MONEY, INFLATION AND GROWTH IN SOUTH AFRICA

by

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DECLARATION

I hereby certify that the work embodied in this thesis is the result of my own investigations except where reference has been made to published literature.

I declare that this work has not already been accepted in substance, nor is it currently being submitted in candidature for any other degree.

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ABSTRACT

The main objective of this thesis is to assess the effectiveness of monetary policy in South Africa to promote high and sustainable real economic growth rates after the adoption of more market-oriented measures in 1980. The thesis consists of three interrelated issues which are examined from the early 1960s until the late 1990s: the exogenous/endogenous nature of the money supply, the underlying causes of inflation and the costs and benefits of inflation.

The main findings that emerge from the thesis are as follows. From a long-run perspective, the results show that the money supply is endogenously determined and that the money supply has been passive in the inflationary process over the period 1966-1997. The inflationary impact of excessive monetary expansion is only relevant over the period 1966-1979 when monetary policy was based on direct control measures. However, direct control measures were largely ineffective in reducing and stabilising inflation because the money supply was also endogenously determined during the period 1966-1979. The endogenous nature of the money supply required a more extensive analysis of the underlying causes of inflation which may not necessarily have been the outcome of excessive monetary expansion by the monetary authorities. After an extensive analysis of structural and/or cost-push forces of inflation, the empirical results indicate that the causes of inflation have changed from a demand-pull inflation over the period 1973-1983, to a cost-push cause of inflation (import prices and wage rate changes) since 1987 when a market determined exchange rate finally stabilised.

The study suggests that even though the cause of inflation was essentially cost-push since the mid-1980s, restrictive demand management policies were effective in reversing the accelerating inflationary trend experienced since the early 1970s. Moreover, the negative impact of double digit inflation on economic growth during the deflationary zone, supports the South African Reserve Bank's (SARB) primary objective of low and stable inflation rates. However, the growth benefits of mild inflation indicate that the SARB's unofficial inflation target of 1-5 percent is too conservative. Furthermore, restrictive monetary policy which is geared towards unrealistically low or even zero inflation, imposes a permanent cost. Cost-push inflation resulting from exchange rate depreciations and wage rate changes will always create an environment which is biased towards inflation. To control cost-push inflation demand management policies will have to be restrictive on a permanent basis, but at the cost of permanent output and employment losses.

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CHAPTER 1

INTRODUCTION

1.1 The objective of the study

After the adoption of more market-oriented monetary policy measures in 1980, monetary policy has played an increasingly important role to reduce and stabilise the inflation rate. The primary objective of the South African Reserve Bank (SARB) is to create price stability which is viewed as an important precondition for high and sustainable growth.

Like many other countries South Africa experienced high and accelerating inflation during the 1970s and 1980s. The move towards more market-oriented monetary policy measures in 1980 witnessed a stringent deflationary programme by the SARB in 1986 to bring inflation down to lower levels. To this end, inflation decelerated since 1986 and single digit rates were again reached in 1994. In 1999 inflation of 5.2 percent was at its lowest level in thirty years.

However, despite the SARB's apparent success in bringing inflation down to lower levels, South Africa's growth performance has been disappointing. During the period 1986-1993 South Africa recorded an average real gross domestic product (GDP) growth rate of 0.96 percent and in the period 1994-1999 an average growth rate of 2.26 percent. The first successful democratic election in 1994 witnessed South Africa's reintegration into the global economy and the return of capital flows. Although South Africa's growth performance improved somewhat during the early stages of the period 1994-1999, the improvement has not been sustainable. This contention is borne out by a median real GDP growth rate of 1.66 percent over the period 1994-1999. Moreover, the newly elected African National Congress (ANC) government's GEAR (growth, employment, and redistribution) policy document still stipulates an orthodox macroeconomic programme of tight monetary and fiscal policy.

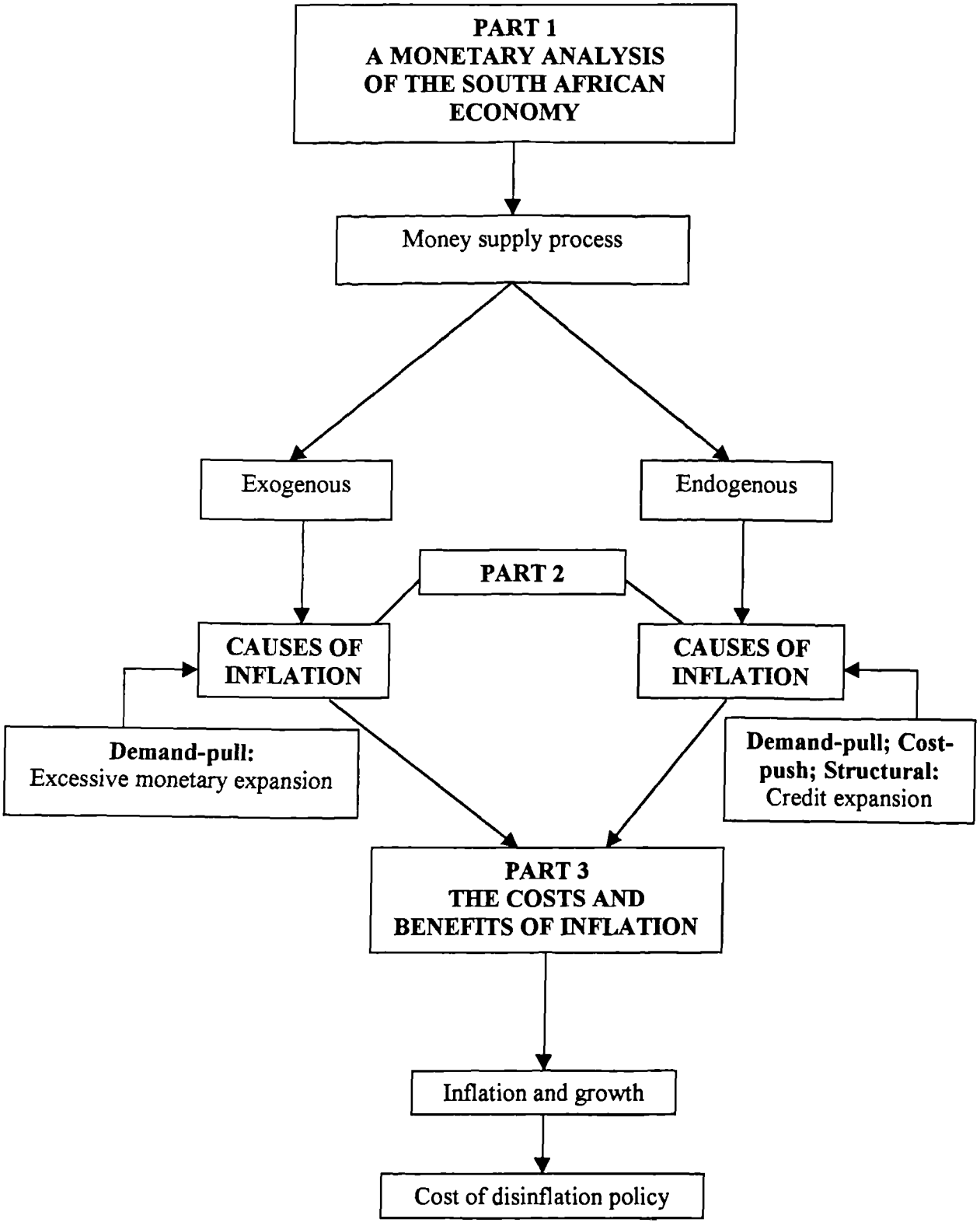
Against this background, and an official unemployment rate which has reached an unprecedented high of 40 percent during the 1990s, the main objective of the thesis is to determine whether the nature and conduct of monetary policy is conducive to high and sustainable growth rates. The descriptive and econometric analysis will be carried out from the early 1960s until the late 1990s. The objective and main structure of the thesis can be represented schematically in Figure 1.1.

The thesis can be divided into three main parts to assess the effectiveness of monetary policy in promoting high and sustainable growth. The effectiveness of monetary policy will crucially depend on the money supply process. If a monetarist contention holds true that the money supply is exogenously determined, then inflation is a purely demand-pull phenomenon which is caused by excessive monetary expansion. Under an exogenously determined money supply the effectiveness of monetary policy will be maximised in reducing and stabilising inflation. However, if the money supply process is endogenous, then it is likely that inflation is caused by a wider range of factors such as cost-push and structural forces. Part 1 (Figure 1.1) first presents an extensive analysis of South Africa's money supply process. If the money supply process contains some endogenous elements, then Part 2 will analyse alternative causes of inflation such as cost-push and structural factors which are not necessarily the outcome of excessive monetary expansion by the monetary authorities.

Irrespective of the money supply process, the first section of Part 3 (Figure 1.1) investigates the costs and benefits of inflation. Particularly, whether there is negative causality running from inflation to growth, thus justifying the SARB's primary objective of low and stable inflation, or in fact, whether inflation under certain circumstances can actually be beneficial to growth. The last section of Part 3 looks at the cost of disinflation policy which will crucially depend on the money supply process. It is plausible to assume that under an exogenously determined money supply disinflation policy will only have short-run costs, because the diagnosis of the underlying cause of inflation (demand-pull) is correct. On the other hand, if the money supply process is endogenously determined then the causes of inflation fall beyond the realms of the SARB alone. To keep the inflation rate in check demand management policies will have to be restrictive on a permanent basis, but at the cost of permanent

Figure 1.1

The Structure of the Thesis



output and employment losses, because the cause of inflation is in essence not demand-pull anymore.

1.2 The significance of the study

Studies that have investigated South Africa's money supply process, causes of inflation and inflation-growth relationship, have generally tended to be of a theoretical and descriptive nature (see e.g. Mohr, 1986, 1990 and 1994; Rogers, 1985 and 1986). Moreover, the few empirical studies that do exist have been highly controversial and ambiguous. The growing importance that has been attached to monetary policy in stabilising and reducing inflation since the 1980s, clearly accentuates the need to extend the theoretical and descriptive content of the existing literature, but more importantly, to substantiate these findings with empirical tests. In this context, the thesis makes three important contributions.

First, in the existing literature there is at present no consensus that there exists a stable money demand function for South Africa. Without a stable money demand function the stable and predictable link between money and money income automatically disappears, and it is therefore not possible to draw concrete conclusions on the exogenous/endogenous nature of the money supply. Moll (1999) applies a wide range of cointegration techniques which show that the M3 income velocity is inherently unstable over the period 1960-1996. By contrast, Hurn and Muscatelli (1992) find evidence of a stable M3 money demand function over the period 1965-1990. The ambiguity of these studies may possibly stem from the changes that occurred in the different definition of money in 1985 when the SARB adopted a policy of monetary growth targeting. According to Hurn (1991) there is little difference between the old and new M1 definitions, but a discernible difference between the old and new M2 and M3 definitions. Because at the time the SARB only backdated the new definitions to 1978, Hurn (1991) subsequently adjusted his own series to make them comparable with the new definitions and backdated the series to 1965. Moll's (1999) M3 definition is obtained from International Financial Statistics and is a narrower definition compared to the official M3 published by the SARB.

Recently the SARB backdated all the new monetary aggregates to 1965. To the author's knowledge, this study is the first to explore the existence of a stable long-run money demand function which is based on the new definitions and backdated to 1965.

Second, empirical studies that have investigated the underlying causes of inflation in South Africa are scant. Some notable exceptions are those conducted by Gallaway *et al.* (1970); Strydom (1976); and Strydom and Steenkamp (1976). However, all these studies are outdated and may have little relevance in describing the long-run causes of inflation in South Africa at the present moment. Moreover, the significant changes that have occurred in South Africa on both the economic and political front, may even suggest that it is not possible to analyse the long-run causes of inflation in a meaningful and interpretable way. This study examines the causes of inflation over a long and extended period, first, to determine whether there exists such a long-run relationship, and second, whether the long-run causes of inflation have changed.

Third, according to a recent survey conducted by Temple (1999), the existing literature on inflation-growth studies suffer from major flaws. There is currently only one empirical study that has investigated the inflation-growth relationship in South Africa. Paul *et al.* (1997) find that there is no causal relationship between inflation and growth over the period 1960-1985 in South Africa. The third part of the thesis attempts to overcome some of the major flaws of inflation-growth time series case studies by explicitly including some of the suggestions made by Temple (1999). The empirical analysis will not only draw on the suggestions made by Temple (1999), but also take into account that the existing empirical literature tend to neglect a major part of the theoretical propositions that have been made about inflation-growth relationships (Thirlwall, 1974).

1.3 Methodology of the study

The thesis contains a theoretical, descriptive and econometric content. Each chapter will precede with a thorough discussion of the theoretical and econometric methodology to be employed. A great deal of importance is attached to the descriptive analysis of the thesis. Significant structural, political and institutional changes that have occurred in

South Africa since the 1960s, suggest that the empirical results obtained from the econometric analysis will only become meaningful and relevant from a policy point of view if the variables under analysis are stable. The descriptive analysis is not only the work of one chapter, but will be developed and extended throughout the thesis to ensure that the econometric results represent stable short-run and long-run relationships. An extensive analysis of the time series properties will therefore form an important part of the empirical methodology.

The econometric methodology draws extensively on the techniques developed by Engle and Granger (1987), Hendry (1995), Johansen and Juselius (1990), Pesaran and Shin (1999) and Pesaran *et. al.* (1996). The choice of the technique will crucially depend on the order of integration of the variables under analysis which in turn will be based on a wide variety of unit root tests. Unit root tests such as the standard Dickey Fuller and Augmented Dickey Fuller test statistics suffer from low power in small samples and tend to be biased by not rejecting the null hypothesis of a unit root when the variables contain a structural break. If the variables under analysis are integrated of order one (I{1}), then standard cointegration techniques will be employed to test for long-run relations. Inferences on the short-run relations can then be drawn by utilising the error correction term from the cointegrating relationships. However, if there is uncertainty about the order of integration of the variables or the variables are stationary (I{0}), then standard cointegration techniques are inappropriate to test whether there exists a long-run relationship. Alternatively, the econometric methodology will then be based on the unrestricted error correction procedure developed by Pesaran *et. al.* (1996) which tests for long-run relations between a set of I(0) variables, a set of I(1) variables and a mixture of I(0) and I(1) variables. The unrestricted error correction procedure is particularly useful in the context of this thesis, because variables measured in rates of change such as inflation and real GDP are likely to be I(0).

Causality tests play an important role in the first part of the thesis to determine the exogenous/endogenous nature of the money supply. Although the standard Granger procedure is useful to detect short-run causality, it says little about long-run causality effects or the exogenous/endogenous nature of the variables. Short-run causality may have permanent long-run effects, but this cannot be established *a priori*. Following Granger's (1988) suggestion, the causality procedures adopted in the thesis will not only

capture short-run effects but also long-run effects. Although causality tests form an important part of the empirical methodology in Chapters 4, 5 and 8, the causality tests are only statistical. 'True' causality can only be established through economic theory.

1.4 An overview of the chapters

The schematic representation in Figure 1.1 shows that the thesis consists of three main parts. Part 1 (Chapters 3-5) presents an extensive monetary analysis of the South African economy to determine the exogenous/endogenous nature of the money supply process. Part 2 (Chapters 6-7) examines alternative causes of inflation which are not necessarily the outcome of excessive monetary expansion by the SARB. Part 3 (Chapter 8) investigates the costs and benefits of inflation and postulates whether disinflation policy may have permanent effects if the underlying cause of inflation is not demand-pull.

Chapter 2 provides a theoretical and descriptive framework to assess South Africa's growth and inflation experience during the period 1965-1996. The analysis will provide some preliminary evidence to evaluate whether monetary policy should be geared towards single digit or even zero inflation, or alternatively, whether inflation in South Africa could be explained by a set of factors which act independently from monetary policy. Chapter 2 will serve as an important background chapter when these issues are analysed in more detail in later chapters.

Chapter 3 examines whether there exists a stable money demand function for South Africa over the period 1965-1997. Given the ambiguous nature of money demand studies in South Africa, the chapter presents an extensive analysis of all three official monetary aggregates to establish whether money demand is stable following the significant financial reforms in South Africa.

Although a stable money demand function is a necessary condition to establish a stable and predictable link between money and money income, it does not necessarily validate the monetarist belief that money is causal in the process of inflation. The main objective of Chapter 4 is to determine whether inflation in South Africa has been caused by

excessive monetary expansion over the period 1966-1997, or whether the money supply has merely been passive in the inflationary process. An analysis of this nature is important for monetary policy, since it provides some guide-line to determine the long-run causes of inflation in South Africa.

Chapter 5 supplements and extends the main findings of Chapter 4. In an attempt to provide a more rigorous analysis of South Africa's money supply process, Chapter 5 describes South Africa's money supply process along several competing, but not mutually exclusive, theoretical paradigms over the period 1966-1997. The period 1966-1997 is further sub-divided into two sub-periods: 1966-1979 when monetary policy was based on direct control measures and 1980-1997 when the monetary authorities adopted more market-oriented measures.

Chapter 6 analyses the long-run causes of inflation in South Africa. Three different types of demand inflation are considered over the period 1962-1997: net 'excess' demand, the dispersion of demand between sub-markets and the demand for agricultural products. The inflationary impact of the dispersion of demand and 'excess' demand for agricultural products originates from structuralist writings who believe that these sources of demand inflation are more persistent and likely to occur under an endogenously determined money supply.

Chapter 7 examines the long-run inflationary impact of exchange rate depreciation in South Africa over the period 1984-1998 when the monetary authorities adopted a more market-oriented exchange rate system. Chapter 7 also acts as a supplement to Chapter 6, by investigating imported inflation over the period 1973-1983. It is envisaged that significant structural changes between the two-sub-periods may have changed the long-run causes of inflation in South Africa. To assess the long-run inflationary impact of an exchange rate depreciation, two interrelated issues are developed in the theoretical and empirical parts of the chapter. First, the degree of import pass-through that results from an exchange rate depreciation. Second, to what extent will the initial rise in import prices trigger a wage-price spiral ?

