monetary dynamics of hyperinflation". In M. Friedman, ed., *Studies in the Quantity Theory of Money*. Chicago: University of Chicago Press.

Calitz, E. and F.K. Siebrits. 1999. *Economic Policy in South Africa*. Pretoria: Unisa Press.

Calitz, E. and F.K. Siebrits. 2001. "After the pain, the gain? An assessment of the 2001/2002 Budget". *Absa Economic Perspective (Special Edition)*. Johannesburg: Absa Group Economic Research.

Cardoso, E. 1981. "Food supply and inflation". *Journal of Development Economics*, (8): 269–84.

Chhibber, A. 1992. "Exchange reforms, supply response, and inflation in Africa". In I. Goldin and L.A. Winters, eds., *Open Economies: Structural Adjustment and Agriculture*. Cambridge: Cambridge University Press.

Chhibber, A. and N. Shafik. 1990. "Exchange reform, parallel markets and inflation in Africa". PRE Working Paper 427. Washington, D.C.: The World Bank.

Corbo, V. 1985. "International prices, wages and inflation in an open economy: A Chilean model". *Review of Economics and Statistics*, 67: 564–73.

De Broeck, M., P. De Masi and V. Koen. 1995. "Inflation dynamics in Kazakstan". IMF Working Paper WP/95/140. Washington, D.C.: International Monetary Fund.

De Kock Commission. 1985. *Final Report of the Commission of Inquiry into the Monetary System and Monetary Policy in South Africa*. Pretoria: Government Printer.

Department of Finance. Various years. *Budget Review*. Pretoria.

De Wet, G.L. 1994. "The RDP and a structural problem in the South African economy". *South African Journal of Economics*, 62, (4): 307–32.

De Wet, G.L. and associates. 1987. *Inflasie in Suid-Afrika*. Durban: Butterworths.

Dickey, D.A. and W.A. Fuller. 1979. "Distribution of the estimators for autoregressive time series with a unit root". *Journal of the American Statistics Association*, 74: 427–31.

Dickey, D.A. and W.A. Fuller. 1981. "Likelihood ratio statistics for autoregressive time series with a unit root". *Econometrica*, 49: 1057–72.

Dollery, B.E. 1984. "Market structure and inflation in South Africa". *South African Journal of Economics*, 52, no. 4: 345–58.

Dornbusch, R. and S. Fischer. 1993. "Moderate inflation". *World Bank Economic Review*, 7 (1): 1–44.

Dornbusch, R. and A. Reynoso. 1993. "Financial factors in economic development". In R. Dornbusch, ed., *Policymaking in the Open Economy*. New York: Oxford University Press.

Durevall, D. and N.S. Ndung'u. 1999. "A dynamic model of inflation for Kenya, 1974–1996". IMF Working Paper WP/99/97. Washington, D.C.: International Monetary Fund.

Evans, P. 1985. "Do large deficits produce high interest rates?" *American Economic Review*, vol. 75: 68–87.

Fedderke, J. and E. Schaling. 2000. *Modelling Inflation in South Africa: A Multivariate Cointegration Analysis*. Research Paper No. 0010. Johannesburg: Rand Afrikaans University, Department of Economics.

Fourie, F.C.v.N. 1984. "Industrele konsentrasie en inflasie in Suid-Afrika, 1972–1979". *South African Journal of Economics*, 52, (4): 359–76.

Fourie, F.C.v.N. 1991. "Economic concentration and anti-inflationary demand policy in South Africa". *South African Journal of Economics*, vol. 59, (1): 16–35.

Frenkel, J. 1978. "Purchasing power parity: Doctrinal perspective and evidence from the 1920s". *Journal of International Economics*, 8: 169–91.

Frenkel, J. 1981. "The collapse of purchasing power parities during the 1970s". *European Economic Review*, 16: 145–65.

Ghosh, A. and S. Phillips. 1998. "Warning: Inflation may be harmful to your growth". *IMF Staff Papers*, 45, (4): 672–710.

Goedhuys, D. 1994. "South African monetary policy in the 1980s". *South African Journal of Economic History*, vol. 9, (2): 145–64.

Greene, J. 1989. "Inflation in African countries: General issues and effects on the financial sector". IMF Working Paper WP/89/86. Washington, D.C.: International Monetary Fund.

Harberger, A.C. 1963 "The dynamics of inflation in Chile."In C.F.Christ ed., *Measurement in Economics, Studies in Mathematical Economics and Econometrics in Memory of Yehuda Grunfeld.* Stanford: Stanford University Press.

Holmes, M.J. 2000. "Does purchasing power parity hold in African less developed countries? Evidence from a panel data unit root test". *Journal of African Economies*, vol. 9, no. 1: 63–78.

Horwood, O.P.F. 1980. "Die huidige fiskale en monetĺre beleid in Suid-Afrika, met spesiale verwysing na die inflasievraagstuk". *South African Journal of Economics*, vol. 48, no. 4: 359–69.

Hurn, A.S. and V.A. Muscatelli. 1992. "The long-run properties of the demand for M3 in South Africa. *South African Journal of Economics*, vol. 60: 159–72.

Isaksson, A. 1999. "Financial liberalization and price stability in Kenya". *Journal of Policy Modelling Working Papers*.Internet source: http://www-east.elsevier.com/jpo/wrkpapers/1706-04/index.html

Jha, R. 1994. *Macroeconomics for Developing Countries*. New York: Routledge.

Johansen, S. and K. Juselius. 1990. "Maximum likelihood estimation and inference on cointegration B With an application to the demand for money". *Oxford Bulletin of Economics and Statistics*, 52: 169–210.

Johansen, S. 1991. "Estimation and hypothesis testing of cointegrating vectors in gaussian vector autoregressive models". *Econometrica*, 59: 1551–80.

Jonsson, G. 1999a. "Inflation, money demand, and purchasing power parity in South Africa". IMF Working Paper WP/99/122. Washington, D.C.: International Monetary Fund.

Jonsson, G. 1999b. "The relative merits and implications of inflation targeting in South Africa". IMF Working Paper WP/99/116. Washington, D.C.: International Monetary Fund.

Kahn, B. 1989. "Exchange controls and exchange rate policy in the South African economy". In P.A. Black and B.E. Dollery, eds., *Leading Issues in South African Macroeconomics*. Johannesburg: Southern Books.