The main purpose of Chapter 8 is to provide a more balanced approach to the relation between inflation and growth in South Africa. This approach stems from the fact that

Central Banks often portray a one-sided view on the costs of inflation without considering that mild inflation can actually be beneficial to growth. The theoretical and empirical analysis will therefore not only focus on the costs of inflation, but also the potential benefits of mild inflation (Thirlwall, 1974). In addition, the empirical methodology also takes into account some of the various flaws of time series case studies identified by Temple (1999). The last section of Chapter 8 looks at the cost of disinflation policy in South Africa. The interpretation of the empirical results in this section will to a large extent depend on the exogenous/endogenous nature of the money supply in Part 1 and the long-run causes of inflation analysed in Chapters 6 and 7. If inflation is a purely demand-pull phenomenon, then the cost of disinflation policy is likely to be temporary. However, if the causes of inflation are dictated by cost-push and/or structural factors, then the cost of disinflation is likely to be permanent, because demand management policies by the SARB addresses the symptoms of inflation and not its underlying causes.

Chapter 9 presents a summary of the main findings and draws some policy conclusions.

CHAPTER 2

MONEY, INFLATION AND GROWTH IN SOUTH AFRICA: A THEORETICAL AND DESCRIPTIVE ANALYSIS

2.1 Introduction

It is almost a universally accepted belief that high and volatile inflation rates undermine economic and social progress. In most countries, Central Banks adopt a stance of utmost conservatism in their endeavour to fight inflation through tight monetary and fiscal policy. The view is generally held that a low inflation rate, or sometimes zero inflation, would eventually foster long-run growth and development. Country evidence over the last decade, however, suggests the contrary. In many developing countries growth has not been an assured product of low and stable inflation rates. The question arises whether low, or zero inflation, is necessarily a precondition for high and sustainable growth rates.

The ability of the monetary authorities to maintain price stability which is conducive to sustainable growth, will ultimately depend on an important condition. The effectiveness of monetary policy will be maximised if the money supply is exogenously determined. Under this condition inflation is a purely demand-pull phenomena and primarily caused by excessive monetary expansion. Alternatively, under an endogenously determined money supply, it is more likely that inflation is caused by a wider range of factors such as structural and cost-push forces which act independently from monetary policy. In such a case restrictive monetary policy measures would merely succeed in addressing the symptoms of inflation and not its underlying causes. If inflation is the product of structural and cost-push factors, sustainable growth will not necessarily follow lower inflation which is achieved through restrictive monetary policy.

Chapter 2 provides a theoretical and descriptive framework to assess South Africa's growth and inflation experience over the last three decades. The analyses will provide some preliminary evidence to evaluate whether monetary policy should be geared towards single digit or even zero inflation, or alternatively, whether inflation in South Africa could be explained by a set of factors which act independently from monetary policy. Chapter 2 will serve as an important background chapter when these issues are analysed in more detail in later chapters. Section 2.2 outlines different models of inflation. Sections 2.3 presents an overview of South Africa's growth and inflation performance. Section 2.4 gives a critical overview of monetary policy. Based on the analysis in sections 2.3 and 2.4, section 2.5 attempts to determine whether South Africa's inflation experience is compatible with the theoretical models outlined in section 2.2. Section 2.6 concludes

2.2 Theoretical models of inflation

The following sections will analyse different theoretical models of inflation and its underlying causes. The focus will specifically be on the conflicting views expressed by monetarists and post-Keynesian/structuralists on the causes of inflation.

2.2.1 The Monetarist explanation of inflation

In its simplest form, monetarists contend that excessive growth in the money supply will lead to an increase in the price level. The monetarist explanation of inflation mainly has its origins in the traditional quantity theory of money developed by Fisher and later modified by the Cambridge school (see e.g., Ghatak, 1995b; Laidler, 1977; Laidler, 1982 and Trevithick, 1977).

Fisher's quantity theory is in essence an equation of exchange:

$$MV = PY, \tag{2.1}$$

where M is the quantity of money in circulation; V is the income velocity of money; P is the average price level of final goods and services; and Y is real income. The model states that an increase in the quantity of money will lead to an equiproportionate increase in the aggregate price level, with the explicit assumptions that V and Y are stable. The assumption that V is constant is equivalent to assuming that the demand for money is constant[1]. The postulate that Y is constant can be found in the classical assumption that Y tends to move smoothly towards its natural rate to achieve full-employment in the long-run (Thirlwall, 1974). The model predicts that if money supply rises more than demand, an increase in expenditure on goods will increase output at first, and if the classical assumption is made that production is near full capacity, a rise in prices will follow shortly thereafter.

In what is seen as an improved and more satisfactory version, the Cambridge school reformulated the traditional quantity equation in the following way:

$$M = kPY \tag{2.2}$$

Although the Cambridge equation is simply an arithmetic reshuffling of the traditional quantity equation, their main contribution is based on the rationale for individuals to hold money. The Cambridge k implies that the demand for money is proportionate to the level of money income PY. It follows that the demand for money is determined by the level of income which is simply a reciprocal of Fisher's V, i.e. $k = 1/V$.

According to Laidler (1982) monetarism is a quantity theory approach to macroeconomics with two distinct elements: First, the traditional quantity theory of money which postulates that fluctuations in the quantity of money cause fluctuations in money income and prices. Second, the restatement or modern version of the quantity theory by Friedman (1959), which is not as such a theory about prices and nominal

[1] The demand for money is stable when money holdings can be explained by functional relationships which have statistical significance, and that the same equation can be applied to different places using different data, without it being necessary to change arguments of the relations to achieve satisfactory results (Laidler, 1982).

income, but rather incorporates a theory of the demand for money with the key theoretical propositions of the traditional quantity theory.

The main contribution of Friedman's (1959) demand for money theory is to investigate how much money households wish to hold under different circumstances, which basically departs from the Keynesian demand for money theory that emphasised the underlying motives of households to hold money (Laidler, 1977). The modern version of the quantity theory specifically looks at wealth in relation to the demand for money, and develops a broader definition of wealth to explain the amount of money households wish to hold. In addition to nonhuman wealth, a broader definition of wealth should also incorporate the present value of labour income, i.e. human wealth. To ensure that the wealth variable entering the demand for money function is as inclusive as possible, but at the same time recognising that there is a lack for a market in human wealth, Friedman (1959) proposed that the ratio of human to nonhuman wealth should be considered in the demand for money function (Laidler, 1977).

In addition to the wealth variable, it is also important to include the opportunity cost (measured by changes in the rate of interest) of holding money in the function, by considering the return on alternative assets such as bonds and equity. Lastly, the price level and its rate of change will potentially also have an influence in determining the amount of money households wish to hold. Since money is a source of purchasing power, it follows that the demand for money is a demand for real balances. Other things being equal, an increase in the price level will lead to an increase in the amount of money households wish to hold to maintain purchasing power parity. On the other hand, an increase in the rate of change of the price level acts as a tax on money holdings. Other things being equal, the higher the rate of change of prices the smaller the demand for money.

Having considered two essential elements of monetarism above, some key theoretical propositions of monetarism can now be considered (Friedman, 1970b):

i) From the above, it is clear that the quantity theory of money will only hold if it is assumed *a priori,* that the demand for money is stable. It follows that an increase in the

rate of growth of the money supply will lead to an increase in nominal income and physical output. The effect on prices will , on average, only be visible 12-18 months after the initial increase in the money supply.

ii) An increase in the rate of growth of the money supply will only increase nominal income and not real income and real output. The negligible impact of increases in the money supply on real variables is in sharp contrast to the original Phillips curve that depicted a conspicuous inverse relationship between unemployment and inflation. In two seminal papers, Friedman (1968) and Phelps (1968) showed that in essence, money is neutral in the long-run.

The original Phillips curve explicitly assumed that during times of low unemployment nominal wages increase more rapidly compared to nominal wages during times of high unemployment. Expansionary macroeconomic policy during times of high unemployment, would thus succeed in increasing aggregate demand for goods and services and in the process induce firms to offer higher nominal wages to attract more labour.

Friedman (1968) and Phelps (1968), however, argued that firms and labour are not concerned about nominal wages but rather the real wage. The expectations-augmented Phillips curve shows that an increase in the rate of growth in the money supply will reduce unemployment below its natural rate, but only in the short-run. Because workers and firms are concerned with real wages, nominal wages will accordingly adjust to reflect the higher inflation rate accruing from an excessive growth in the money supply. In the long-run, when actual and expected inflation are equal, the real wage remains constant, so that the economy adjusts back to its natural rate of unemployment. Unemployment will only diverge from its natural rate when there is a significant improvement in real factors such as technology and productivity or with ever-accelerating inflation

iii) Monetarists view the money supply as exogenous and under the direct control of the central bank. The money supply is viewed as a multiple of the monetary base, so that any attempt to control the money supply should come from the Central Bank's control over

the monetary base. If it is assumed that the money multiplier is stable and predictable, the direction of causation therefore runs from the monetary base to the money supply.

iv) Monetarists see inflation as the outcome of excessive aggregate expenditure that was initially triggered by excessive growth in the rate of the money stock. A policy that is based on reducing the inflation rate should gradually reduce the money supply via the Central Bank's control over the monetary base, i.e. the adoption of a monetarist growth rule. To keep the inflation rate in check and to erode inflationary expectations, the growth rate of the money supply should roughly be equal to the growth rate of real income.

The most extreme monetarist view regards fiscal policy as unimportant in the allocation of scarce resources. It is argued that the allocation of scarce resources should be left to the market, while price controls and income policies have little effect in reducing the inflation rate. Monetarists only regard fiscal policy as important insofar as a budget deficit constitutes one source of monetary expansion. The success of a monetarist growth rule in reducing the inflation rate will thus ultimately depend on the ability of fiscal authorities to avoid excessive budget deficits that are financed by monetary expansion.

v) The assumption of an exogenous money stock thus far, is only applicable to an open economy with a flexible exchange rate. A flexible exchange rate system would permit a country to inflate at a higher rate than the world inflation rate and in principle insulate the domestic money stock from balance of payments effects. For example, excessive growth in the money stock of a specific country will result in positive inflation differentials between that country and the rest of the world. The price of non-tradable goods will increase while, at the same time, the depreciation of the exchange rate causes an increase in the price of tradable goods with a resultant increase in the aggregate domestic price level. The demand for money now adjusts to the exogenously determined money supply. In addition, an exogenous money stock under a flexible exchange rate system would cause little fluctuations of the exchange rate around its par values (Rogers, 1986).

Under a fixed exchange rate system, the traditional view believe that monetary authorities have little control over the domestic money stock (Laidler, 1982). If, for example, the world inflation rate is higher than the domestic inflation rate of a specific country, the balance of payments would be converted into a surplus and in the process cause an increase in the domestic money stock. In this case the money stock is endogenous since the direction of causation runs from an increase in money income to an increase in the money stock. The authorities have no option but to surrender control over the money supply, because the endogenous money supply must now adjust to excess money demand.[2]

2.2.2 A Structuralist/Post-Keynesian explanation of inflation

In contrast to the monetarist view of inflation, structuralists see inflation as the outcome of three interrelated factors (Mohr and Rogers, 1995). First, the underlying factors such as the socio-economic structure of an economy, which are responsible for the economy's inflationary bias. Underlying factors of inflation normally involve the degree of political stability in an economy, the political strength and bargaining power of trade unions and the degree of conflict between different groups in the society. Once the underlying factors are in place, or an economy experiences socio-economic instability, initiating factors trigger or intensify a particular inflationary episode. Typically, structuralists see inflation as the product of structurally induced changes in relative prices, dispersions between sub-markets, cost-push factors, exchange rate depreciations and spiralling budget deficits (Ghatak, 1995b).

Unlike monetarists, structuralists and post-Keynesians see excessive growth in the money supply merely as a propagating factor in the inflationary process and not its underlying cause. Monetary expansion is endogenous and largely responds to initiating factors of inflation (Kaldor, 1982). It is important to acknowledge that structuralists and post-Keynesians do not deny the fact that growth in the money stock would cause an

[2] It is important from a theoretical point of view, to realise that a fixed exchange rate implies that the domestic inflation rate is equal to the world inflation rate. If the domestic economy inflates at a lower rate than the world economy, authorities have no other option but to adjust the money supply to meet excess demand. Inflation rates will thus be realigned and the exchange rate is kept at its fixed level.

inflationary process. Structurally induced inflation, however, is sometimes seen as a necessary or natural outcome of higher growth.[3] In developing counties where structural forces are particularly acute, non-accommodating monetary policy would cause low growth and high unemployment. The government therefore faces an inevitable "trade-off" between growth and inflation (Johnson, 1984) .

In what follows, the discussion will briefly focus on the theoretical issues that relate to structural factors of inflation. Particular attention will be paid to the initiating factors of inflation, while the contention of structuralists and post-Keynesians that the money supply is endogenous will be discussed in more detail at a later stage.

2.2.2.1 Dispersions between markets and the relative price of food

Structuralists normally view changes, or an autonomous change in the relative price of food as one of the most common causes of inflation in developing countries (Cardosa, 1981; Ghatak, 1995b; Johnson, 1984). The underlying argument is that the supply of food in developing countries is inelastic due to low productivity, inadequate technology or a bad harvest.

It is argued that the natural process of economic development causes an increase in income of the non-agricultural sector, which then translates into a higher demand for food produced in the agricultural sector. Because the supply of food is largely inelastic, excess demand leads to an increase in the relative price of food.

Excess demand for food stimulated by a rise in income of the non-agricultural sector, will not only lead to an increase in relative prices of food, but, according to structuralists, would cause an increase in the aggregate price level. The basic argument is that an increase in the relative price of food caused by rigidities in the agricultural sector translates into a higher cost of living in the non-agricultural sector. If producers base their price as some mark-up over the nominal wage rate and factor prices are rigid

[3] Monetarists, however, strongly disagree that structural factors cause inflation. According to them the direction of causation runs from inflation to structural problems (Ghatak, 1995b)

downward, the initial increase in the relative price of food would lead to a wage-price inflation spiral and eventually a self-perpetuating inflationary process.

The dispersion of demand hypothesis, which is distinctly different from net 'excess' demand in a Phillips curve relation, predicts that the greater the dispersion of demand between sub-markets the higher the rate of inflation. Structuralists are of the view that a country may experience rapid inflation even when the economy is on balance in aggregate. As demand shifts from one sector to another as a result of changes in tastes and the distribution of income, prices will tend to rise in those sectors which are expanding, but not fall to the same extent in the declining sectors if prices are inflexible downwards.

2.2.2.2 Foreign exchange shortages and imported inflation

A common characteristic shared by many developing countries is that their exports are based on a few primary commodities, while production of the manufacturing sector is largely geared towards the domestic market. Export growth of primary products are primarily dependent on world demand and prices which are determined in international commodity markets. It follows that the economies of developing countries are particularly vulnerable to external shocks such as a sudden drop in the price of their main primary export product. Moreover, the total world demand for primary products is normally price and income inelastic.

Imports of capital and intermediate goods are essential inputs in the growth and development process of developing countries. Given the low export earnings of developing countries and their high propensity to import, foreign exchange shortages will cause balance of payments difficulties and eventually lead to a self-perpetuating inflationary process. To correct the balance of payments policy-makers could, alternatively, adopt a trade regime of import substitution and exchange rate devaluations. Import substitution by itself constitutes an important source of inflation, since it leads to uncompetitiveness and inefficiencies in production (Thirlwall, 1974).

Because developing countries predominantly export primary products and the manufacturing sector is unable to take advantage of favourable exchange rate movements, a depreciating exchange rate will worsen an already deteriorating terms of trade. The degree to which changes in the exchange rate affect import prices and domestic export prices, i.e. the degree of pass through, will crucially depend on the price and supply elasticities of exports and the price elasticity of imports (Branson, 1972; Hooper and Mann, 1989; Hussain and Thirlwall, 1984). Imports are normally price inelastic while the world demand for total primary exports is price and income inelastic. An exchange rate depreciation or devaluation will therefore cause a further deterioration in the terms of trade. Export earnings will not be enough to finance essential imports, so that the effect of an exchange rate depreciation is directly felt through an increase in import prices and indirectly through an increase in domestic prices. The inflationary process will become self-perpetuating when domestic producers charge a price which is some mark-up over wage costs (Dwyer and Lam, 1995).

To summarise, structuralists and post-Keynesians basically emphasise the shortage of foreign exchange in developing countries as an important source of inflation. Because exports are mainly based on a few primary commodities in developing countries and imported inputs are price inelastic, chronic balance of payments problems develop which may cause a deterioration in the terms of trade and inflationary pressure.

2.2.2.3 Cost-push inflation

According to structuralists and post-Keynesians, an increase in the cost of production is one of the main sources of inflation (Trevithick, 1977). Cost-push inflation could be the result of increases in the nominal wage rate and declining productivity; an increase in import prices and an increase in profit margins (Mohr and Rogers, 1995). In turn, cost-push inflation is closely related to initiating factors of inflation as mentioned earlier. A depreciation of the exchange rate, for example, will increase import prices which could lead to an increase in the aggregate price level, especially if imports are essential inputs in the production process, or consumption goods form a large component of imports. The initial increase in the price level could further lead to an ongoing inflationary process if

trade unions have the bargaining power to increase nominal wages of union members in reaction to the higher cost of living.

The most popular belief of the cost-push view is that the monopolistic behaviour of trade unions is one of the most important causes of cost-push inflation. Wage increases without a commensurate increase in labour productivity is highly inflationary while, at the same time, the inflationary process is further exacerbated if product prices are based as some constant mark-up over wage costs.

2.2.2.4 Budget deficits

A further structural feature of developing countries, is the nature of their tax system and the budget deficit that results from low tax revenue and high government expenditure. Often in developing countries growth in tax revenue does not keep pace with the inflation rate. High inflation therefore erodes the real value of taxes and creates a budget deficit if government expenditure tends to be fixed in real terms (Ghatak, 1995b; Thirlwall, 1974). Furthermore, collection lags are often long, so that when taxes are eventually collected they are worth less in real terms than when assessed originally (Ghatak, 1995b). In addition, many developing countries are characterised by extreme income inequalities and a concomitant narrow tax base. Generally, tax revenue has not been enough to finance growing government expenditures on investment and goods and services.

Budget deficits may lead to monetary expansion to finance excessive government expenditure and eventually a further rise in the inflation rate. From a structuralist viewpoint it becomes clear that the direction of causation does not necessarily run from budget deficits to higher inflation, but most often in developing countries there is evidence of bi-directional causality - high inflation also increases the budget deficit[4] (Dornbusch and Sturzenegger, 1990).

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[4] Monetarists, on the other hand, believe that budget deficits are exogenously determined. In other words, budget deficits are caused by fiscal mismanagement and the direction of causation runs from higher budget deficits to higher inflation.

2.3 A change in the underlying causes of inflation, 1965-1996

The period 1994 to 1996 witnessed a significant change in South Africa, both on the economic and political front. In 1994 apartheid was finally abolished and the country experienced its first free and democratic election. From an economic point of view, the successful political transformation in 1994 and the election of the new government of national unity restored investors' confidence and gave South Africa renewed access to foreign capital and export markets. These developments tended to impact favourably on economic variables such as the real gross domestic product (GDP) growth rate and inflation rate which averaged around 3 and 8 percent respectively. However, the newly elected government inherited an economy from the previous apartheid-regime that is characterised by extreme socio-economic inequalities. To address these inequalities, it is envisaged that it will take some time before the socio-economic benefits of the government's economic policy documents are felt.

The sudden spurt in growth in the period 1994-1996 should thus not be viewed as the outcome of major structural changes in the economy. Although the South African economy will undoubtedly benefit from its reintegration into the global economy, the main structural features of the economy have not changed significantly.

An overview of the South African economy over the period 1965-1996, intuitively suggests that the underlying causes of inflation have changed since the early 1980s. The 1980s witnessed significant structural changes in the South African economy: after 1979 monetary policy changed from direct control measures to more market oriented measures; in 1983 the South African Reserve Bank (SARB) allowed the exchange rate to be more market-determined which saw a sharp depreciation in the exchange rate of the rand; from 1985 to 1993 the economy experienced a severe balance of payments constraint; political instability increased during the 1980's that witnessed disinvestment campaigns and the tightening of trade and financial sanctions; and the export of gold, which constitutes South Africa's main source of foreign exchange earnings, was adversely affected by a sharp drop in the dollar gold price.

To illustrate the difference between inflation and growth and other macroeconomic variables over the sample period, Table 2.1 sub-divides the sample period into two sub-periods: 1965-1981 and 1982-1996.

Table 2.1

Macroeconomic Indicators for South Africa in Annual Average Percentages, 1965-1996

	1965-1981	1982-1996
Real GDP growth rate	4.2	1.2
GDP per capita	1.46	-1.16
GDS/GDP	25.43	20.50
GDFI/GDP	25.74	20.16
Private Investment/GDP	13.60	12.80
Public Investment/GDP	12.14	7.26
Inflation rate (consumer prices)	8.5	13.0

Table 2.1 provides some support for the popular view that a higher inflation rate reduces growth. It could be argued that the higher annual average inflation rate of 13 percent in the period 1982-1996 depressed growth to an annual average rate of 1.2 percent. Furthermore, if a higher inflation rate is necessarily associated with greater inflation variability, the sharp drop in gross domestic investment (GDFI) from 25.74 percent in the sub-period 1965- 1981 to 20.16 percent in the sub-period 1982-1996, could be explained by a greater degree of uncertainty. It should be noted, however, that the sharp decline in GDFI can mainly be attributed to public investment, since private investment remained remarkably stable over the entire period. From Table 2.1 it can also be seen that GDP per capita, which is a broad proxy for the overall living standard, grew at a negative rate of 1.16 percent per annum over the period 1982-1996.

Alternatively, it could be argued that the figures presented in Table 2.1 are misleading and conceal the important fact that over the two sub-periods major structural changes and disruptions in the South African economy could potentially explain the differences in

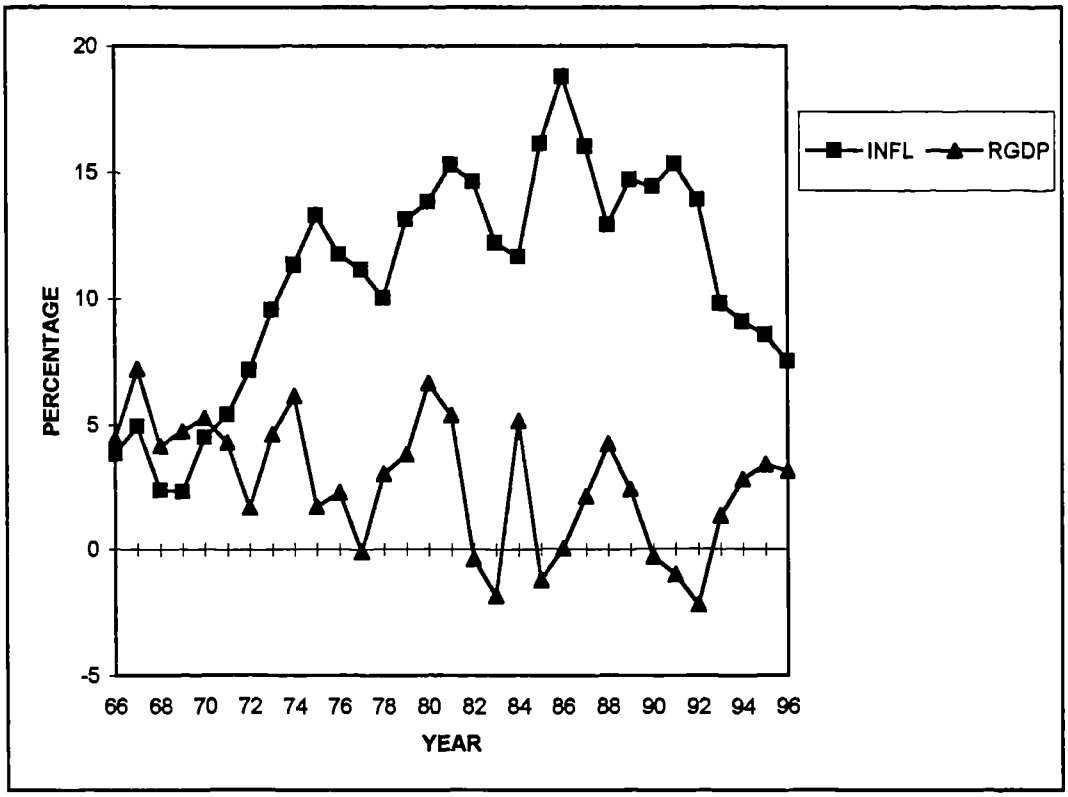
growth and inflation over the two sub-periods. Inflation in this case, can therefore not be viewed as the sole cause of low savings, investment and growth. It seems plausible to view inflation as the product of structural changes and disruptions and not its underlying cause. Low growth in the period 1982-1996 can then mainly be attributed to structural changes and disruptions. Although inflation alone could have affected growth negatively, the argument presented thus far sheds doubt on the popular belief by Central Banks world-wide that inflation is the main contributor to slower growth. When structural forces are at work disinflationary policy imposes a cost, at least in the short-run, but potentially also in the long-run.

It is informative to trace the relationship between inflation (INFL) and growth (RGDP) over the entire sample period in Figure 2.1. From Figure 2.1 it can be seen that it is difficult to detect a definite inverse relationship between inflation and growth, although inflation follows an upward trend and growth a downward trend. During the 1960s and early 1970s, there seem to be no relation between inflation and growth. The relationship becomes clearer during the late 1970s and early 1980s, although the relationship seems to be positive rather than negative. The positive relationship could be explained by the high dollar gold price that prevailed during much of the period and the concomitant excess liquidity in the economy. A visible inverse relationship is only noticeable from the mid-1980s until 1993.

The visual evidence alone, however, disguises many important facts. It is possible that inflation below a certain rate does not matter for growth. In addition, it is not possible to assert whether inflation causes low growth or low growth causes high inflation, or whether there is in fact bi-directional causality. These issues are empirical matters which fall beyond the immediate scope of this chapter and will therefore be taken up in later chapters.

Figure 2.1

Inflation and Growth in South Africa, 1965-1996



The discussion will commence by providing a critical overview of monetary policy in South Africa over the two sub-periods. First, to discern whether the conduct of monetary has any similarities to a monetarist way of thinking. Second, to assess the efficiency and credibility of monetary policy. Lastly, to evaluate the stance of monetary authorities regarding to the cost of inflation and the cost of disinflation policy.

2.4 A critical overview of monetary policy in South Africa, 1965-1996

2.4.1 The conduct of monetary policy before 1979 and after 1979

The conduct of monetary policy in South Africa over the period 1965-1996 can broadly be divided into two sub-periods. Before 1979 monetary policy was generally based on

direct control measures such as periodic quantitative limits on bank credit, liquid asset requirements and mild repression of the interest rate[5].

In its Final Report (1985) the Commission of Inquiry into the Monetary System and Monetary Policy in South Africa, highlighted some basic deficiencies associated with direct control measures that contributed to unemployment, price instability and balance of payments problems (Black and Dollery, 1989):

i) Excessive increases in monetary aggregates
ii) Fluctuations in income velocity
iii) Interest rates were not allowed to adjust to desired levels after the inflation rate increased sharply during the mid-1970s.
iv) Spot and forward rates were not allowed to adjust in accordance with changes in monetary aggregates.

Following the Commision's recommendations in its Interim Report in 1978 and eventually its Final Report in 1985, the period after 1979 witnessed a significant change in monetary policy from direct control measures to more market-oriented measures. Over the period 1980-1996 the South African SARB's monetary policy was primarily based on the cost of borrowing from the discount window[6]. Through its open market operations the SARB ensures that financial institutions always remain indebted to it. When financial institutions seek accommodation at the discount window, the SARB can charge an interest rate slightly above or equal to its chosen bank rate (Whittaker, 1992). Short-term market interest rates will closely approximate the discount rate since financial institutions will not lend at a rate which is below the discount rate nor will they borrow at a rate which is higher than the prevailing discount rate.

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[5] For a more detailed exposition of monetary policy in South Africa see e.g., Black and Dollery (1989), Fourie *et al.* (1992); 'Republic of South Africa' (1985); Whittaker, (1992).

[6] Although monetary policy over the period 1980-1996 was still based on the cost of borrowing from the discount window, two changes occurred in 1995: overnight loans replaced rediscounting and the removal of bankers' acceptance as collateral for overnight loans (Schoombee, 1996). In addition, to create greater flexibility in the market for short-term funds, the SARB in 1998 introduced a new upgraded electronically driven National payments System to provide for a daily automated settlement of outstanding interbank positions (Stals, 1997). The present discount window facility is still retained to provide banks with a further source of funds, but the interest rate charged will be at a substantial premium compared to those established in the regular repurchase transactions.

By maintaining a positive money market shortage through open market operations, excess liquidity during a specific point in time, will be used to retire previous debt. The SARB's discount policy will, however, only become effective in altering short-term interest rates, if the money market shortage is not too low nor too high thus making refinancing difficult and rendering inappropriate expectations about interest rates (Fourie *et al.*, 1992)[7].

According to Whittaker (1992), long-term interest rates are formed in financial markets as an approximate average of expected future short-term rates. Market participants thus form expectations according to the SARB's view on future inflation and output. If, for example, the SARB expects the future inflation rate to rise, then the bank rate may be expected to rise, which will be reflected by higher current long-term interest rates than short-term rates.

In sum, it can be said that monetary policy in South Africa is basically an interest rate policy. The SARB exerts a powerful influence on short-term interest rates in its endevour to alter the demand for money and bank credit. Although, compared to the period before 1979, interest rates are more market-related, it becomes clear from the above discussion that it is not market-determined. In the following section it will be shown exactly how monetary policy operates to achieve the primary objective of the South African SARB.

2.4.2 Objectives of monetary policy in South Africa

The SARB has as its primary objective the protection of the internal and external value of the rand. Although the SARB has independence in implementing monetary policy, it cannot act entirely independently from broad socio-economic objectives (Schmulow and Greyling, 1996). It is therefore envisaged that a low and stable inflation rate will create a sound macroeconomic environment conducive to the achievement of other secondary objectives, such as growth and employment creation.

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[7] Nel (1994) showed that after the gradual implementation of the current monetary policy in the early 1980s, the SARB established a closer relation between the bank rate and short-term market interest rates during the later parts of the 1980s.

Monetary policy can also not be separated from exchange rate policy and the overall balance of payments situation. After the breakdown of the Bretton Woods system in 1971 the SARB experimented with various exchange rate systems and eventually opted for a managed floating exchange rate system in 1983. The SARB has the power to act as a buyer and seller of foreign exchange. During times of exchange rate variability the SARB can effectively intervene in the foreign exchange market to stabilise the exchange rate. Despite direct intervention in the foreign exchange market, it is also perceived that the protection of the internal value of the rand will simultaneously stabilise or correct balance of payments problems and hence protect the external value of the rand (Stals, 1993)[8].

The official stance of the SARB is that inflation cannot be sustained over the long-term if it is not fuelled by excessive growth in the money supply (Stals, 1997). The assumption therefore is that the direction of causation runs from excessive growth in the money supply to increases in the price level. Since 1985 monetary policy has been based on certain predetermined targets for the M3 money stock, that is not a rigid growth rule, but merely serves as a basic guide-line to monetary authorities[9]. In addition to the M3 money stock, a wider range of financial indicators are also used to assess the effectiveness of monetary policy. These include (Stals, 1997): changes in bank credit extension; the level and the maturity structure of interest rates; the level of changes in the official foreign reserves; movements in the exchange rate of the rand; and current and expected trends in inflation. Although targeting of the money stock reflects some monetarist elements, the operation of monetary policy described in the previous section is in stark contrast to the rigid monetary growth rule proposed by monetarists.

The interest rate is one discretionary variable that the SARB has at its disposal to maintain price stability. Through the mechanisms described in the previous section, the SARB exerts a powerful impact on short-term market interest rates. Inflationary pressure

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[8] Under a flexible exchange rate system a high and variable domestic inflation rate will automatically be reflected in a variable exchange rate, especially if South Africa is inflating at a higher rate than its major trading partners.

[9] The SARB admits that changes in M3 and its shorter -term components should be interpreted with some circumspection, but over the long-term changes in M3 remains a useful guide-line to assess the effectiveness of monetary policy (Stals, 1997).

at any given point in time will cause the SARB to increase its discount rate. Short-term market rates will follow a similar increase, with expectations of a future increase in the bank rate causing long-term interest rates to increase as well.

Restrictive monetary policy therefore works through its effect on the cost of credit, with a subsequent decline in the rate of growth of the money supply and eventually price stability. The interest rate is the exogenous variable while, in a credit economy, the money supply is treated as endogenous. It becomes clear that monetary policy in South Africa is not based on a monetarist growth rule but rather reflects a Post-Keynesian way of thinking (Rogers, 1985; Rogers, 1986). In essence, the impact of monetary policy is based on manipulating aggregate expenditure and, in the case of restrictive monetary policy, to realign expenditure with the production capacity of the economy.

To summarise, it can be said that monetary policy is primarily based on lowering the inflation rate and creating a sound macroeconomic environment conducive to sustainable growth and development. Although the SARB concedes that the maintenance of high real interest rates could have undesirable effects in the short-run, it remains adamant that low and stable inflation will increase growth and development in the long-run. It should also be noted, that because the interest rate is a discretionary variable, the SARB has also during times shown its willingness to implement more expansionary monetary policy measures when market conditions improved. Monetary expansion, of course, need not be inflationary if the increase in the money supply is equally matched by an increase in real output or an increase in the demand for money.

2.4.3 A critical overview of monetary policy

After the publication of the De Kock Commission's' Final Report in 1985 monetary policy, and specifically the effectiveness of monetary policy in creating price stability, came under close scrutiny. In the section that follows some of the main criticisms levelled against monetary policy at the time will be outlined. However, the discussion will not only focus on the ability and effectiveness of monetary policy to create price stability, since this debate has to a large extent abated in South Africa. Of more importance, is

whether price stability and the constant need to lower the inflation rate is necessarily compatible with the socio-economic needs and conditions in South Africa.

i) At the time, it was argued that monetary authorities will not be able to control the money supply effectively through its interest rate policy (De Wet, 1986; Kantor, 1986). For example, during an upswing in the business cycle and henceforth an increase in the demand for credit, changes in the interest rate will prove to be an impotent stabilisation measure. Market participants will simply anticipate an increase in income that will enable them to pay the cost of a higher interest rate.

ii) Monetary authorities place too much faith in their judgmental capabilities. Because the interest rate is a discretionary policy variable, changes in the interest rate will reflect the SARB's perceptions on current and future economic conditions. Since economic variables operate with lags, it is possible that at a specific point in time the SARB's predictions about future economic conditions are incorrect. An incorrect forecast, which reduces instead of stimulating aggregate demand, could prove to be disastrous to the country's growth and employment prospects.

iii) The effectiveness of monetary policy as a stabilisation measure will crucially depend on sound fiscal management and discipline. Over the last two decades, the South African economy has been characterised by low growth, high unemployment, extreme social and income inequalities, and a low overall standard of living as measured by GDP per capita. Under a new political dispensation since 1994, it is difficult to envisage how fiscal authorities will be able to resist political pressure from increasing its overall level of expenditure[10]. It follows that there is an implicit "trade-off" between stabilisation on the one hand, and employment growth on the other hand. It becomes increasingly difficult to convince the economically and socially deprived that high unemployment should be tolerated in the short-run, since the benefits of stabilisation will tend to benefit everyone in the long-run.