Khan, M.S. and A.S. Senhadji. 2000. "Threshold effects in the relationship between inflation and growth". IMF Working Paper WP/00/110. Washington, D.C.: International Monetary Fund.

Kirkpatrick, C. and F. Nixson. 1987. "Inflation and stabilisation policy in LDCs". In N. Gemmell, ed., *Surveys in Development Economics*. Oxford: Basil Blackwell.

Mahdavi, S. and S. Zhou. 1994. "Purchasing power parity in high inflation countries: Further evidence". *Journal of Macroeconomics*, 16: 403–22.

Mboweni, T. 1999. "Inflation targeting in South Africa". *South African Journal of Economics*, 67. (4): 400–9.

McNown, R. and M. Wallace. 1989. "National price levels, purchasing power parity, and cointegration: A test of four high inflation economies". *Journal of International Money and Finance*, 8: 533–45.

Meijer, J.H. 1987. "Changes in monetary policy since 1982 (Part I)". *Economics*, 1, (2): 58–65.

Meijer, J.H. 1988. "Changes in monetary policy since 1982 (Part II)". *Economics*, vol. 2, no. 1: 11–24.

Mohr, P.J. 1986. "The De Kock Commission and inflation". *South African Journal of Economics*, 54, (1): 22–40.

Moll, T. 1993. "Macroeconomic policy in turbulent times". In M. Lipton and C. Simkins, eds., *State and Market in Post-Apartheid South Africa*. Johannesburg: Witwatersrand University Press.

Moll, P.G. 1999. "Money, interest rates, income and inflation in South Africa". *South African Journal of Economics*, 67, (1): 34–64.

Moore, B.J. and B.W. Smit. 1986. "Wages, money and inflation". *South African Journal of Economics*, 54, (1): 80–93.

Ndung'u, N.S. and R.W. Ngugi. 1999. "Adjustment and liberalisation in Kenya: The financial and foreign exchange markets". *Journal of International Development*, 11: 465–91.

Nell, K.S. 2000/01. "The endogenous/exogenous nature of South Africa's money supply under direct and indirect monetary control measures". *Journal of Post-Keynesian Economics*, 23, (2): 313–29.

Pretorius, C.J. and M.M. Smal. 1994. "A macro-economic examination of the price formation process in the South African economy". *South African Reserve Bank Quarterly Bulletin*, March: 25–37.

Republic of South Africa. Various years. Annual Budget Speech of the Minister of Finance. Pretoria.

Rodriquez, C. 1978. "A stylized model of the devaluation-inflation spiral". *IMF Staff Papers*, 25, (1): 76–89.

Ross, K. 1998. "Post stabilization inflation dynamics in Slovenia". IMF Working Paper WP/98/27. Washington, D.C.: International Monetary Fund.

Sachs, J. and F. Larrain. 1993. *Macroeconomics in the Global Economy*. Englewood.

Saini, K.G. 1982. "The monetarist explanation of inflation: The experience of six Asian countries". *World Development*, 10, (10): 871–84.

South African Reserve Bank. 1996. *Annual Economic Report 1995*. Pretoria.

South African Reserve Bank. 2001a. Electronic data. Internet source: http://www.resbank.co.za/Economics/hist.html

South African Reserve Bank. 2001b. *Monetary Policy Review (March 2001)*. Pretoria.

South African Reserve Bank. 2001c. "Proposals to improve the functioning of the South African Reserve Bank's refinancing system and the interbank market". Pretoria.Internet source: http://www.resbank.co.za/mmd refinancing_system.doc

Sowa, N.K. and J.K. Kwakye. 1993. *Inflationary Trends and Control in Ghana*. Research Paper No. 22. African Economic Research Consortium, Nairobi.

Stals, C.L. 1996. "The role of monetary policy". Address to a conference of the Bureau for Economic Research at the University of Stellenbosch. Stellenbosch, 8 November.

Statistics South Africa. 1997. *South African Labour Statistics (1995)*. Pretoria.

Strydom, P.D.F. 1976. "Inflation in South Africa I: Institutional aspects". *South African Journal of Economics*, vol. 44, (2): 115–38.

Strydom, P.D.F. 1981. "Kwantifisering in die ekonomie". *South African Journal of Economics*, vol. 49, (1): 62–8.

Strydom, P.D.F. and L. Steenkamp. 1976. "Inflation in South Africa II: Aggregate demand and price expectations". *South African Journal of Economics*, vol. 44, (4): 417–34.

Truu, M.L. 1975. "Inflation in the South African economy". *South African Journal of Economics*, 43, (4): 446–70.

Truu, M.L. 1981. "The Minister and quantification in economics". *South African Journal of Economics*, 49, (1): 59–61.

Van den Heever, J.P. 2001. "A note on inflation targeting in South Africa". *South African Journal of Economics*, 69, (1): 168–77.

Wasserfalen, W. 1985. "Forecasting, rational expectations and the Philips Curve: An empirical investigation". *Journal of Monetary Economics*, vol. 15: 7–27.

Whittaker, J. 1992. "Monetary policy for economic growth". In I. Abedian and B. Standish, eds., *Economic Growth in South Africa*. Cape Town: Oxford University Press.

World Bank. 2001a. Country data. Internet source: http://www.worldbank.org/data/countrydata/countrydata.htmlWorld Bank. 2001b. World Development Indicators. Internet source: http://www.worldbank.org/data/wdi2001/pdfs/tab4_16.pdf

Figure A1: Recursive residuals from the OLS estimation of the PPP relationship

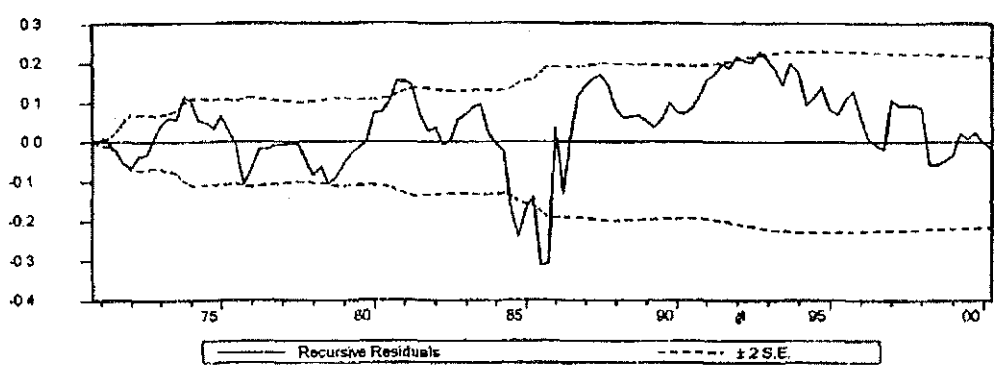


Figure A2: Recursive residuals from the OLS estimation of the money demand relationship