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[10] *"Many South Africans fear that a future democratic government will choose (or be forced) to apply a variety of irresponsible macroeconomic policies in an attempt to deliver short-term benefits to the hitherto politically disenfranchised and economically disempowered."* (Mohr, 1994:p.1). In the following section, the complementary relationship between monetary and fiscal policy and the effects of fiscal deficits on the stabilisation objective, will be discussed in greater detail.

iv) It is uncertain to what extent restrictive monetary policy affects the different components of aggregate expenditure. If the income-effect is dominant, i.e. high real interest rates induce consumers to expect increases in future income, high real interest rates will increase current consumption expenditure. The brunt of restrictive policy will then necessarily fall on investment expenditure with potential adverse effects on growth and employment.

Regarding government expenditure, high real interest rates could invoke more fiscal discipline. It is, however, likely that a cut in government expenditure following an increase in the cost of borrowing will come from the investment side and not consumption expenditure. If fiscal deficits are the underlying cause of high real interest rates, the financing of the budget deficit in a non-inflationary way will prove to be self-defeating. First, high real interest rates crowd out private investment. Second, a substantial proportion of tax revenue would be used to finance the cost of higher real interest rates and not investment expenditure. If government expenditure is not growth-promoting, future tax revenue will not be forthcoming, while persistent budget deficits and a commensurate increase in the cost of borrowing could eventually lead the government into a debt-trap.

The scenario sketched above has severe implications for the country's balance of payments and the overall objective of maintaining price stability. Restrictive monetary policy and a reduction in investment expenditure, undermine the country's ability to produce goods and services domestically. If consumption is subject to a dominant income-effect, consumption goods will have to be imported with ensuing balance of payments problems and inflationary pressure.

v) In South Africa there is no predetermined inflation target. In the absence of such a target, the SARB uses the average inflation rate of South Africa's major trading partners as a basic guide-line (Stals, 1997).[11] Since South Africa's major trading partners primarily consist of developed countries, it is difficult to understand the economic

[11] In 1992 South Africa's major trading partners were the following (Mohr and Rogers, 1995): Germany, United States, Japan, United Kingdom, Italy, France, Hong Kong and Belgium.

rationale for a low inflation differential between a group of developed countries and a developing country like South Africa.

When South Africa is inflating at a higher rate than its major trading partners, the exchange rate will depreciate under a flexible exchange rate system. It could then be argued that a depreciation of the exchange rate will perpetuate the inflationary process. The inflationary impact of an exchange rate depreciation will, however, crucially depend on the price elasticities of imports and exports. Although it is recognised that South Africa's exports have traditionally been mineral-related, manufactured exports have not been insensitive to exchange rate depreciations (see e.g., Fallon and De Silva, 1994). A positive inflation differential could therefore improve the international competitiveness of the manufacturing sector and ensure that the domestic inflation rate is maintained at a stable level.

Given the vast difference in structural features between developed and developing countries, any deflationary policy that is primarily aimed at bringing the South African inflation rate down from say 8 percent to 4 percent (the average of its major trading partners), inevitably implies a cost. It therefore becomes important in a South African context to determine an official inflation target that takes into account differences in structural features, the cost of deflationary policy and whether the domestic inflation rate could be maintained at a stable level despite inflation differentials between South Africa and its major trading partners.

vi) Since the publication of the Final Report in 1985, and under the auspices of dr. Stals who took office from governor De Kock in 1989, the South African SARB have made significant strides in gaining credibility and maintaining consistency in implementing monetary policy. It is sometimes assumed, however, that credibility and consistency in implementing macroeconomic policy would lead to a low and stable inflation rate that is conducive to long-run growth (Whittaker, 1992). Furthermore, it is argued that consistency and credibility would subdue inflationary expectations and thus permit the SARB to implement more expansionary monetary policy (Schmulow and Greyling, 1996).

In its Final Report (1985) the De Kock Commission conceded that structural and cost-push forces cause inflationary pressure in the South African economy, but concluded that it cannot lead to an ongoing inflationary process if it is not accommodated by increases in the rate of growth in the money supply. Similarly, these sentiments are shared by the current governor of the South African SARB (Stals, 1997): *"Over the long-term, it remains true that inflation cannot be sustained indefinitely unless it is fuelled by continuous excessive money creation."*

From the statements made by the SARB and various economic commentators in South Africa, it can be deduced that restrictive monetary policy only implies a short-run cost. A low and stable inflation rate will reduce uncertainty with a concomitant positive impact on investment, growth and employment. There is, however, a short-run cost since the real interest rate will have to remain relatively high in order to reduce inflation and maintain price stability. Over the long-run, when the SARB has proved its ability to apply restrictive monetary policy on a consistent basis, inflationary expectations will subdue and thus allow the SARB to implement more expansionary monetary policy. Sustainable long-run growth will thus be the outcome of less uncertainty and a lower cost of borrowing.

Potentially, the argument presented above is seriously flawed since it subsumes that the direction of causality runs from inflation to growth. However, once structural and cost-push forces play a role it is no longer plausible to assume that there is only one-way causation, but also reverse causation from low growth to high inflation. If it is assumed that the direction of causation runs from inflation to growth, restrictive monetary policy could potentially succeed in bringing the inflation rate down to low and stable levels. However, although the SARB may have a proven track record of implementing consistent monetary policy, lower inflationary expectations will not necessarily permit the SARB to implement more expansionary monetary policy. In an inflationary environment, expansionary monetary policy will inevitably trigger an inflationary process. The SARB therefore faces an inevitable "trade-off" between stabilisation and growth.

2.4.4 Some descriptive evidence

Table 2.2 provides some descriptive evidence to evaluate the conduct of monetary policy over the period 1965-1996.

Table 2.2

Monetary Indicators for South Africa in Average Annual Percentages, 1965-1996

Indicator	1965-1981	1982-1996
Real GDP growth rate	4.2	1.2
GDS/GDP	25.4	20.5
GDFI/GDP	25.7	20.1
M3/GDP	62.6	58.1
Excessive money	10.0	13.7
Real domestic credit growth rate	3.3	2.4
Credit/GDP	77.1	63.3
Average annual inflation rate (CPI)	8.5	13.0
Variance (σ^2)	19.1	10.4
Nominal lending rate	9.7	18.0
Nominal discount rate	6.7	14.9
Real lending rate	1.3	5.0
Real discount rate	-1.7	1.9

From the Table it can be seen that the average real GDP growth rate, savings ratio and gross domestic fixed investment ratio declined sharply in the period 1982-1996, compared to the period 1965-1981.

Contrary to the predictions made by the financial liberalisation school, more market-oriented measures led to a decline in the average M3 to GDP ratio from 62.6 percent to 58.1 percent over the two sub-periods. The decline in financial development as measured by the M3 to GDP ratio, tends to support Demetriades and Hussein (1996) who showed

that the direction of causation runs from the level of GDP to financial development in South Africa.

The move towards more market-related interest rates is illustrated by the sharp increase in both the nominal and real interest rates during the period 1982-1996. The impact of the higher cost of borrowing is reflected by a lower real domestic credit growth rate and credit to GDP ratio in the period 1982-1996. However, on average the inflation rate of 13 percent in the period 1982-1996 was significantly higher than the average rate of 8.5 percent in the period 1965-1981.

From a monetarist perspective, it can be seen that the average growth rate in the money supply in excess of the real output growth rate is almost equivalent to the inflation rate in both sub-periods.[12] The most striking feature of Table 2.2, however, is that the higher average inflation rate in the period 1982-1996 coincided with a lower variance of the inflation rate compared to the period 1965-1981. Through the adoption of more market-oriented measures, the SARB therefore managed to maintain the inflation rate at relatively low and stable levels.

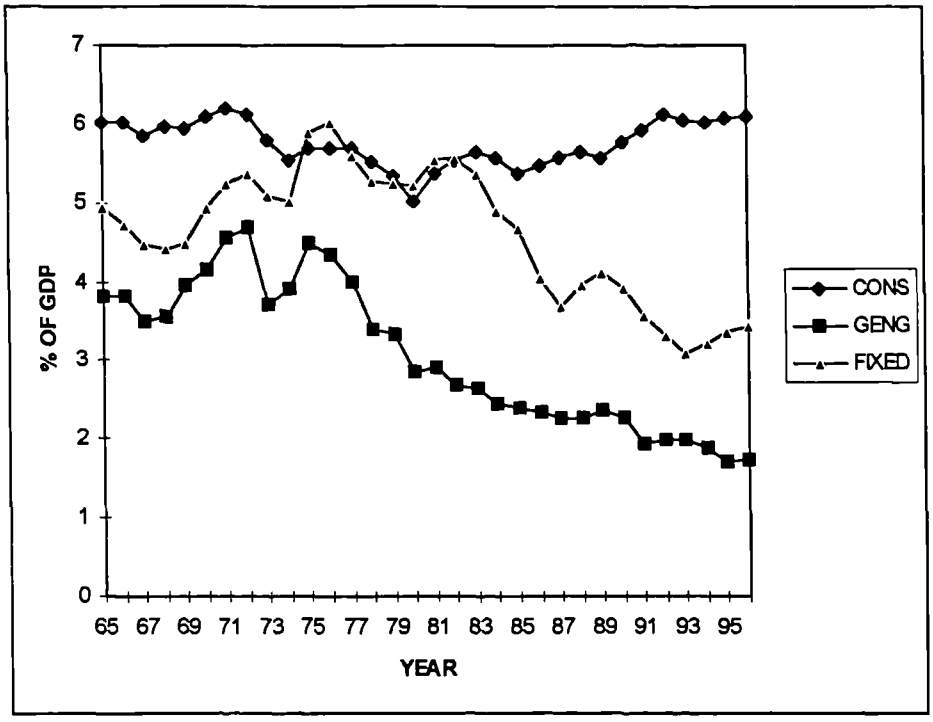
Because restrictive monetary policy after 1979 is primarily based on reducing aggregate expenditure, it is informative to review how the different components of aggregate expenditure were affected over the period. From Figure 2.2 it can be seen that after the adoption of more market-oriented measures, general government investment (GENG) and gross domestic fixed investment (FIXED) declined sharply. Both components of investment, however, have been in a declining phase since the mid-1970s. Private consumption expenditure (CONS) on the other hand, remained fairly stable and showed an upward trend during the 1980's. From the visual evidence it can be deduced that investment expenditure has borne the brunt of restrictive monetary policy while consumption expenditure has been subjected to an income-effect. It should be kept in mind that the negative effect of a more market-related interest rate on investment should

[12] Note that in the previous section it was emphasised that although the SARB believe that inflation cannot occur without excessive growth in the money supply, the interest rate is the exogenous variable and the money supply is treated as endogenous.

not be viewed in isolation from adverse market conditions that prevailed during the 1980s .

Figure 2.2

Private Consumption, Government Investment and Fixed investment



To summarise, it can be said that over the entire sample period South Africa's inflation experience has been relatively stable. The inflation rate never exceeded 20 percent while, after the adoption of more market-oriented measures, the SARB managed to stabilise the inflation rate at relatively low levels. The decline in the inflation rate to single digit levels from 1994 to 1996, can also be attributed to greater consistency and credibility of the SARB in implementing monetary policy. However, it still remains an empirical matter to determine exactly what effect inflation has on growth; whether inflation matters at all; and lastly the direction of causality between inflation and growth.

2.5 Structural features of the South African economy

After the adoption of more market-oriented monetary policy measures, the SARB has frequently stated that inflationary pressure and thus the need to increase interest rates, mainly originate from an inflexible labour market, a balance of payments constraint and fiscal deficits (Stals, 1997). In what follows, an attempt is made to present some of the salient structural features of the South African economy over the two sub-periods. The discussion will proceed by using the theoretical exposition of the structuralist/post-Keynesian causes of inflation as a basic guide-line.

2.5.1 A sectoral decomposition of economic activity and the price of food

Structuralists attribute price inflation to an inelastic agricultural sector with a concomitant increase in the price of food which is then transmitted into an overall price increase. Figure 2.3 shows that the agricultural sector has performed well over both sub-periods and maintained a high average annual real growth rate. The mining sector has been in a declining phase since the period 1965-1981 and recorded a negative average growth rate in the period 1982-1996. The manufacturing and services sector recorded the highest average growth rates of over 6 percent and 3 percent respectively in the period 1965-1981, but showed a significant decline in the subsequent sub-period. The exceptionally high growth rate of the manufacturing sector in the period 1965-1981 can mainly be attributed to a trade regime of import substitution, while the transformation towards export markets during the 1980s and 1990s was effectively delayed by trade and financial sanctions.

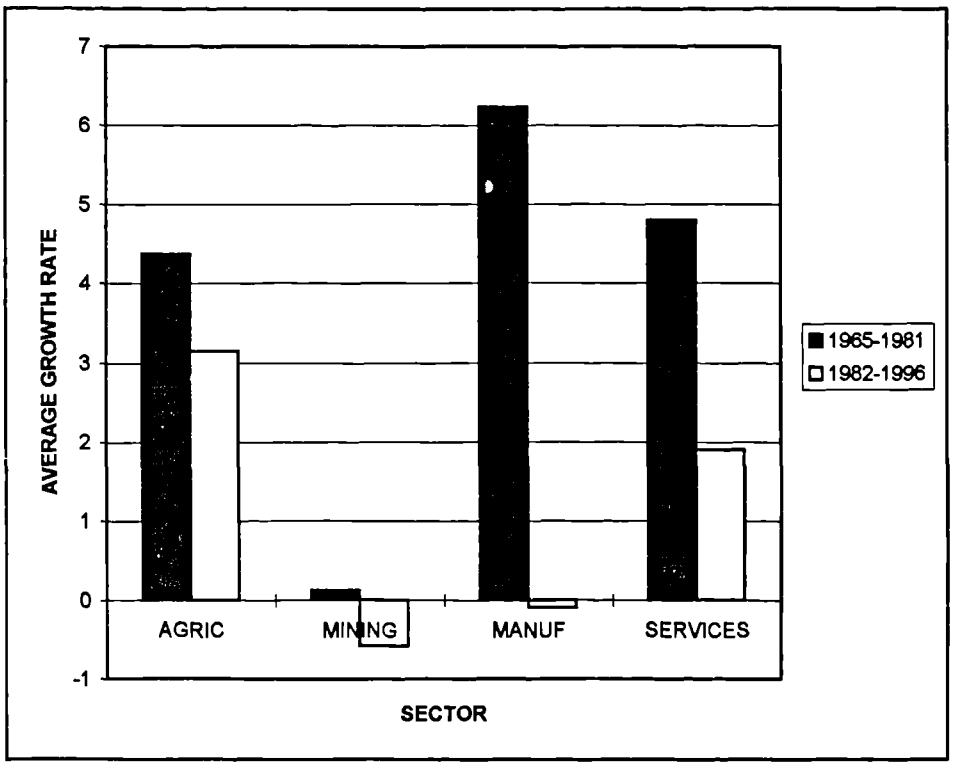
Although the agricultural sector recorded the highest growth rate over the sample period, its percentage contribution to GDP declined markedly since the 1960's (see e.g., Mohr and Rogers, 1995). The mining sector remains the most important sector in the South African economy in terms of income, employment and foreign exchange earnings.

South Africa's exports are mainly mineral-related which has made the economy extremely vulnerable to changes and fluctuations in world commodity prices. To a large

extent the manufacturing sector is dependent on the well-being of the agricultural sector and especially the mining sector, since manufactured goods are mainly based on the processing of raw materials (Fallon and de Silva, 1994).

Figure 2.3

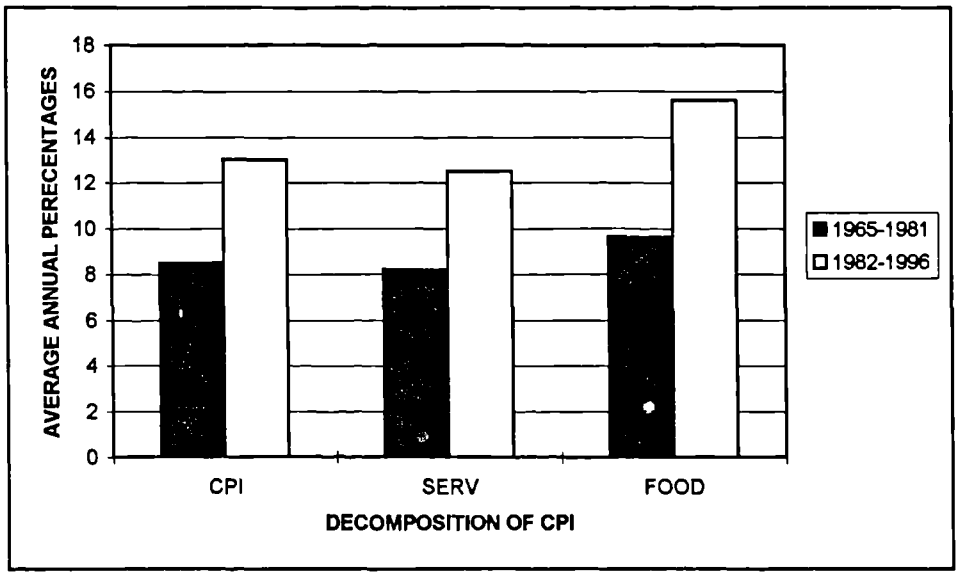
A Decomposition of Economic Activity by Sector



Despite the declining percentage contribution of the agricultural sector to GDP, South Africa is self-sufficient in food production and a major exporter in foodstuffs such as fruit, maize and sugar (Mohr and Rogers, 1995). A decomposition of the consumer price index (CPI) in Figure 2.4 shows that the price of food has shown the sharpest increase in both sub-periods, with a relatively high weight of around 19 percent in the calculation of the overall CPI. It is also notable that in both sub-periods the increase in the price of food on average outpaced the overall inflation rate.