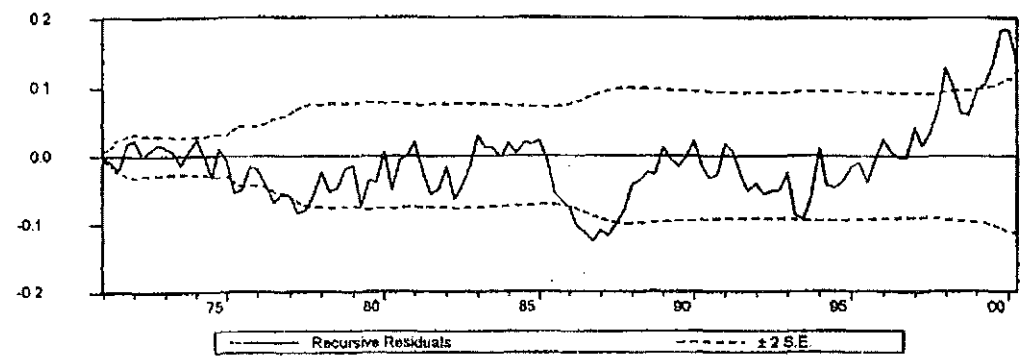
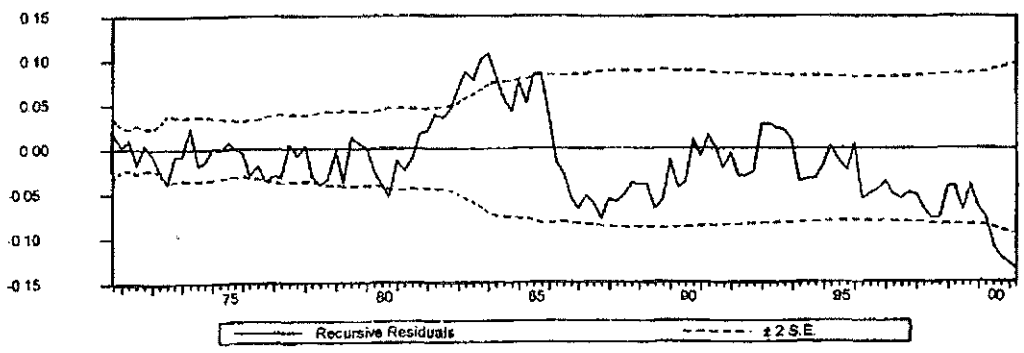
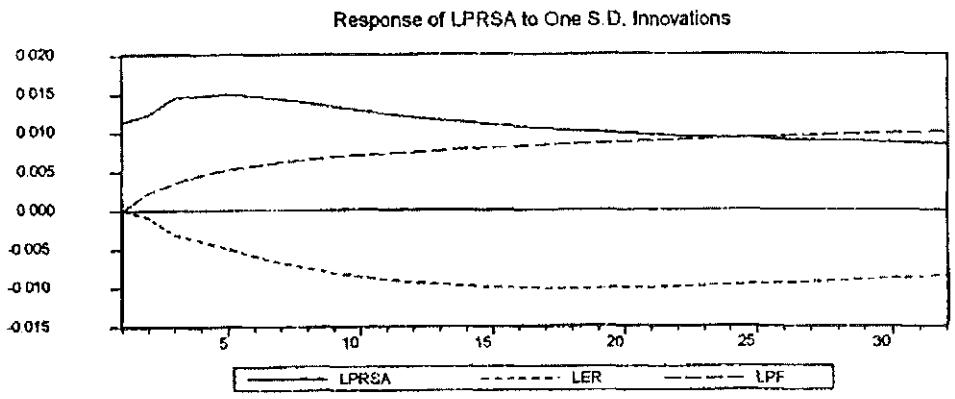


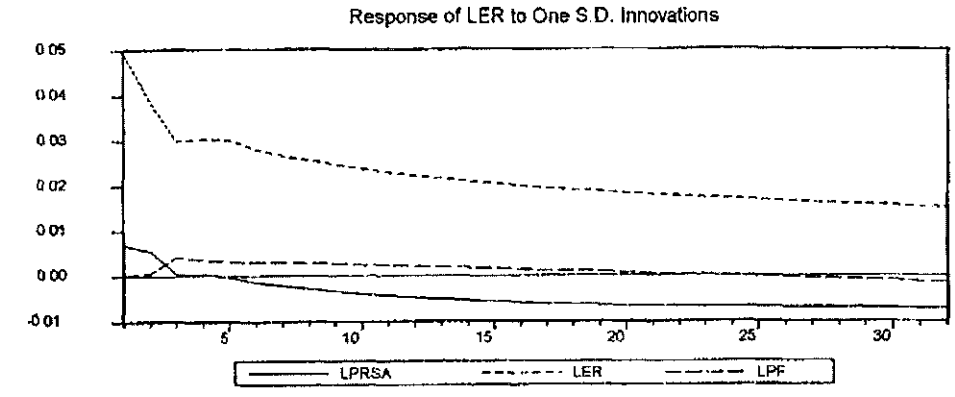
Figure A3: Recursive residuals from the OLS estimation of the labour market relationship

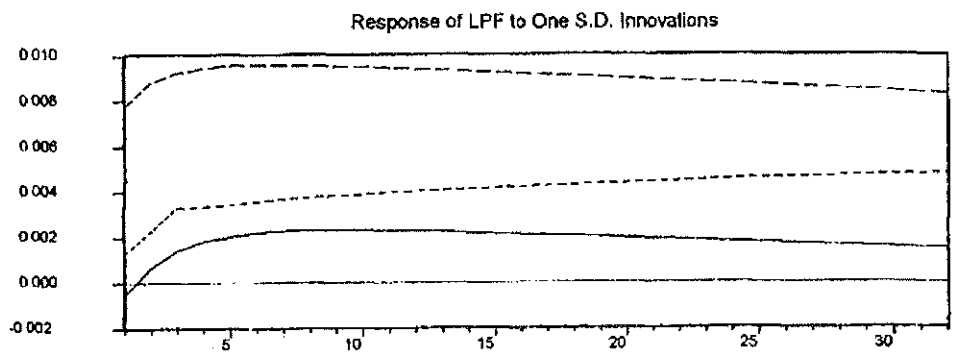


Appendix: Supplementary charts and tables

Figure A4: Impulse responses of shocks to the PPP relationship
A4a: Response of LPRSA to one S.D. innovation
A4b: Response of LER to one S.D. innovation
A4c: Response of LPF to one S.D. innovation