Figure 2.4

A Decomposition of the Consumer Price Index (CPI)



From the descriptive evidence it can be concluded that the contribution of the price of food to aggregate price inflation should not be underestimated. Although South Africa is largely self-sufficient in food production the potential of the agricultural sector is limited since only 12 percent of the total land area is suitable for crop cultivation (Mohr and Rogers, 1995).

2.5.2 Cost-push factors of inflation

Structuralists and post-Keynesians view increases in the cost of production as an important contributing factor to overall inflation. In a South African context, an inflexible labour market, and the ability of trade unions to bargain for wage increases in excess of labour productivity, has constituted an important (potential) source of inflation since the early 1980s (Mohr and Rogers, 1995).

Following the publication of the Wiehahn Commission's report in 1979, the 1980s witnessed a significant change in labour legislation. From 1980 racial discrimination in the labour market was abolished and black trade unions were granted the same bargaining power as white trade unions. Compared to the rather peaceful labour situation before 1980, the 1980s and 1990s were characterised by increased labour unrest as

measured by strikes, work stoppages and man-days lost. From 1980 to 1992 membership of registered trade unions increased from 808 000 to 2 906 000 (Mohr and Rogers, 1995; Sadie, 1992).

Figure 2.5

Nominal Wage and Labour Productivity Growth Rates

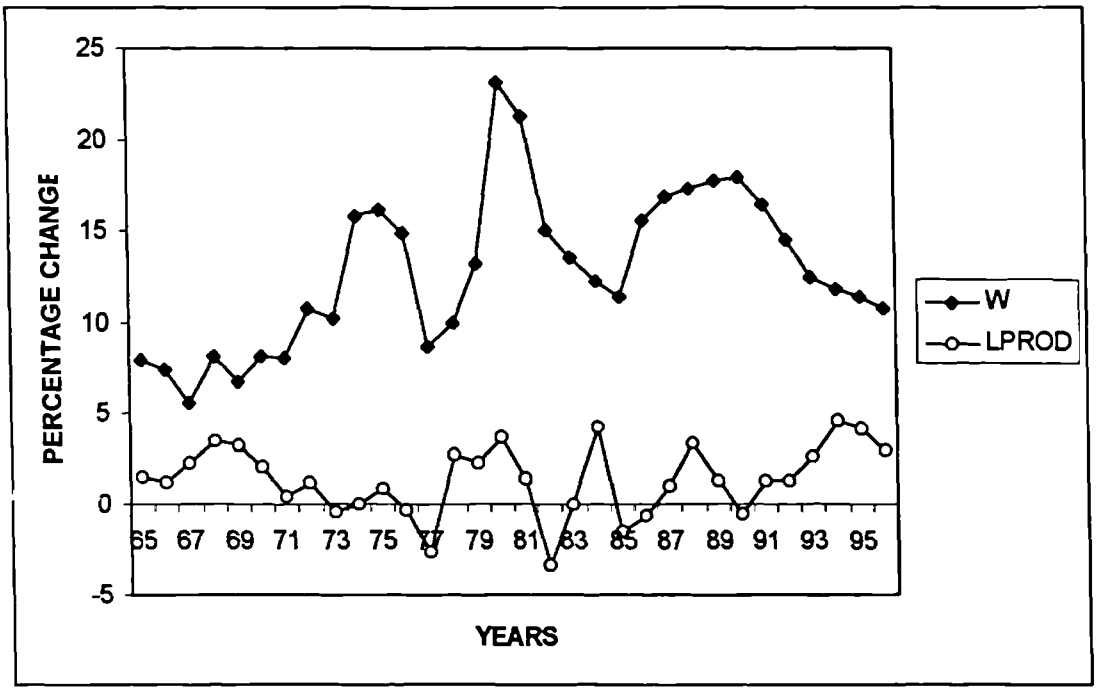


Figure 2.5 compares the growth rates in nominal wages (private sector) and labour productivity over the period 1965-1996. Figure 2.5 shows that after the recommendations of the Wiehahn commission in 1979, the immediate effect was a sharp increase in the nominal wage rate (W). Sharp increases in the wage rate can also be detected during the mid-1970s and mid-1980s. Labour productivity (LPROD) on the other hand varied little before 1980, but thereafter showed a greater degree of variability. The potential inflationary impact of militant trade unions since the early 1980's could be viewed as the outcome of three interrelated factors. First, nominal wage increases that are not commensurate with labour productivity cause the inflation bias. Second, the loss of production as a result of strike actions and work stoppages. Third, uncertainty about how many workers will turn up and when the next disruption will occur. Employers inevitably make short-term adjustments by increasing the cost of their products. The

increase in short-term costs reduces the purchasing power of the initial wage increase which causes another wage hike and eventually a self-perpetuating inflationary process.

2.5.3 Foreign exchange shortages and imported inflation in South Africa

South Africa's trade structure and balance of payments are in many ways reminiscent of a typical developing country. South Africa's exports are based on a few primary commodities, most notably mineral-related products. Exports of gold have historically played an important role in determining the country's level of foreign exchange reserves, the balance of payments position and the exchange rate. The undiversified nature of the export sector has made the economy particularly vulnerable to external shocks such as fluctuations in the dollar price of gold.

Since the 1920s the development of South Africa's manufacturing sector has primarily been based on import substitution (Baker *et al*, 1993).Generally, it is more profitable to produce for the domestic market than it is to export. According to Fallon and de Silva (1994), high levels of protectionism have caused an anti-export bias on two accounts. First, it makes domestic sales at home more lucrative than sales abroad by allowing domestic producers to raise their price level above those that would prevail under free-trade conditions. Second, it adversely affects the international competitiveness of exporters by raising the cost of imported inputs used in the production of export goods.

In 1970 import substitution had reached its final stage to promote the development of the manufacturing sector. In 1980 the authorities introduced various export incentives to promote exports. Despite substantial trade liberalisation during the 1980s, the tariff structure remained over complex, it was subjected to frequent changes and it remained biased against exports (Fallon and de Silva, 1994). The slow-down in domestic demand during the 1980s, coupled with trade sanctions and the inability of the manufacturing sector to gear its production towards export markets, led to a secular decline in manufacturing production (see e.g., Figure 2.3). Despite a trade regime of import substitution, growth in the South African economy has been increasingly dependent on its ability to import capital and intermediate goods (De Wet, 1995; Fallon and de Silva, 1994).

Many of the features discussed above are reflected in the development of the balance of payments over the period 1965-1996. Table 2.3 shows that during the period 1965-1981, South Africa recorded a current account deficit (as a percentage of GDP) of 2.2 percent which was effectively financed by capital inflow as a percentage of gross domestic saving (GDS) of 9.2 percent. In addition to capital inflows, the relatively high gold price and the subsequent trade surplus, permitted high levels of imported capital and intermediate goods. In the absence of a balance of payments constraint, growth averaged 4.2 percent which was mainly driven by a boom in domestic production of manufactured goods.

The situation, however, changed dramatically in the subsequent period. Disinvestment campaigns emanating mainly from Western nations, accompanied by stricter trade and financial sanctions, forced the government to declare a debt moratorium on foreign debt in 1985. Disinvestment together with the repayment of foreign debt contributed to net capital outflows of around R5 billion per annum during the period 1985-1993.

Van der Walt and De Wet (1993) showed that between 1985 and 1993 the balance of payments placed an effective ceiling on growth of around 0.9 to 2.7 percent per annum. Table 2.3 illustrates that over the period 1982-1996 the current account had to be transformed into a surplus to finance net capital outflows of 2.2 percent of GDS.[13] To finance capital outflows the current account recorded a surplus of 0.7 percent per annum.

[13] Following the successful political transformation in 1994, South Africa experienced net capital inflows from 1994 to 1996. In 1994 financial sanctions were lifted which gave South Africans renewed access to foreign capital markets. Table 2.3 shows that South Africa is not overborrowed. The imposition of financial sanction and the immediate repayment of debt from 1985 to 1993, resulted in a decline in the foreign debt to GDP ratio. Net capital inflows thus primarily consisted of short-term credit and not long-term capital flows. For the purpose of the analysis the period 1994-1996 is not treated separately.

Table 2.3

Selected Balance of Payments Indicators for South Africa in average annual percentages, 1965-1996

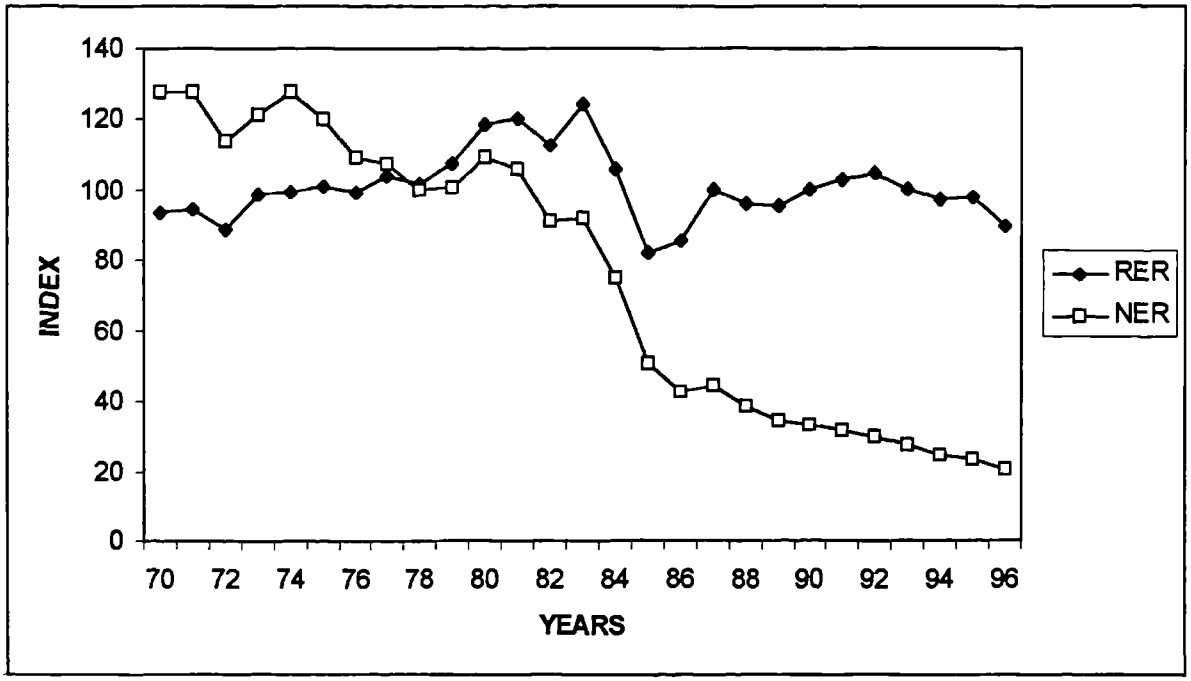
Indicator	1965-1981	1982-1996
Current account/GDP	-2.2	0.7
Exports/GDP	14.5	14.9
Gold exports/GDP	9.5	8.3
Imports/GDP	21.8	18.2
Trade balance/GDP	2.2	5.0
Export prices	13.6	10.5
Import prices	11.6	10.7
Terms of trade	1.7	-0.1
Capital flow/GDS	9.2	-2.2
Foreign exchange reserves/Imports	29.9	21.1
Foreign Debt/GDP	2.3	1.5

From Table 2.3 it can be seen that the current account surplus was mainly the result of a sharp decrease in imports as a percentage of GDP, while the increase in exports was almost negligible. In addition, the period 1982-1996 witnessed a decline in the dollar gold price, although the share of gold exports as a percentage of GDP remained fairly stable over the sample period. The importance of gold in relation to total exports, is shown by the high ratio of gold exports to GDP compared to other exports. The overall effect of the decline in the dollar gold price is best captured by the significant deterioration in the terms of trade from an average rate of 1.7 percent in 1965-1981, to a negative rate of change of 0.1 percent in the period 1982-1996. Following the decline in the dollar gold price and capital outflows, South Africa's foreign exchange reserves as a ratio of imports, declined substantially from 29.9 percent in the period 1965-1981 to 21.1 percent in the period 1982-1996.

South Africa's undiversified export sector and high import propensity suggest that the economy is highly susceptible to imported inflation.[14] Moreover, South Africa cannot rely on an indefinite inflow of foreign capital to finance imported goods and to maintain the exchange rate at a stable level. Figure 2.6 shows that the adoption of a managed flexible exchange rate system in 1983, initially led to a sharp depreciation in the nominal (NER) and real exchange rate (RER). The nominal exchange rate shows a steady, but depreciating trend from 1987, while the real exchange rate seems to have stabilised after the initial depreciation.

Figure 2.6

Real and Nominal Effective Exchange Rate for South Africa, 1970-1996



The inflationary impact of a depreciating nominal exchange rate could be reduced if exports of manufactured goods increase to take advantage of improved international competitiveness. Fallon and de Silva (1994) showed that exports of manufactured goods increased between 1983 and 1986 in reaction to the depreciation of the real exchange rate. However, the shift in world demand away from mineral-related products to more

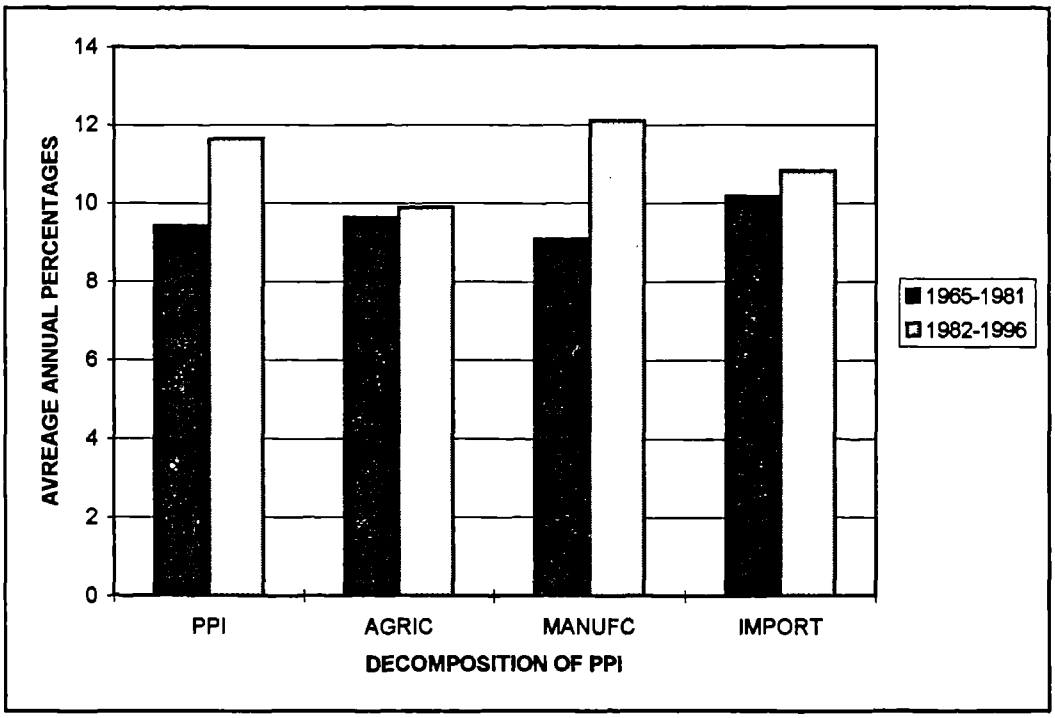
[14] Kahn (1987), for example, estimated that for every one percent rise in domestic expenditure, manufactured imports will rise by 2.16 percent.

technology-intensive products, will force South Africa to increase manufactured exports at a faster rate to offset the terms of trade decline in mineral products.

The inflationary impact of nominal exchange rate depreciations in the period 1982-1996, could be viewed by decomposing the producer price index (PPI). Figure 2.7 shows that the average rate of increase in the price of imported goods amounted to 10.17 and 10.82 percent in the sub-periods 1965-1981 and 1982-1996 respectively. With the exception of manufactured goods in the period 1982-1996, the price of imported goods showed the sharpest increase in both sub-periods.

Figure 2.7

A Decomposition of the Producer Price Index (PPI)



It is also important to note that under a flexible exchange rate system a positive inflation differential between South Africa and the rest of the world, will be reflected by a depreciation of the nominal exchange rate. If the depreciation equally offsets the inflation differential, the real exchange rate will remain stable. Potentially, the SARB face two conflicting objectives. First, if the nominal exchange rate depreciation exactly offsets the inflation differential the stable real exchange rate would serve as an incentive to export

manufactured goods. Second, if imports are price inelastic and exports supply inelastic, the depreciation could lead to an increase in prices and eventually an increase in aggregate prices. The SARB could react by actively intervening in the foreign exchange market to maintain the nominal exchange rate at a stable level. However, if South Africa is inflating at a higher rate than the rest of the world and the nominal exchange rate is stabilised through active intervention in the foreign exchange market, the real exchange rate would appreciate and undermine the competitiveness of the manufacturing sector.

Figure 2.6 shows that the steady, but depreciating nominal exchange rate since 1987, may be suggestive of active intervention by the SARB to stabilise the rate. During this period, however, the real exchange rate appreciated.

To summarise, it can be said that acute foreign exchange shortages emanating from South Africa's undiversified export sector and high propensity to import, imply that the economy is vulnerable to imported inflation which could lead to a self-perpetuating inflationary process. In 1994 the new government of national unity launched its "Reconstruction and Development Programme" (1994) and its outgrowth - a "Macroeconomic Strategy for Growth, Employment and Redistribution" in 1996. Both programmes have, as one of its main objectives, to create a more diversified and competitive export sector in South Africa. Moreover, South Africa is clearly committed to liberalising its trade regime having been a signatory of the GATT agreement in 1994, together with its affiliation to the latest "World Trade Organisation".