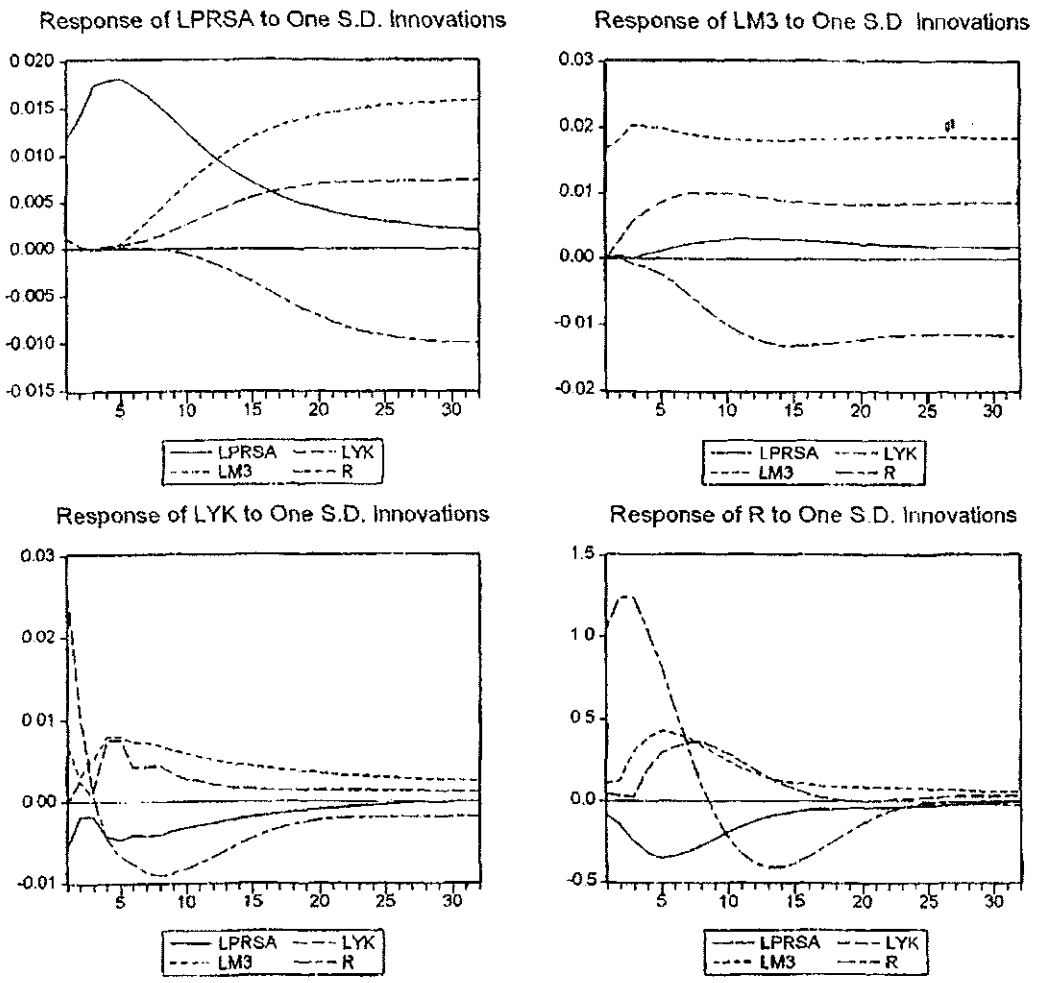






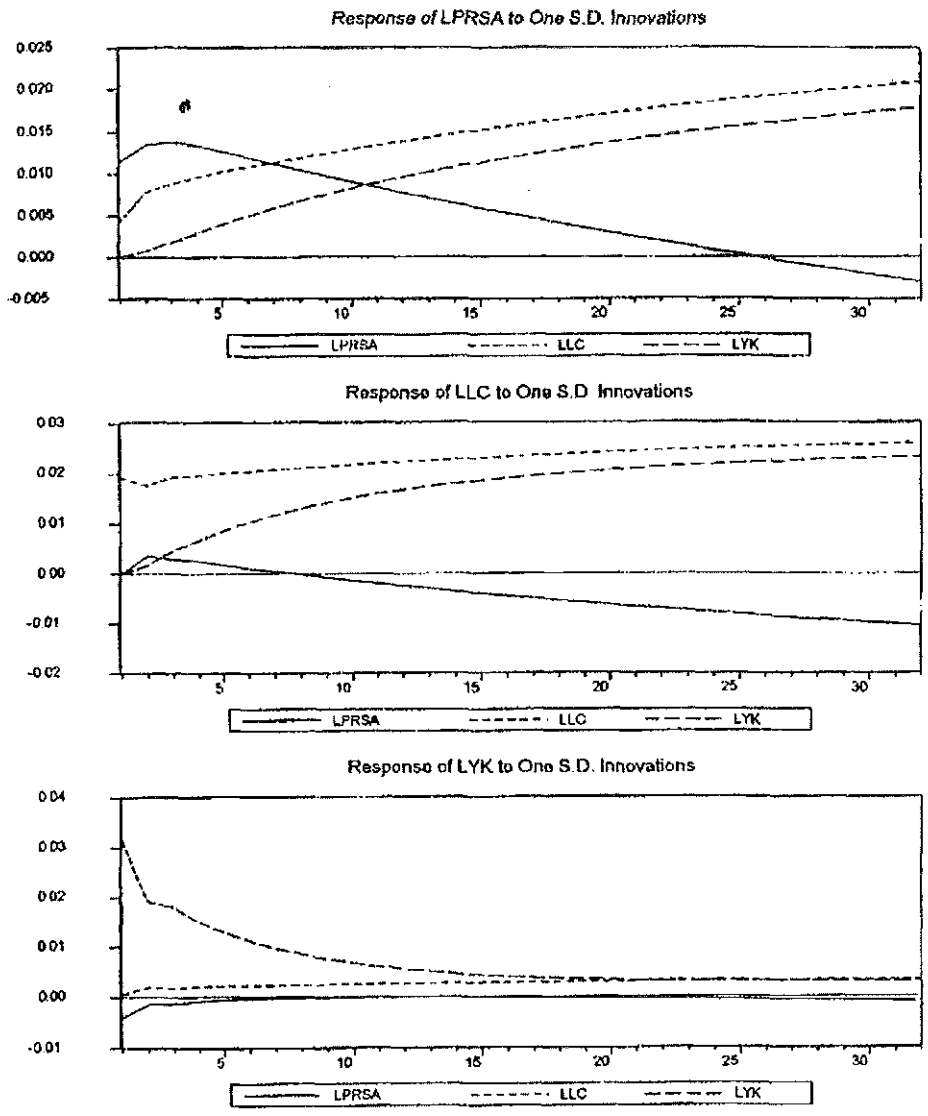
Ordering of variables cpi, er, p^f

Figure A5: Impulse responses of shocks to the money demand relationship
A5a: Response of LPRSA to one S.D. innovation
A5b: Response of LM3 to one S.D. innovation
A5c: Response of LYK to one S.D. innovation
A5d: Response pf R to one S.D. innovation



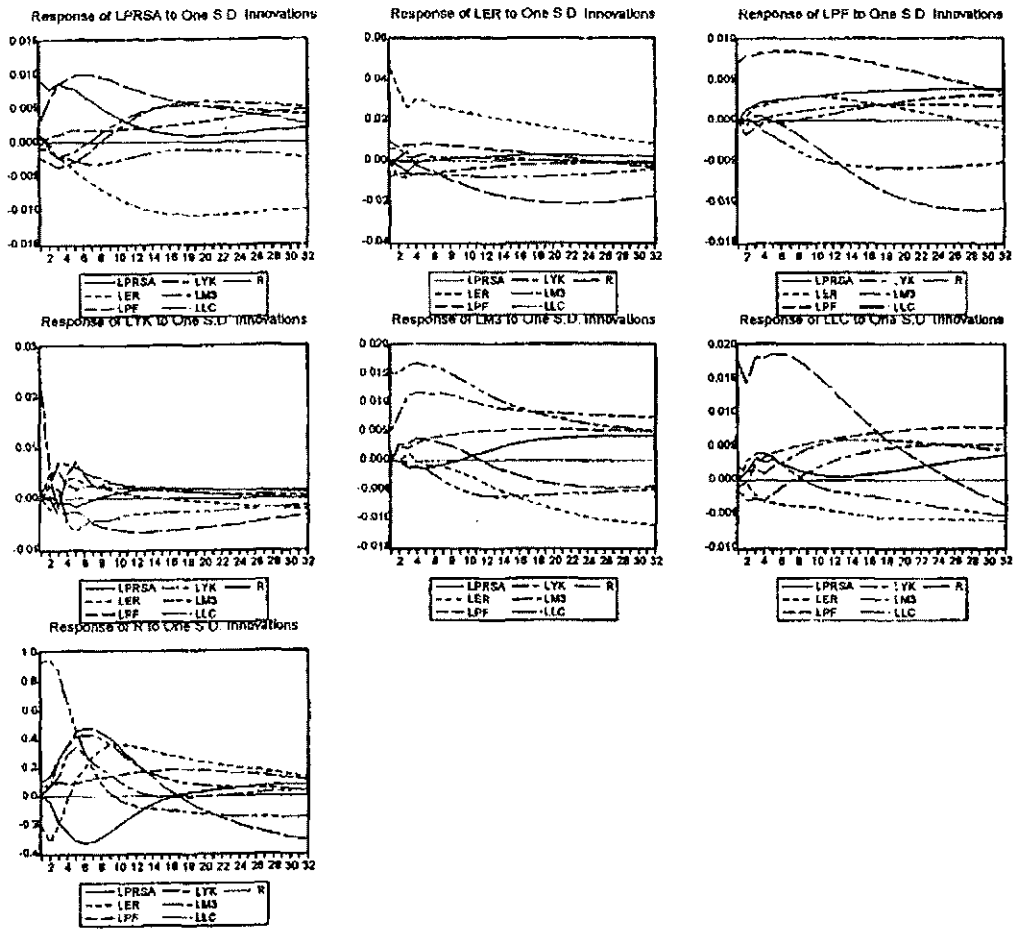
Ordering of variables lm3, cpi, y, r

Figure A6: Impulse responses of shocks to the labour market relationship
A6a: Response of LPRSA to one S.D. innovation
A6b: Response of LLC to one S.D. innovation
A6c: Response of LYK to one S.D. innovation



Ordering of variables: iic(or wc) cpi,y.