2.5.4 Budget deficits and inflation in South Africa

The government of national unity in 1994 inherited an economy which is characterised by extreme socio-economic inequalities. Moreover, the unequal distribution of income is divided along racial lines where the largest proportion of income and wealth is distributed among the white population group[15] (Whiteford and McGrath, 1994). The extent of income inequality is captured by South Africa's Gini coefficient of 0.68 in 1991

[15] For example, the Gini coefficient for blacks increased from 0.47 in 1975 to 0.62 in 1991. For whites the Gini coefficient increased from 0.36 in 1975 to 0.46 in 1991.

(Mohr and Rogers, 1995). When compared to other developing and developed countries, the high Gini coefficient suggests that South Africa has one of the most unequal distributions of income in the world.

In addition to South Africa's highly skewed distribution of income, there is an acute shortage of skilled manpower and an excess supply of unskilled manpower. Sadie (1992), for example, calculated that between 1990-2005 the increment in highly skilled manpower will only amount to 4.6 percent, while the increment in unskilled manpower amounts to 65.6 percent. The reasons for the high growth in unskilled manpower, mainly originates from the apartheid-regime before 1994. Van der Berg (1989) calculated that in the year 1986/1987, state expenditure per black pupil amounted to R367 and for white pupils to about R2746.

Over the period 1965-1996 South Africa's real economic growth rate has generally not kept pace with a population growth rate of about 2.6 percent per annum. Consequently, unemployment as a percentage of the economically active population group averaged around 25 percent over the period.

Against the backdrop of low economic growth during the 1980s and early 1990s, the national budget has been subjected to mounting pressure to create a more equitable distribution of income and socio-economic opportunities. From a macroeconomic point of view, a highly skewed income distribution also implies low personal savings and a narrow tax base.

To create more equality, the current government has to achieve two potentially conflicting, but mutually interdependent objectives. First, over the short-term the budget should be used as a redistributive instrument to create greater equality in income, education, housing and social welfare. Given the skew distribution of income and the concomitant narrow tax base, the scope is limited to achieve equality through redistribution alone. Second, it is therefore necessary to maintain a sound macroeconomic environment conducive to sustainable long-run growth. The achievement of the first objective could lead to spiralling budget deficits and eventually an unstable macroeconomic environment which inhibits the country's long-run growth

potential. It therefore becomes important to restructure the budget, i.e. to increase investment expenditure and to reduce current expenditure, which will lead to the attainment of the redistribution objective, but at the same time reduce budget deficits to create a stable macroeconomic environment.

Given the high demands on the budget, the discussion that follows provides a historical overview to assess whether the nature and magnitude of fiscal spending and financing have been inflationary. It should also be kept in mind that the financing of the budget deficit in a non-inflationary way implies a cost in terms of high real interest rates.

2.5.4.1 A historical overview of fiscal expenditure and financing in South Africa, 1965-1996

Table 2.4 illustrates that current expenditure (as a percentage of GDP) has increased rapidly since the period 1976-1981, averaging 28.5 percent in the period 1982-1996. The main components of current expenditure have shown a similar increase, with consumption expenditure averaging 18.6 percent per annum in the period 1982-1996 and interest payments 4.7 percent. Investment expenditure as a percentage of GDP, however, declined to an average of 2.2 percent in the period 1982-1996.

On the revenue side, Table 2.5 shows that both indirect and direct taxes as a percentage of GDP displayed a similar increasing trend, averaging 11.4 and 13.2 percent in the period 1982-1996 respectively.

Table 2.6 illustrates that the fiscal deficit as a percentage of GDP increased moderately from an average of 4.1 percent in the period 1965-1981 to an average of 4.4 percent in the period 1982-1996. It is not always the deficit *per se* that matters, but rather whether excessive expenditure is used on productive outlays (Abedian, 1992). The rapid increase in current expenditure and the secular decline in investment expenditure suggest that government spending has not been growth-promoting.

Table 2.4

Current and Investment Expenditure in Percent of GDP

	Current expenditure				Investment expenditure
	Consumption Expenditure	Interest Payment	Other	Total	
1965-1981	12.7	1.7	3.6	18.0	3.8
1982-1996	18.6	4.7	5.2	28.5	2.2

Table 2.5

General Government Indirect and Direct Taxes in Percent of GDP

	Indirect taxes	Direct taxes	Total
1965-1981	7.4	11.2	18.6
1982-1996	11.4	13.2	24.6

Table 2.6

Fiscal Deficit (in Percent of GDP) and Total Outstanding Government Debt

	Fiscal deficit	GDP-debt (percentage differences)
1965-1981	4.1	2.3
1982-1996	4.4	-4.8

Table 2.7

General Government and Private Net Saving (as a Percentage of GDP)

	Net government saving	Net private saving	Total net saving
1965-1981	3.6	9.8	13.4
1982-1996	-1.9	7.4	5.5

Moreover, Table 2.7 indicates that the government has been a net dissaver in the period 1982-1996. Dissaving should not pose a problem if borrowed funds (or taxes) from the private sector are utilised in a productive way. However, the fall in net total saving and net private saving reflect the government's preference for consumption expenditure instead of investment expenditure in the period 1982-1996. This point is illustrated in Table 2.6, where the growth rate in total nominal outstanding debt exceeded the nominal economic growth rate by an average of 4.8 percent in the period 1982-1996. The excessive growth in government debt, indicates that the taxable capacity of the economy is diminishing at a rapid rate.

The high demands on government expenditure since 1980, coupled with the fact the taxable capacity of the economy is limited, suggest that the financing of the budget deficit could be inflationary. On the other hand, financing the budget deficit in a non-inflationary way would imply high real interest rates with possible adverse effects on private investment. These issues are discussed in the next section.

2.5.4.2 Interest rates, inflation and the budget deficit

Standard literature normally distinguishes between a debt-financed deficit and a money-financed deficit. It is then believed that a debt-financed deficit (i.e. debt issued to the public) is non-inflationary, while a money-financed deficit (when the Treasury borrows directly from the Central Bank) is inflationary.

Monetary policy plays an important role in its capacity to manage outstanding government debt in South Africa. The SARB's open market operations are primarily aimed at financing a fiscal deficit in a non-inflationary way. In many respects, however, South Africa's monetary system differ from the oversimplified standard version.

If, for example, the SARB buys securities directly from the Treasury (i.e. a money-financed deficit), it credits the Treasury's account by the amount of the purchase (Fourie *et al*, 1992:396-397). In this interim stage there is no change in the monetary sector's net claims on the government sector and thus no change in the money supply or monetary institutions' cash reserves. As soon as the Treasury spends the newly received funds, the monetary sector's net claim on the government sector increases by an equal amount to the decline in government deposits. At this stage it would seem as if the money supply has increased, since the private sector's deposits with monetary institutions have risen. However, because banks always remain indebted to the SARB, excess liquidity will be used to retire previous debt. The money supply and interest rates therefore remain unchanged.

Conversely, when government debt is taken up by the private banking sector, it ultimately leads to an increase in accommodation by commercial banks. When the Treasury spends these funds it re-enters the financial system, which enables banks to repay previous accommodation (Kahn, 1991). Similarly, when debt is taken up by the non-banking private sector, the money supply will remain unchanged, because money is simply channelled from the private sector to the government sector.

From the foregoing discussion, it becomes clear that it does not really matter whether debt issues are taken up by the SARB or the public. Furthermore, a debt-financed deficit will not necessarily increase interest rates, since the rediscount rate of the SARB is closely approximated by short-term market interest rates.

According to Kahn (1991), a fiscal deficit will be inflationary when fiscal expenditure causes an increase in the demand for bank credit. Potentially, a fiscal deficit financed through money creation during an upswing in the business cycle, may cause an increase in the demand for bank credit and hence cause inflationary pressure.

From Table 2.8 it can be seen that most debt issues have been taken up by the non-monetary private sector[16] in both sub-periods. The debt holdings of domestic marketable stock by insurers and private pension funds increased from an average of 19.2 percent in the period 1965-1981, to 28.2 percent of the total in the period 1982-1994. On the other hand, the monetary sector have traditionally owned a small proportion of long-term domestic marketable stock debt (LDMD) which averaged around 6 percent of the total over the entire period. The ownership distribution of domestic marketable long-term stock debt, suggests that the budget deficit is almost entirely debt-financed and not monetised.

Table 2.8

Ownership Distribution of Domestic Marketable Long-term Stock Debt of the Government (as a Percentage of LDMD)

	Public Investment Commissioners	Monetary sector	Insurers and private pension funds	Other	Total
1965-1981	69.0	6.7	19.2	5.1	100.0
1982-1994	49.4	6.6	28.2	15.8	100.0

To conclude, it can be said that budget deficits have probably not been a major cause of excessive monetary expansion in the South African economy. However, the financing of the budget deficit in a non-inflationary way could prove to be self-defeating in the long-run. Although budget deficits may not directly have caused an increase in interest rates at a specific point in time, the composition and inefficiency of government spending, will virtually force monetary authorities to maintain interest rates at relatively high levels. Furthermore, high interest rates crowd-out private investment, reduces growth and eventually diminishes the taxable capacity of the economy. If the fiscal authorities continue to be a net dissaver, high interest rates will perpetuate the cost of debt-servicing and eventually lead the government into a debt-trap.

[16] The non-monetary private sector includes the Public Investment Commissioners, insurers and private pension funds. The monetary sector comprises of banks and the SARB.

2.6 Conclusion

The theoretical and descriptive analysis presented in this chapter, suggest that significant structural changes in the South African economy over the period 1965-1996 may have caused a change in the underlying causes of inflation between the two sub-periods 1965-1981 and 1982-1996. After the adoption of more market oriented monetary policy measures in 1980, monetary policy has played an increasingly important role to reduce and stabilise the inflation rate. The primary objective of the SARB is to create price stability which is viewed as an important precondition for high and sustainable economic growth. However, throughout this chapter it has been argued that monetary policy will be more effective when the money supply is exogenously determined. If inflation is caused by a set of factors which act independently from monetary policy, then restrictive measures could impose permanent costs in terms of output and employment losses.

From the guide-lines provided by the theoretical and descriptive analysis, the remaining chapters will mainly be concerned with empirical tests of the following nature:

i) Part 1 of the thesis (Chapters 3, 4 and 5) presents a monetary analysis of the South African economy to determine the exogenous/endogenous nature of the money supply. If the money supply is exogenously determined, the primary cause of inflation is excessive monetary expansion.

ii) Depending on the exogenous/endogenous nature of the money supply, Part 2 of the thesis investigates structural and cost-push forces of inflation under the assumption that the money supply is endogenous. Chapter 6 presents a theoretical and empirical exposition of the inflationary impact of net 'excess' demand, dispersion of demand, and the demand for agricultural products. Chapter 7 looks at cost-push inflation resulting from import prices and wage rate changes.

iii) Finally, Part 3 examines the costs and benefits of inflation. Chapter 8 investigates the relation between growth and inflation. Particularly, whether there is negative causality running from inflation to growth, thus justifying the SARB's primary objective of low

and stable inflation. In Chapter 8 an attempt is also made to calculate the cost of disinflation policy and to postulate whether restrictive policy could have permanent costs if inflation is not necessarily the outcome of excessive monetary expansion.

CHAPTER 3

THE STABILITY OF MONEY DEMAND IN SOUTH AFRICA, 1965-1997

3.1 Introduction

An important issue concerning monetary policy is to identify a stable money demand function (Friedman, 1959; Friedman and Schwartz, 1982; Laidler, 1977; Laidler, 1982)[1]. A stable money demand function is a necessary condition to establish a direct link between the relevant monetary aggregate and nominal income, and hence to assess a monetarist contention that excessive monetary expansion is the underlying cause of inflation. However, it is important to stress that although empirical support for a stable money demand function is a necessary condition for there to be a predictable link between money and money income, it does not necessarily validate the monetarist belief that the money supply is causal in the process of inflation (Kaldor, 1982). The effectiveness of monetary growth targeting will not only depend on a stable money demand function, but, more importantly, whether the money supply is exogenously determined by the monetary authorities. The exogenous/endogenous nature of the money supply will be the main focus of Chapters 4 and 5.

In a South African context, it is important from a policy point of view to establish whether there exists a stable long-run relationship for M3 money demand. After the adoption of more market-oriented monetary policy measures in 1980, the South African Reserve Bank (SARB) chiefly relied on setting predetermined growth targets for M3 to achieve its primary objective of price stability (Mohr and Rogers, 1995). Recently, the Reserve Bank conceded that M3 has lost some of its credibility as a reliable indicator and should be supplemented with other financial indicators such as changes in bank credit extension, and movements in the exchange rate of the rand (Stals, 1997). However, the

[1] According to Laidler (1982) the demand for money holdings is stable when money holdings can be explained by functional relationships which have statistical significance, and that the same equation can be applied to different countries using different data, without it being necessary to change arguments of the relations to achieve satisfactory results.

Reserve Bank still perceives changes in the rate of growth of M3 as important, since inflation cannot be sustained over the long-term if it is not accommodated by excessive growth in the money supply (Stals, 1997).

Although the study of money demand has always been a popular subject in applied econometrics it has recently gained in popularity. Following significant financial deregulation and innovation in many countries it has become important to establish whether the underlying properties of the money demand function still hold (Melnick, 1995). More importantly, recent econometric techniques effectively avoid problems of spurious regressions that have been associated with previous studies (Miller, 1991; Hoffman *et al.*, 1995; Taylor, 1994).

Even though the SARB view the M3 money supply as an important indicator for monetary policy, studies that have employed cointegration techniques in South Africa are at present ambiguous and highly controversial. Hurn and Muscatelli (1992) provide evidence of a cointegrating relationship between M3, income, prices and interest rates over the period 1965-1990. In contrast, Moll (1999) applies a wide range of cointegration techniques which show that M3 money demand over the period 1960-1996 is unstable following the significant financial reforms in 1980.

The main purpose of this chapter is to assess whether there exists a stable long-run demand for money function in South Africa. Three different definitions of money demand will be considered: M1 which consists of coins, banknotes and other demand deposits; M2 which also includes other short and medium-term deposits; and M3 which additionally includes long-term deposits. In addition, the study will adopt two different estimation procedures that include the single equation techniques developed by Engle and Granger (1987) and the maximum likelihood systems procedure developed by Johansen and Juselius (1990).

The chapter is organised as follows. Section 3.2 provides a theoretical overview and considers the relevant money demand function to be estimated for South Africa. Section 3.3 estimates the long-run model while section 3.4 looks at the dynamic short-run model. Section 3.5 considers whether the estimated results satisfy the theoretical properties of a

stable money demand function. Finally, section 3.6 ends with some summary remarks. The money demand functions for South Africa are estimated over the period 1965-1997 using annual data[2]. The data are from the South African Reserve Bank's historical data set published on the internet (http://www.resbank.co.za/Economics/econ.html).

3.2 Theoretical issues

3.2.1 A money demand function for South Africa

A standard demand for money function can be expressed in the following way (Laidler, 1977):

$$(M/P)^d = f(y, i) \tag{3.1}$$

where; y = real income

i = the appropriate nominal interest rate that reflects the opportunity cost of holding money

$(M/P)^d$ = the demand for real money balances

Economic theory further states that money demand is positively related to income and negatively to the interest rate. Furthermore, the demand for money is treated as the demand for real balances, implicitly assuming that the function is homogenous of degree one in the level of prices.

Some doubts have been raised on whether real income (y), as measured by real gross domestic product, is an appropriate scale variable for narrow definitions of money (Mankiw and Summers, 1986). In their study for the United States, Mankiw and Summers (1986) show that consumer spending generates more M1 and M2 money demand compared to investment and government spending, which favours real consumption expenditure as a more suitable scale variable.

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[2] Taylor (1993) cites Shiller and Peron (1985) who argue that when analysing long-run relationships, the length of the time series is far more important than the number of observations.

To capture the influence of foreign variables in determining an appropriate money demand function, more recent studies have considered the impact of the exchange rate and foreign interest rate (Carruth and Sanchez-Fung, 1997; Choudhry, 1995; Chowdhury, 1997). The exchange rate variable captures the impact of currency substitution on money demand, where an expected depreciation of the exchange rate leads to a decline in the demand for domestic money and an increase in the demand for foreign money. In addition, capital mobility is proxied by an appropriate foreign interest rate variable, where an increase in the foreign interest rate increases the return on foreign bonds and subsequently leads to a decline in the demand for domestic currency (McKinnon, 1983).

Equation (3.1) can be modified in the following way:

$$(M/P)^d = f(y, i, fi, exr), \tag{3.2}$$

where *fi* is the foreign interest rate proxied by the United States' treasury bill rate; and *exr* the expected exchange rate proxied by the Rand/Dollar exchange rate. The rapid globalisation of economies during the 1980s and 1990s, the liberalisation of foreign exchange controls and the adoption of more market-oriented exchange rate systems, suggest that the demand for money cannot realistically be estimated without considering the impact of foreign influences.

An overview of the South African economy during the period 1965-1997, casts some doubt on the validity of equation (3.2) as an appropriate money demand function. Until 1982 South Africa's exchange rate was not market-related while, at the same time, strict exchange controls were used to prevent capital flight. It was only in 1995, after the successful democratic election in 1994, that the financial rand mechanism[3] was finally abolished and the Reserve Bank continued to relax exchange control measures.

[3] The financial rand mechanism was an exchange control measure imposed to protect the capital account of the balance of payments against capital outflow. Theoretically speaking, disinvestment had no influence on the capital account because trade took place through the financial rand market between non-residents only.

In 1983 the South African Reserve Bank adopted a managed floating exchange rate system that witnessed a sharp depreciation of the nominal effective exchange rate. Whether currency depreciation had a major impact on the demand for money, however, is not clear-cut. Political instability that prevailed during the 1980s and early 1990s played a major role in determining macroeconomic policy. Disinvestment campaigns emanating mainly from Western nations, accompanied by stricter trade and financial sanctions, forced the government to declare a moratorium on foreign debt in 1985. Disinvestment together with the repayment of foreign debt contributed to net capital outflows of around R5 billion per annum during the period 1985-1993.

The above considerations, coupled with the fact that South Africa had been isolated from international capital and financial markets during the 1980s and early 1990s, indicate that equation (3.1) is the relevant money demand function for South Africa.

3.2.2 Descriptive evidence on the stability of money demand in South Africa

Thus far, the overview has essentially argued why the inclusion of variables to capture foreign influences may not be plausible in a South African context. However, a crucial issue is whether money demand in South Africa displays stability following financial reforms in 1980 and the debt standstill in 1985[4].

Figure 3.1 depicts the log of the income velocities in nominal terms for the three different definitions of money over the period 1965-1997. A striking feature of Figure 3.1, is the rise in the income velocities of M1 and M2 until 1980 and the preciptuous decline thereafter. The rise in velocity over the period 1965-1979 can mainly be ascribed to the "disintermediation" phenomena experienced at the time, where credit extensions took place outside the banking system to avoid direct credit constraints imposed by the Central Bank (Black and Dollery, 1989). The subsequent fall in velocity since 1980 can mainly be attributed to "reintermediation" which saw the return of disintermediated credit to the balance sheet of banks. The most important implication is that the money demand

[4] Some of the major financial reforms since 1980 included the abolition of bank credit control measures, the abolition of deposit rate controls, and lower liquid asset and cash reserve requirements.

functions for M1 and M2 may not be the same over the sub-periods 1965-1979 and 1980-1997.

Figure 3.1

Nominal Velocity (VM) of the Different Definitions of Money, 1965-1997

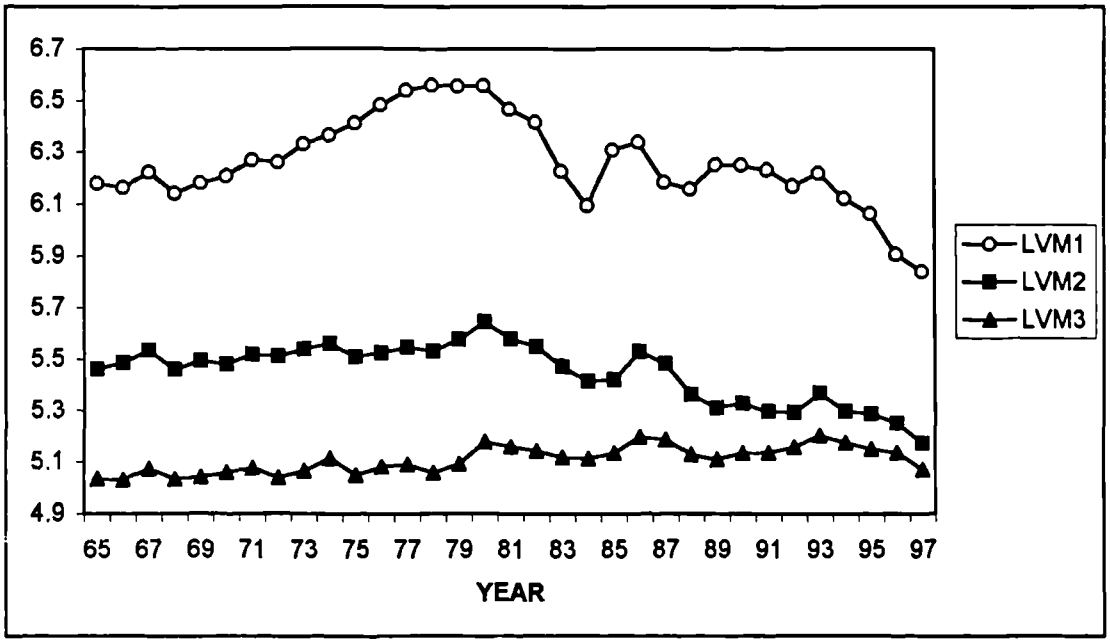


Figure 3.1 shows that the income velocity for M3 remained fairly stable along its trend value over the period 1965-1979, with a slight rise in velocity since 1980. The visual evidence strongly suggests that velocity becomes more stable as we move from a narrow to a broader definition of money, and further implies that the instability in the different velocities can be found in the demand for deposits and currency components which define a narrow M1 definition of money[5].

[5] Over the period 1965-1979 the rise in velocity is more conspicuous for a narrow definition of money, i.e. a rise in nominal GDP without a proportional increase in currency and demand deposits that define the narrow definition of money. A possible explanation could be that once the disintermediated credit is spent, it returns as deposits on the liability side of the balance sheet of banks with a subsequent rise in medium and long-term deposits and hence a more stable velocity for a broader definition of money. Over the period 1980-1997, the return of disintermediated credit induced agents to hold more money in the form of currency and demand deposits and hence the subsequent decline in velocity for narrower definitions of money. Using an extreme example, the effect of financial reforms is similar to moving from a barter economy to one with a financial system, so that the immediate effect is a rise in the demand for currency relative to medium and long-term deposits that define a broader definition of money.

The increase in the instability of velocity as we move from a broader to a narrow definition of money may well provide an explanation why Moll (1999) found no evidence of a stable M3 money demand function, and why there has been some contradicting evidence on the stability of M3 money demand in South Africa. The M3 definition used in this study is obtained from the SARB's historical data set and defines the broadest definition of money in South Africa. In contrast, Moll's (1999: 63) data are obtained from International Financial Statistics, where M3 is defined as M1 plus time and savings deposits. According to Moll (1999) *"..... the figure for M1 + time and savings deposits is closer to the SARB's M3 than it is to the SARB's M2"* (p.64). Clearly, as the visual evidence suggests, empirical support for a stable velocity will crucially depend on whether we use the broadest definition of money. Any definition which is M1, M2 or somewhere between M2 and M3, may yield unstable results. This contention is further supported by Hurn and Muscatelli's (1992) empirical study over the period 1965-1990, which finds a stable long-run M3 money demand function based on the broadest definition of money in South Africa.

3.2.3 Opportunity cost variable

In deciding on an appropriate opportunity cost variable it is important to acknowledge that South Africa is characterised by a well developed and integrated financial system that largely differs from Montiel's (1996) extensive review for the rest of the Sub-Saharan African countries. On the other hand, theory suggests that if the interest rate variable is not market-related or has been subjected to regulatory measures such as interest rate ceilings, then the inflation rate is a more reliable proxy for the opportunity cost of holding money (Ghatak, 1995b). Before 1980 the interest rate was mildly repressed but since 1980 the Reserve Bank adopted more market-oriented policy measures. However, the adverse political and economic conditions that prevailed during the 1980s and 1990s, forced the Reserve Bank to change the interest rate on a regular basis to maintain price stability.

Many demand for money studies for high-inflation countries use the inflation rate as an alternative proxy for the opportunity cost of holding money, since asset substitution is likely to be between money and real assets rather than between money and financial

assets (Deadman, 1995; Ghatak, 1995b). A casual overview of South Africa's inflationary experience for the period 1965-1997, shows that the inflation rate has been relatively mild and stable compared to typical high-inflation countries. However, since it is uncertain to what degree the interest rate has been market- related in South Africa, the interest rate and the inflation rate as an alternative, will be considered as an appropriate opportunity cost variable.

To arrive at a working definition of a stable demand for money function, Laidler's (1982) definition (footnote 1) can be extended to state that a stable money demand function can normally be explained by just a few observable economic variables while the parameter estimates should be relatively small; an income elasticity ranging between 0.5- 1.0 or a little greater, and the interest rate elasticity between -0.1 and -0.5. Moreover, the estimated quantitative values of the parameters should not change too much over a long period (Laidler, 1982).

In Friedman's early writings, the real demand for money was seen as a function of real income and the interest rate, although Friedman (1959) later stated that in practice the interest rate did not feature in the money demand function. The reason for the secondary importance of the interest rate can be found in the extreme monetarist view that money is not a close substitute for a small range of financial assets, but for a much wider range of assets that include real or financial assets (Goodhart and Crockett, 1970).

In a comprehensive overview of empirical money demand studies, Goodhart and Crockett (1970) showed that the interest rate has featured in most of the money demand functions although, generally, the effect has been very small. The important point is that the properties entering the demand for money function will to a large extent depend on the money definition being used. For example, when a narrow definition for money (M1) is used, the interest rate effect is likely to be higher compared to a broader definition. The reason is that for a broad definition of money the movement between current and time deposits that define the relevant broad monetary aggregate largely captures the interest rate effect. Thus, for a broader definition of money, the interest rate is unlikely to show whether money has close substitutes or not. Furthermore, since short-term interest rates

are subject to a greater degree of variation than long-term interest rates, the interest rate effect is likely to be smaller when a short-term interest rate is used.

3.3 Estimating long-run money demand

By adopting Hendry's (1995) general-to-specific modelling approach, equation (3.2) is estimated as an Unrestricted Vector Auto Regressive (UVAR) model of order three for the different definitions of money (not reported here). In addition to the interest rate, the UVAR also included inflation as an alternative proxy for the cost of holding money. The results generally showed that real income is significant in all the different money demand equations; the foreign variables were found to be insignificant; and the interest rate was only marginally significant at the 10% level in the M3 money demand equation. The results suggest that a simple money demand function represented by equation (3.1) should be considered for South Africa

First it is necessary to test whether the relevant variables in equation (3.1) are stationary and to determine the orders of integration of the variables. To test for unit roots in the levels and first differences of the variables, a standard Augmented Dickey Fuller (ADF) test is performed. Table 3.1 shows that the null hypothesis of a unit root in levels cannot be rejected for all of the variables, but that it is rejected when the variables are measured in first differences. The exception is *Lp*, where the null hypothesis of a unit root cannot be rejected in levels and in first differences. Most of the variables are therefore integrated of order one, i.e. I(1). Since the ADF test indicates that the price level is possibly I(2), the demand for money is treated as the demand for real money balances to ensure that all the variables under analysis are I(1) (Harris, 1995).

Engle and Granger (1987) showed that when two non-stationary variables of the same order {I(1)} cointegrate to form a stationary series {I(0)}, then a standard OLS procedure can be used. In addition, cointegration between two non-stationary variables allow the inclusion of stationary variables such as shift dummies. The main drawback of the Engle-Granger (1987) procedure is that it is only applicable to the bivariate case,

Table 3.1

Augmented Dickey Fuller Test Statistics, 1965-1997

Variable	ADF test statistics (including a constant)
$Lm1/p$	-0.17
$Lm2/p$	-0.95
$Lm3/p$	-1.68
Ly	-2.66
$Lpcons$	-2.18
Li	-1.44
$\dot{p}$	-1.95
Lp	-0.90
$\Delta Lm1/p$	-4.68**
$\Delta Lm2/p$	-5.52**
$\Delta Lm3/p$	-4.51**
ΔLy	-3.55**
$\Delta Lpcons$	-3.13**
ΔLi	-6.52**
$\Delta\dot{p}$	-4.57**
ΔLp	-2.33

Notes:

1. $Lm1/p$, $Lm2/p$ and $Lm3/p$ are the different definitions of money divided by the consumer price (CPI) and transformed into logarithms.
2. Ly is the logarithm of real income as measured by real gross domestic product.
3. $Lpcons$ is the logarithm of real income as measured by real private consumption expenditure.
4. Li is the logarithm of the government bond yield.
5. Lp is the logarithm of the price level and $\dot{p}$ is the inflation rate.
6. ** denotes that the null hypothesis of a unit root is rejected at the 5 % level of significance. In each case the optimal lag-length was determined by the maximised log-likelihood test and Akaike Information Criterion.

while the Johansen procedure tests for more than one cointegrating vector and is thus tailor-made for the multivariate case. Although this is a distinct advantage, the Johansen procedure has various limitations. In the case of more than one cointegrating vector, it is difficult to know which cointegrating vector is the money demand equation. Moreover, the Johansen procedure is sensitive to the choice of the lag length. Over-parameterisation may lead to the over-rejection of the null hypothesis of no cointegration. Given these limitations, it is always useful to supplement the cointegration analysis with a simple procedure such as Engle-Granger (1987).

When the relevant variables cointegrate to form a stationary series, the first step of the Engle-Granger (1987) procedure involves estimating the long-run demand for money by OLS,

$$Lm/p_t = a_0 + a_1 Ly_t + a_2 Li_t + \varepsilon_t, \tag{3.3}$$

where all the variables are defined as before and the different definitions of the demand for money are treated as the demand for real money balances. Because the Johansen procedure searches for more than one cointegrating vector, the analysis will first focus on the more sophisticated Johansen procedure.

3.3.1 The Johansen Procedure

Turning to the Johansen Maximum Likelihood procedure, it is first necessary to estimate the number of lags required in the VAR system. By arbitrarily starting from a VAR system of order 3, the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC) indicate that a VAR system of order 2 is the appropriate lag-length for all three money demand functions, irrespective of whether *Ly* or *Lpcons* is the scale variable.

In Table 3.2, panel A indicates that the null-hypothesis of no-cointegrating vector cannot be rejected at the 5% level of significance for *Lm1/p*, *Lm2/p* and *Lm3/p* when *Lpcons* is the scale variable. The result is not surprising for *Lm3/p*, since theory predicts that

Table 3.2

Johansen Cointegrating Vectors with *Lpcons* and *Ly* as the Scale Variables, 1965-1997

VAR (lag length 2)			
Panel A: Tests for Cointegration between Money, *Lpcons* and *Li*			
Monetary aggregate	H_0	λ max eigenvalue	λ trace
Lm1/p	r = 0	12.80	17.80
	r ≤ 1	4.08	5.00
	r ≤ 2	0.92	0.92
Lm2/p	r = 0	12.39	25.04
	r ≤ 1	8.41	21.65
	r ≤ 2	4.24	4.24
Lm3/p	r = 0	12.39	22.19
	r ≤ 1	6.78	9.79
	r ≤ 2	3.01	3.01
Panel B: Tests for Cointegration between Money, *Ly* and *Li*			
Monetary aggregate	H_0	λ max eigenvalue	λ trace
Lm1/p	r = 0	14.55	23.09
	r ≤ 1	7.57	8.54
	r ≤ 2	0.97	0.97
Lm2/p	r = 0	12.78	25.73
	r ≤ 1	7.60	12.94
	r ≤ 2	5.34	5.34
Lm3/p	r = 0	22.60**	39.08**
	r ≤ 1	9.64	16.48
	r ≤ 2	6.83	6.83
Panel B(i): Long-run Elasticities			
Monetary aggregate	Real Income (*Ly*)	Government Bond Yield (*Li*)	
Lm3/p	1.28 (0.16)	-0.1 (0.10)	
Panel B(ii): Likelihood Ratio Test Statistic			
Monetary aggregate	$\eta Li = 0$		
Lm3/p	0.81		

Note:

1. ** denotes significance at the 5% level.
2. The 5% critical values for the max eigenvalue and trace test statistics in Panel B for the Lm3/p equation are 21.12 and 31.54 respectively.
3. The figures in parentheses ( ) are asymptotic standard errors.

Lpcons is a more suitable scale variable for narrow definitions of money (see Mankiw and Summers, 1986).

From panel B of Table 3.2, it can be seen that the null hypothesis of no-cointegrating vector for *Lm1/p* and *Lm2/p* cannot be rejected at the 5% level of significance when *Ly* is the scale variable, but that the maximum eigenvalue and trace test statistics reject the null of no-cointegration for *Lm3/p*. A unique long-run cointegrating relation therefore exists between *Lm3/p*, *Ly* and *Li*. The results in Table 3.2 exclude dummy variables, but the results were not sensitive when two dummy variables were restricted to lie inside or outside the cointegration space[6].

An economic interpretation of the results can be obtained by normalising the cointegrating vector on *Lm3/p*. Panel B(i) indicates that the long-run elasticity estimates of *Ly* and *Li* contain the correct theoretical signs although the elasticity estimate of *Li* is close to zero. The likelihood ratio test from panel B(ii) shows that the interest rate elasticity is not statistically different from zero at the 5% level of significance. The restricted version of the cointegrating relation, therefore indicates that a long-run relationship exists between *Lm3/p* and *Ly*. The result basically accords with the theoretical exposition discussed earlier, which shed some doubt on whether interest rates have truly been market-related in South Africa. In addition, the interest rate effect is likely to be smaller for a broad definition of money. The absence of a cointegrating relationship for M1 and M2 supports the visual evidence presented earlier. The theoretical and empirical implications of no-cointegration for M1 and M2 will be discussed in section 3.5.

To obtain an accurate elasticity estimate for *Lm3/p*, Table 3.3 includes a shift dummy variable in the VAR model that captures the debt standstill in 1985 and substantial capital

[6] The first dummy variable took the value of unity over the period 1985-1997 and zero otherwise to capture the debt standstill, and the second dummy variable the value of unity over the period 1980-1997 and zero otherwise to capture the financial reforms.

outflows thereafter. The shift dummy variable takes the value of one for the period 1985-1997 and zero otherwise[7].

The maximum eigenvalue and trace test statistics in panel A from Table 3.3, show that the null hypothesis of no-cointegration can be rejected at the 5% level. The conclusion can be reached that there exists a unique long-run relationship between *Lm3 p* and *Ly*. Panel C illustrates that the income elasticity of 1.29 in panel B, is statistically greater that one at the 1% level of significance.

Table 3.3

The Johansen Procedure with the Inclusion of a Dummy Variable in the VAR Model

VAR (lag length 2)			
Panel A: Tests for cointegration between *Lm3/p* and *Ly*			
Monetary aggregate	H_0	λ max eigenvalue	λ trace
Lm3/p	r = 0	26.66**	30.77**
	r ≤ 1	6.78	9.79
Panel B: Long-run Elasticity			
Monetary aggregate	Real Income (*Ly*)		
Lm3/p	1.29 (0.03)		
Panel C: Likelihood Ratio Test Statistic			
Monetary aggregate	$\eta Ly = 1$		
Lm3/p	15.70***		

Notes:

1. The likelihood ratio test in panel C has a $\chi^2(1)$ distribution under the null hypothesis; the one percent critical value is 6.63.
2. *** and ** denote significance at the 1% and 5% level respectively.
3. The 5% critical values for the max eigenvalue and trace test statistics in Panel A are 14.88 and 17.86 respectively.
4. The figures in parentheses ( ) are asymptotic standard errors.