Figure A7: Impulse responses of various shocks to the overall model



Ordering of variables p^f, y, m3, cpi, er, lc, r

Table A1: Vector autoregression estimates

Variable	cpi	e	pf	y	m3	wc	i
c	-0.4	0.3	-0.3	8.2	-1.9	0.1	-67.0
	(-0.7)	(0.1)	(-0.6)	(5.8)	(-2.0)	(0.0)	(-1.2)
cpi_{-1}	0.9	-0.2	0.1	0.04	-0.02	0.1	-5.4
	(8.1)***	(-0.5)	(1.9)*	(0.2)	(-0.1)	(0.7)	(-0.5)
cpi_{-2}	0.1	-0.2	-0.1	-0.2	-0.2	0.1	-13.3
	(1.0)	(-0.3)	(-0.6)	(-0.7)	(-0.8)	(0.5)	(-1.0)
cpi_{-3}	-0.2	0.4	-0.03	0.1	0.2	-0.3	6.9
	(-2.5)**	(1.0)	(-0.6)	(0.3)	(1.1)	(-1.8)*	(0.8)
e_{-1}	-0.02	0.7	0.01	-0.04	0.00	0.0	-2.3
	(-1.0)	(7.5)***	(0.8)	(-0.8)	(0.1)	(0.4)	(-1.1)
e_{-2}	-0.05	-0.02	0.01	0.05	0.02	-0.03	4.0
	(-1.8)*	(-0.2)	(0.6)	(0.8)	(0.5)	(-0.7)	(1.5)
e_{-3}	0.02	0.2	-0.01	0.01	-0.1	-0.01	0.3
	(1.0)	(2.1)**	(-0.4)	(0.1)	(-1.4)	(-0.2)	(0.1)
pf_{-1}	0.2	-0.04	1.1	0.7	0.3	0.1	9.9
	(1.7)*	(-0.1)	(11.0)***	(2.1)**	(1.2)	(0.3)	(0.7)
pf_{-2}	-0.1	0.6	-0.1	-0.3	-0.5	0.4	-9.1
	(-0.3)	(0.6)	(-0.9)	(-0.5)	(-1.5)	(0.9)	(-0.0)
pf_{-3}	-0.2	-0.5	0.01	-0.2	0.2	-0.4	-5.2
	(-1.2)	(-0.8)	(0.1)	(-0.6)	(1.0)	(1.4)	(-0.4)
y_{-1}	-0.01	-0.04	-0.05	0.1	0.1	-0.1	-1.4
	(-0.2)	(-0.2)	(-1.5)	(1.1)	(2.0)**	(0.7)	(-0.3)
y_{-2}	0.03	-0.04	0.05	-0.2	0.1	0.0	1.5
	(0.7)	(-0.2)	(1.6)	(-2.1)**	(1.8)*	(0.5)	(0.4)
y_{-3}	0.02	0.03	0.01	0.1	0.00	-0.00	4.8
	(0.6)	(0.1)	(0.4)	(0.7)	(0.01)	(-0.0)	(1.2)
$m3_{-1}$	-0.1	0.2	-0.1	0.2	0.9	-0.03	-0.4
	(-1.7)*	(0.5)	(-1.1)	(1.2)	(9.2)***	(-0.3)	(-0.0)
$m3_{-2}$	0.03	-0.4	0.2	0.3	0.1	0.0	13.1
	(0.3)	(-0.8)	(2.4)**	(1.4)	(0.6)	(0.2)	(1.5)
$m3_{-3}$	0.1	0.3	-0.1	-0.2	-0.2	0.01	-11.2
	(1.8)*	(0.8)	(-1.8)*	(-0.9)	(-1.5)	(0.1)	(-1.6)*
wc_{-1}	0.2	0.2	-0.03	-0.03	0.2	0.8	3.1
	(3.4)***	(0.6)	(-0.6)	(-0.2)	(1.7)	(7.4)***	(0.5)
wc_{-2}	0.01	0.2	-0.03	-0.2	-0.1	0.3	9.7
	(0.1)	(0.6)	(-0.6)	(-0.9)	(-0.6)	(2.2)**	(1.3)
wc_{-3}	-0.1	-0.5	0.01	0.01	0.01	-0.1	0.2
	(-1.1)	(-1.5)	(0.2)	(0.1)	(0.1)	(1.1)	(0.0)
r_{-1}	-0.00	-0.01	0.00	0.0	-0.00	0.00	1.01
	(-0.5)	(-1.7)*	(0.7)	(1.0)	(-0.1)	(1.8)*	(9.9)***
r_{-2}	-0.00	0.01	-0.00	-0.00	-0.00	-0.00	-0.1
	(-1.0)	(0.7)	(-1.1)	(-0.4)	(-0.7)	(-0.4)	(-0.9)
r_{-3}	-0.00	0.0	0.00	-0.00	0.00	-0.00	-0.1
	(-0.0)	(0.03)	(0.5)	(-1.65)	(0.6)	(-0.9)	(-1.4)
Dppp	0.01	-0.1	-0.00	0.00	0.00	-0.01	-1.2
	(2.3)**	(-3.6)***	(-0.5)	(0.2)	(0.4)	(-1.0)	(-1.7)*
Dmd	-0.0	0.02	-0.00	0.03	-0.01	0.00	-0.02
	(-0.7)	(0.8)	(-0.7)	(2.2)**	(-0.7)	(0.5)	(-0.0)
R^2	0.99	0.99	0.99	0.98	0.99	0.99	0.96
Adj R^2	0.99	0.99	0.00	0.98	0.99	0.99	0.94
Std error	0.01	0.05	0.01	0.03	0.02	0.02	1.08
RSS	0.01	0.27	0.01	0.07	0.03	0.04	111.2
F	47371	1006	13102	203.5	24500	15734	89.0
SC	-5.4	-2.3	-6.08	-3.7	-4.46	-4.27	3.75

Other recent publications in the AERC Research Papers Series:

The Behaviour of Income Velocity in Tanzania 1967–1994, by Michael O.A. Ndanshau, Research Paper 50.

Consequences and Limitations of Recent Fiscal Policy in Côte d'Ivoire, by Kouassy Oussou and Bohoun Bouabre, Research Paper 51.

Effects of Inflation on Ivorian Fiscal Variables: An Econometric Investigation, by Eugene Kouassi, Research Paper 52.

European Economic Integration and the Franc Zone: The Future of the CFA Franc after 1999, Part II, by Allechi M'Bet and Niamkey A. Madeleine, Research Paper 53.

Exchange Rate Policy and Economic Reform in Ethiopia, by Asmerom Kidane, Research Paper 54.

The Nigerian Foreign Exchange Market: Possibilities for Convergence in Exchange Rates, by P. Kassey Garba, Research Paper 55.

Mobilizing Domestic Resources for Economic Development in Nigeria: The Role of the Capital Market, by Fidelis O. Ogwumike and Davidson A. Omole, Research Paper 56.

Policy Modelling in Agriculture: Testing the Response of Agriculture to Adjustment Policies in Nigeria, by Mike Kwanashie, Abdul-Ganiyu Garba and Isaac Ajilima, Research Paper 57.

Price and Exchange Rate Dynamics in Kenya: An Empirical Investigation (1970–1993), by Njuguna S. Ndung'u, Research Paper 58.

Exchange Rate Policy and Inflation: The Case of Uganda, by Barbara Mbire, Research Paper 59.

Institutional, Traditional and Asset Pricing Characteristics of African Emerging Capital Markets, by Ino L. Inanga and Chidozie Emenuga, Research Paper 60.

Foreign Aid and Economic Performance in Tanzania, by Timothy S. Nyoni, Research Paper 61.

Public Spending, Taxation and Deficits: What Is the Tanzanian Evidence? by Nehemiah Osoro, Research Paper 62.

Adjustment Programmes and Agricultural Incentives in Sudan: A Comparative Study, by Nasredin A. Hag Elamin and Elsheikh M. El Mak, Research Paper 63.

Intra-industry Trade between Members of the PTA/COMESA Regional Trading Arrangement, by Flora Mndeme Musonda, Research Paper 64.

Fiscal Operations, Money Supply and Inflation in Tanzania, by A.A.L. Kilindo, Research Paper 65.

Growth and Foreign Debt: The Ugandan Experience, by Barbara Mbire, Research Paper 66.

Productivity of the Nigerian Tax System: 1970–1990, by Ademola Ariyo, Research Paper 67.

Potentials for Diversifying Nigeria's Non-oil Exports to Non-Traditional Markets, by A. Osuntogun, C.C. Edordu and B.O. Oramah, Research Paper 68.

Empirical Studies of Nigeria's Foreign Exchange Parallel Market II: Speculative Efficiency and Noisy Trading, by Melvin Ayogu, Research Paper 69.

Effects of Budget Deficits on the Current Account Balance in Nigeria: A Simulation Exercise, by Festus O. Egwaikhide, Research Paper 70.

Bank Performance and Supervision in Nigeria: Analysing the Transition to a Deregulated Economy, by O.O. Sobodu and P.O. Akiode, Research Paper 71.

Financial Sector Reforms and Interest Rate Liberalization: The Kenya Experience, by R.W. Ngugi and J.W. Kabubo, Research Paper 72.

Local Government Fiscal Operations in Nigeria, by Akpan H. Ekpo and John E.U. Ndebbio, Research Paper 73.

Tax Reform and Revenue Productivity in Ghana, by Newman Kwadwo Kusi, Research Paper 74.

Fiscal and Monetary Burden of Tanzania's Corporate Bodies: The Case of Public Enterprises, by H.P.B. Moshi, Research Paper 75.

Analysis of Factors Affecting the Development of an Emerging Capital Market: The Case of the Ghana Stock Market, by Kofi A. Osei, Research Paper 76.

Ghana: Monetary Targeting and Economic Development, by Cletus K. Dordunoo and Alex Donkor, Research Paper 77.

The Nigerian Economy: Response of Agriculture to Adjustment Policies, by Mike Kwanashie, Isaac Ajilima and Abdul-Ganiyu Garba, Research Paper 78.

Agricultural Credit Under Economic Liberalization and Islamization in Sudan, by Adam B. Elhiraika and Sayed A. Ahmed, Research Paper 79.

Study of Data Collection Procedures, by Ademola Ariyo and Adebisi Adeniran, Research Paper 80.

Tax Reform and Tax Yield in Malawi, by C. Chipeta, Research Paper 81.

Real Exchange Rate Movements and Export Growth: Nigeria, 1960–1990, by Oluremi Ogun, Research Paper 82.

Macroeconomic Implications of Demographic Changes in Kenya, by Gabriel N. Kirori and Jamshed Ali, Research Paper 83.

An Empirical Evaluation of Trade Potential in the Economic Community of West African States, by E. Olawale Ogunkola, Research Paper 84.

Cameroon's Fiscal Policy and Economic Growth, by Aloysius Ajab Amin, Research Paper 85.

Economic Liberalization and Privatization of Agricultural Marketing and Input Supply in Tanzania: A Case Study of Cashewnuts, by Ngila Mwase, Research Paper 86.

Price, Exchange Rate Volatility and Nigeria's Agricultural Trade Flows: A Dynamic Analysis, by A.A. Adubi and F. Okunmadewa, Research Paper 87.

The Impact of Interest Rate Liberalization on the Corporate Financing Strategies of Quoted Companies in Nigeria, by Davidson A. Omole and Gabriel O. Falokun, Research Paper 88.

The Impact of Government Policy on Macroeconomic Variables, by H.P.B. Moshi and A.A.L. Kilindo, Research Paper 89.

External Debt and Economic Growth in Sub-Saharan African Countries: An Econometric Study, by Milton A. Iyoha, Research Paper 90.

Determinants of Imports in Nigeria: A Dynamic Specification, by Festus O. Egwaikhide, Research Paper 91.

Macroeconomic Effects of VAT in Nigeria: A Computable General Equilibrium Analysis, by Prof. D. Olu Ajaka iye, Research Paper 92.

Exchange Rate Policy and Price Determination in Botswana, by Jacob K. Atta, Keith R. Jefferis, Ita Mannathoko and Pelani Siwawa-Ndai, Research Paper 93.

Monetary and Exchange Rate Policy in Kenya, by Njuguna S. Ndung'u, Research Paper 94.

Health Seeking Behaviour in the Reform Process for Rural Households: The Case of Mwea Division, Kirinyaga District, Kenya, by Rose Ngugi, Research Paper 95.

Trade Liberalization and Economic Performance of Cameroon and Gabon, by Ernest Bamou, Research Paper 97.

Quality Jobs or Mass Employment, by Kwabia Boateng, Research Paper 98.

Real Exchange Rate Price and Agricultural Supply Response in Ethiopia: The Case of Perennial Crops, by Asmerom Kidane, Research Paper 99.

Determinants of Private Investment Behaviour in Ghana, by Yaw Asante, Research Paper 100.

An Analysis of the Implementation and Stability of Nigerian Agricultural Policies, 1970–1993, by P. Kassey Garba, Research Paper 101.

Poverty, Growth and Inequality in Nigeria: A Case Study, by Ben E. Aigbokhan, Research Paper 102.

Effect of Export Earnings Fluctuations on Capital Formation, by Godwin Akpokodje, Research Paper 103.

Nigeria: Towards an Optimal Macroeconomic Management of Public Capital, by Melvin D. Ayogu, Research Paper 104.

International Stock Market Linkages in South Africa, by K.R.. Jefferies, C.C. Okeahalam and T.T. Matome, Research Paper 105.

An Empirical Analysis of Interest Rate Spread in Kenya, by Rose W. Ngugi, Research Paper 106

The Parallel Foreign Exchange Market and Macroeconomic Perfromance in Ethiopia, by Derrese Degefa, Reseach Paper 107.

Market Structure, Liberalization and Performance in the Malawi Banking Industry, by Ephraim W. Chirwa, Research Paper 108.

Liberalization of the Foreign Exchange Market in Kenya and the Short-Term Capital Flows Problem, by Njuguna S. Ndung'u, Research Paper 109.
External Aid Inflows and the Real Exchange Rate in Ghana, by Harry A. Sackey, Research Paper 110.
Formal and Informal Intitutions 'Lending Policies and Access to Credit by Small-Scale Enterprises in Kenya: An Empirical Assessment, by Rosemary Atieno, Research Paper 111.
Financial Sector Reform Macroeconomic Instability and the Order of Economic Liberalization: The Evidence from Nigeria, by Sylvanus I. Ikhinda and Abayomi A. Alawode, Research Paper 112.
The Second Economy and Tax Yield in Malawi, by C. Chipeta, Research Paper 113.
Promoting Export Diversification in Cameroon: Toward Which Products? by Lydie T. Bamou, Research Paper 114.
Asset Pricing and Information Efficiency of the Ghana Stock Market, by Kofi A. Osei, Research Paper 115.
An Examination of the Sources of Economic Growth in Cameroon, by Aloysius Ajab Amin, Research Paper 116.
Trade Liberalization and Technology Acquisition in the Manufacturing Sector: Evidence from Nigeria, by Ayonrinde Folasade, Research Paper 117.
Total Factor Productivity in Kenya: The Links with Trade Policy, by Joseph Onjala, Research Paper 118.
Kenya Airways: A Case Study of Privatization, by Samuel Oyieke, Research Paper 119.
Determinants of Agricultural Exports: The Case of Cameroon, by Daniel Gbetnkon and Sunday A. Khan, Research Paper 120.
Determinants of Regional Poverty in Uganda, by Francis Okurut, Jonathan Odwee and Asaf Adebua, Research Paper 122
Exchange Rate Policy and the Parallel Market for Foreign Currency in Burundi, by Janvier D. Nkurunziza, Research Paper 123.
Structural Adjustment, Poverty and Economic Growth: An Analysis for Kenya, by Jane Kabubo-Mariara and Tabitha W. Kiriti, Research Paper 124.
Liberalization and Implicit Government Finances in Sierra Leone, by Victor A.B. Davis, Research Paper 125.
Productivity, Market Structure and Trade Liberalization in Nigeria, by Adeola F. Adenikinju and Louis N. Chete, Research Paper 126.
Productivity Growth in Nigerian Manufacturing and Its Correlation to Trade Policy Regimes/Indexes (1962–1985), by Louis N. Chete and Adeola F. Adenikinju, Research Paper 127.
Financial Liberalization and Its Implications for the Domestic Financial System: The Case of Uganda, by Louis A. Kasekende and Michael Atingi-Ego, Research Paper 128.
Public Enterprise Reform in Nigeria:Evidence from the Telecommunications Industry, by Afeikhena Jerome, Research Paper 129.
Food Security and Child Nutrition Status among Urban Poor Households in Uganda: Implications for Poverty Alleviation, by Sarah Nakabo-Sswanyana, Research Paper 130.
Tax Reforms and Revenue Mobilization in Kenya, by Moses Kinyanjui Muriithi and Eliud Dismas Moyi, Research Paper 131.
Wage Determination and the Gender Wage Gap in Kenya: Any Evidence of Gender Discrimination? by Jane Kabubo-Mariara, Research Paper 132.
Trade Reform and Efficiency in Cameroon's Manufacturing Industries, by Ousmanou Njika, Research Paper 133.
Efficiency of Microenterprise in the Nigerian Economy, by Igbekele A. Ajibefun and Adebiyi G. Daramola, Research Paper 134.
The Impact of Foreign Aid on Public Expenditure: The Case of Kenya, by James Njeru, Research Paper 135.
The Effects of Trade Liberalization on Productive Efficiency: Electrical Industry in Cameroon, by Ousmanou Njikam, Research Paper 136.
How Tied Aid Affects the Cost of Aid-Funded Projects in Ghana, by Barfour Osei, Research Paper 137.
Exchange Rate Regimes and Inflation in Tanzania, by Longinus Rutasitara, Research Paper 138.
Private Returns to Higher Education in Nigeria, by O.B.Okuwa, Research Paper 139.
Uganda's Equilibrium Real Exchange Rate and Its Implications for Non-Traditional Export Performance, by Michael Atingi-Ego and Rachel Kaggwa Sebudde, Research Paper 140.

Dynamic Inter-Links among the Exchange Rate, Price Level and Terms of Trade in a Managed Floating Exchange Rate System: The Case of Ghana, by Vijay K. Bhasin, Research Paper 141.

Financial Deepening, Economic Growth and Development: Evidence from Selected Sub-Saharan African Countries, by John E. Udo Ndebbio, Research Paper 142.

AFRICAN ECONOMIC RESEARCH CONSORTIUM

P.O. BOX 62882 - 00200
NAIROBI, KENYA

TELEPHONE (254-20) 2734150
2734153 2734157 2734163
2734166 2734179

FAX (254-20) 2734170 2734173

E-MAIL:
communications@aercafrica.org

WEB SITE:
http://www.aercafrica.org

The principal objective of the African Economic Research Consortium (AERC), established in August 1988, is to strengthen local capacity for conducting independent, rigorous inquiry into problems pertinent to the management of economies in sub-Saharan Africa.

In response to special needs of the region, AERC has adopted a flexible approach to improve the technical skills of local researchers, allow for regional determination of research priorities, strengthen national institutions concerned with economic policy research, and facilitate closer ties between researchers and policy makers.

Since its establishment, AERC has been supported by private foundations, bilateral aid agencies and international organizations.

SPECIAL PAPERS contain the findings of commissioned studies in furtherance of AERC's programmes for research, training and capacity building.

RESEARCH PAPERS contain the edited and externally reviewed results of research financed by the AERC.

It is AERC's policy that authors of Special and Research papers are free to use material contained therein in other publications. Views expressed in such papers are those of the authors alone and should not be attributed to the AERC's sponsoring Members, Programme Committee, or Secretariat.

Further information concerning the AERC, and additional copies of Special and Research Papers, can be obtained by writing to: African Economic Research Consortium, P.O. Box 62882 - 00200, Nairobi, Kenya.

ISBN 9966-944-44-3