[7] Note from Figure 3.1 that the dummy variable could possibly capture the higher volatility f velocity since the 1980s, and not necessarily an overall decline in velocity. The shift dummy is included as a deterministic component in the VAR model.

3.3.2 Engle-Granger first-step procedure

The ADF-test in model 1 from Table 3.4 indicates that the null-hypothesis of no-cointegration can be rejected at the 5% level of significance.

Table 3.4

Long-run Static OLS Estimations for *Lm3/p*, 1965-1997

Variables	Model 1	Model 2
constant	-9.80 (-9.48)	-9.17 (-19.82)
Ly	1.38 (14.39)	1.32 (34.84)
Li	-0.04 (-0.67)	
DUM_{85}	-0.04 (-2.48)	-0.05 (-3.04)
Diagnostic tests		
R^2	0.98	0.98
LM-test	F(1,28) = 3.15	F(1,29) = 2.84
Ramsey's RESET test	F(1,28) = 0.01	F(1,29) = 0.00
Normality	$\chi^2(2) = 1.34$	$\chi^2(2) = 1.13$
Heteroscedasticity	F(1,31) = 0.47	F(1,31) = 0.39
ADF(1) test	-4.13	-3.97

Notes:

1. t-statistics in parentheses.
2. The 5% critical values for the ADF tests in models 1 and 2 are 3.97 and 3.53 respectively.

The inclusion of DUM_{85} in model 1, illustrates that the debt standstill and ensuing capital outflow had a negative impact on the demand for real M3 money balances. When the restriction of a zero interest rate elasticity is imposed, the ADF-test in model 2 indicates that the variables are cointegrated at the 5% level of significance[8]. The income elasticity of 1.32 is almost similar to the income elasticity estimate of 1.29 obtained from the Johansen procedure. Furthermore, model 2 passes the range of diagnostic tests.

A crucial question concerning money demand functions is whether the estimates display parameter constancy (Hendry and Ericsson, 1991; Ericsson *et al.*, 1994)[9]. The constancy of the model is shown in Figure 3.2, which plots the recursively estimated coefficient of *Ly*. In addition, Figure 3.3 plots the cumulative sum of squares (CUSUMQ) of the recursive residuals of model 2, and shows that the null hypothesis of parameter constancy cannot be rejected at the 5% level of significance.

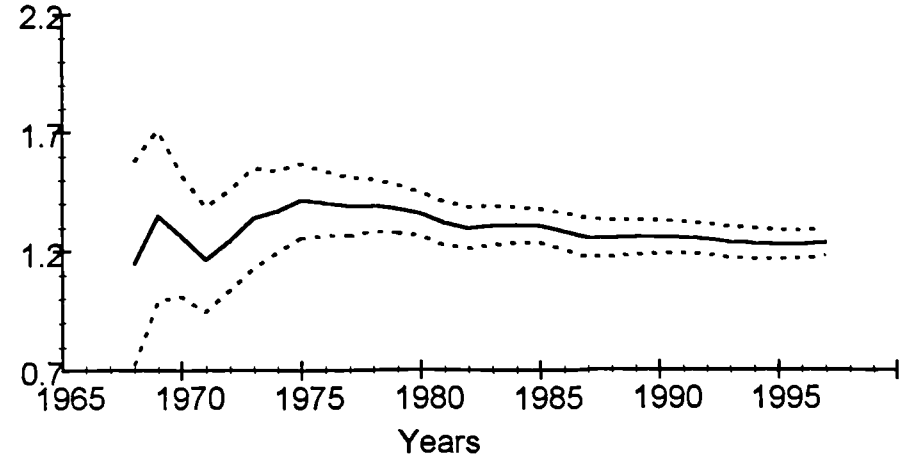
---

[8] An important cautionary note when we interpret the t-statistics in the first step procedure. Park and Phillips (1988) show that the OLS estimator in the first step has an asymptotic distribution which is nonnormal and depends on nuisance parameters (see Inder, 1993). The t-statistics will therefore not be valid asymptotically. The exclusion of the interest rate, however, is consistent with the results obtained from the Johansen procedure. The first step procedure is nonetheless useful to test for cointegration, since this procedure is not sensitive to the chosen lag length, and thus, overcomes one of the major limitations of the Johansen procedure.

[9] The Chow-test for structural breakpoints in 1980 and 1985, indicate that we cannot reject the null hypothesis of structural stability at the 1% level of significance for the breakpoint since 1980, but that the null is rejected at the 1% level of significance for the breakpoint since 1985. It is important to acknowledge that the Chow-test is indicative whether there has been a change in the intercept *and/or* slope (i.e. a constant elasticity). Since we have already established that there exists a long-run relationship between the variables through cointegration analysis, we expect the purported structural instability since 1985 to reflect a change in the intercept and *not* to be indicative of parameter non-constancy. When both a slope and shift dummy were included in the equation, the results (not reported here) showed that both dummies were not statistically different from zero. When included separately, however, the slope dummy was statistically significant but the magnitude of the parameter estimate (-0.004) showed that the income elasticity estimate would not have changed when rounded. To improve the explanatory power of the model the shift dummy is included.

Figure 3.2

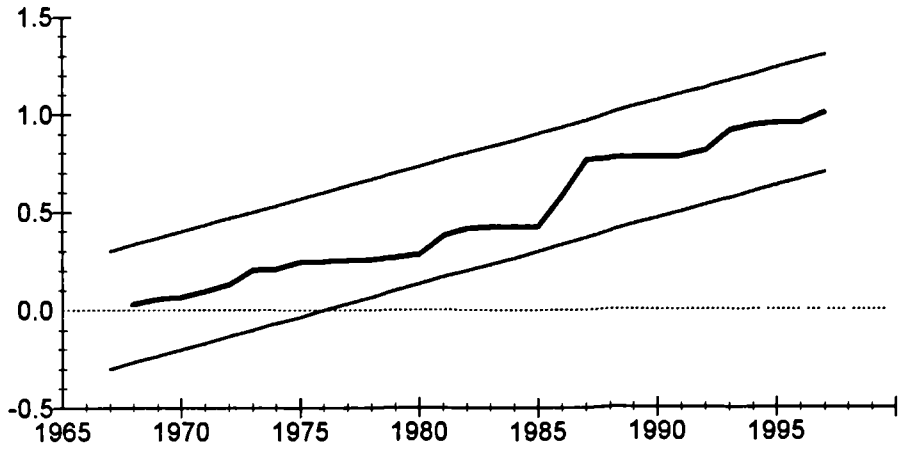
Recursive Estimation of the Coefficient on *Ly* and its Estimated Standard Error



Note:

Figure 3.3

CUSUMQ Test for the *Lm3/p* Regression



Note: Straight lines represent critical bounds at the 5% level of significance.

3.4 The short-run dynamic model

Since the variables *Lm3 p* and *Ly* are cointegrated, the second-step of the Engle and Granger (1987) procedure shows how the short-run dynamic version of the long-run relationships estimated from model 2 in Table 3.4, can be specified as an error correction model of the following form:

$$\Delta Lm3/p_t = b_0 + b_1 EC_{t-1} + \sum b_2 \Delta Lm3/p_{t-1} + \sum_{b3} \Delta Ly_{t-1} + \varepsilon_t \ , \qquad (3.4)$$

where the error correction term (EC_t) is the residuals of model 2 in Table 3.4.

A crucial question concerning the error correction model is what the optimal lag-length should be. A popular technique is Hendry's general-to-specific methodology by eliminating lags with insignificant parameter estimates (Gilbert, 1986; Hoque and Al-Mutairi, 1996; Miller, 1991). Accordingly, an error correction model with three lags was initially estimated; those parameter estimates with insignificant lags were eliminated and the model was re-estimated.

The following parsimonious model was estimated (standard errors in parentheses):

$$\Delta Lm3/p_t = \underset{(1.58)}{-8.12} + \underset{(0.13)}{0.39}\Delta Lm3/p_{t-1} - \underset{(0.17)}{0.88}EC_{t-1} + \underset{(0.24)}{0.87}\Delta Ly_t + \varepsilon_t \qquad (3.5)$$

R^2 = 0.68; *DURBIN'S- H:* 1.49; *STANDARD ERROR OF REGRESSION*: 0.029; *LM*: F(1,26) = 1.24; *RESET*: F(1,26) = 0.60; *NORMALITY* χ^2 (2): = 0.80; *HETEROSC*: F(1,29) = 0.44; $CHOW_{1980,1983,1985}$ F(4,23): 0.96, 0.80, 0.81

The error correction model is well-determined and passes all the diagnostic tests proposed by Hendry and Ericsson (1991). A standard Chow-test is performed to test for structural stability of the model. Besides 1985, two potential structural breakpoints are identified: 1980 when more market-oriented monetary policy measures were adopted; and 1983 when the Reserve Bank adopted a managed floating exchange rate system that

witnessed a sharp depreciation of the nominal exchange rate. The Chow-test for all three potential breakpoints confirm that the model is structurally stable, i.e., the parameter estimates are constant over the whole period. The error correction term indicates that the speed of adjustment is swift with about 88% of any disequilibrium between actual and equilibrium M3 money balances being made up during the course of a year. The high magnitude of the error correction coefficient suggests that the demand for real money balances is very sensitive to changes in income.

3.5 Stability properties for the different definitions of money

The results reported in this study provide evidence that *Lm3/p* is the only money demand function that yields a long-run demand relationship. The estimation results for the long-run and short-run models showed that *Lm3/p* displays parameter constancy over the entire period, while the interest rate, although with the correct theoretical sign, is insignificantly different from zero. The real demand for broad money is solely explained by real income (*Ly*) which provides some support for the monetarists theoretical proposition that there exists a direct link between the M3 money stock and money income. Moreover, the long-run income elasticity estimates that range between 1.29 and 1.32 indicate that the results are robust.[10]

The absence of a long-run cointegrating relationship for M1 and M2 intuitively suggests that financial reforms since 1980 and/or the debt standstill of 1985, could have induced a change in the long-run relationships of both monetary aggregates. In addition to the visual evidence presented earlier, Figures 3.4-3.5 plot the cumulative sum of squares (CUSUMQ) of the recursive residuals and show that *Lm1/p* and *Lm2/p* display parameter instability when the relevant money demand definition is regressed on real income (*Ly*)[11].

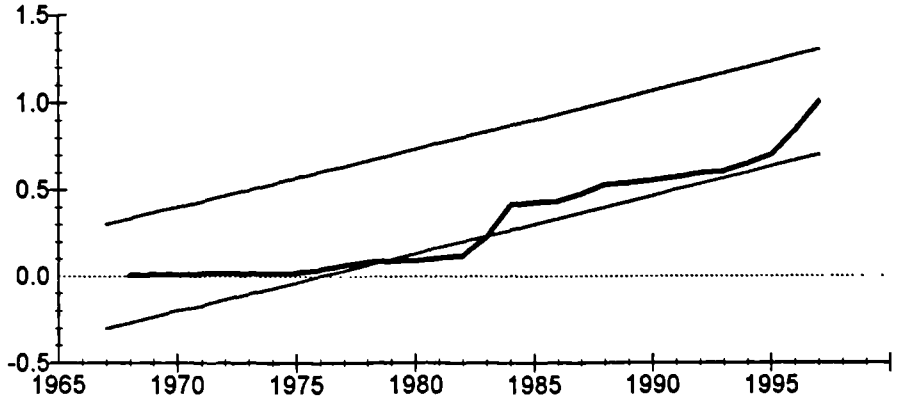
---

[10] The long-run income elasticity of 1.29-1.32 for *Lm3/p*, roughly accords with the magnitudes reported in other studies that have used a broad definition of money. Ghatak (1995a) estimated money demand functions for India that spanned the period 1950-1986 and reported long-run income elasticity estimates for M3 that ranged between 1.1 and 1.7; Chowdhury (1997) an elasticity estimate of 1.29 for Thailand; and Thornton (1996) an elasticity estimate of 2.04 for Mexico.

[11] Identical pictures were presented when *Lpcons* was the scale variable.

Figure 3.4

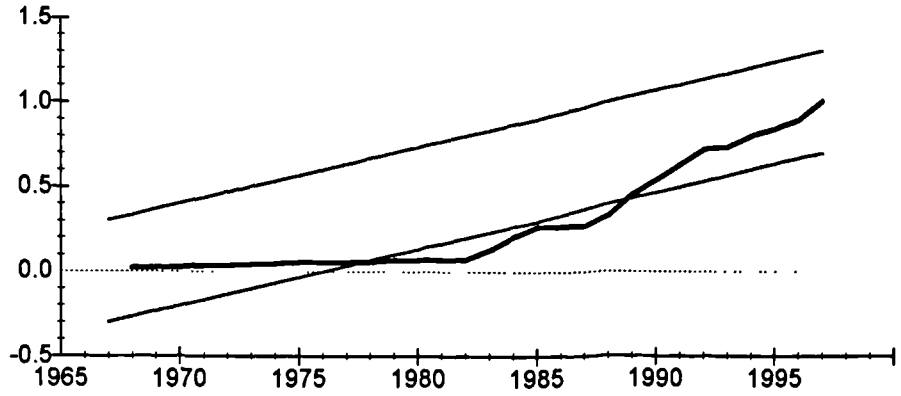
CUSUMQ Test for the *Lm1/p* Regression



Note: Straight lines represent critical bounds at the 5% level of significance

Figure 3.5

CUSUMQ Test for the *Lm2/p* Regression



Note: Straight lines represent critical bounds at the 5% level of significance

To capture the impact of financial reforms in 1980 and the debt standstill in 1985, we include shift and slope dummies for the *Lm1 p* and *Lm2 p* regressions[12]. However, the results (not reported here) showed that the inclusion of shift and slope dummy variables to capture the debt standstill in 1985 were statistically insignificant. This suggests that the dominant source of instability in the M1 and M2 definitions of money were the financial reforms in 1980. In Table 3.5 (t-statistics in parentheses), model 1 and model 2 report the income elasticity estimates as measured by *Ly* when shift and slope dummy variables are included for *Lm1/p* and *Lm2/p* respectively. By adopting the dummy variable approach[13] model 1 and model 2 capture the impact of financial reforms since 1980, where the shift dummy variable (DUM_{80}) takes the value of zero for the period 1965-1979 and one otherwise. Both the slope and shift dummy variables are statistically significant, which indicate that financial reforms since 1980 may have induced a significant change in the parameter estimates of both monetary aggregates.

The dummy variable approach allows the direct interpretation of the parameter estimates obtained from model 1 and model 2. For *Lm1/p* the income elasticity estimates are 0.65 and 3.35 over the sub-periods 1965-1979 and 1980-1997 respectively; and for *Lm2 p* 1.32 and 2.86 over the same sub-periods. However, the elasticity estimates seem unrealistically high in the second sub-period despite the advantage of the dummy variable approach (see footnote 11)[14]. It is uncertain whether the elasticity estimates are sensible since the regressions over the two sub-periods could be spurious. Given the small sample size over the two sub-periods, tests for cointegration would not necessarily indicate whether the variables entering the money demand function are related over the long-run. Alternatively, model 3 and model 4 estimate the money demand functions in first differences. The first difference estimates show that the parameter estimates of 0.84 and 1.13 for *Lm1/p* and *Lm2/p* respectively, have not changed markedly over the first sub-period compared to the level estimates. However, over the sub-period 1980-1997 the parameter estimates of 2.55 and 1.96 differ widely compared to the level estimates.

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[12] Recall that we argued in section 3.2 that the M2 definition of money demand may be unstable due to the financial reforms in 1980 and the debt standstill in 1985.

[13] The main advantage of the dummy variable approach, is that it estimates the model over the whole period and thus preserves observation points (Gujurati, 1995).

[14] Friedman (1971) for example, postulates that the income elasticity for economies experiencing rapid economic development ranges between 1.5-2.0.

Table 3.5

Structural Stability of *Lm1*/p and *Lm2/p*

Variables	**Model 1** *Lm1/p*	**Model 2** *Lm2/p*	**Model 3** *ΔLm1/p*		**Model 4** *ΔLm2/p*	
			1965-1979	1980-1997	1965-1979	1980-1997
constant	-2.28 (-1.34)	-9.59 (-10.55)				
Ly	0.65 (4.62)	1.32 (17.60)	0.84 (2.44)	2.55 (3.34)	1.13 (4.52)	1.96 (4.18)
DUM_{80}	-33.42 (-7.63)	-19.15 (-8.20)				
$DUM_{80} \times Ly$	2.70 (7.69)	1.54 (8.22)				
Diagnostic tests						
R^2	0.95	0.98				
LM-test	F(1,28) = 9.64	F(1,28) = 2.48	F(1,12) = 0.33	F(1,16) = 0.09	F(1,12) = 0.06	F(1,16) = 0.02
Ramsey's RESET test	F(1,28) = 0.40	F(1,28) = 0.29	F(1,12) = 0.02	F(1,16) = 0.75	F(1,12) = 1.09	F(1,16) = 0.19
Normality	$\chi^2(2) = 1.82$	$\chi^2(2) = 0.56$	$\chi^2(2) = 0.67$	$\chi^2(2) = 0.93$	$\chi^2(2) = 0.82$	$\chi^2(2) = 0.24$
Heteroscedasticity	F(1,31) = 0.22	F(1,31) = 1.18	F(1,12) = 2.01	F(1,16) = 1.06	F(1,12) = 0.05	F(1,16) = 0.65

Irrespective of whether the demand for money functions are estimated in levels or first differences, the results indicate that both $Lm1p$ and $Lm2p$ suffer from parameter instability over the period 1965-1997. The high parameter estimates for income over the period 1980-1990 may be indicative of increased monetisation of the economy following financial reforms since 1980[15].

3.6 Conclusion

The main findings of this chapter have shown that there exists a stable long-run demand for money function for M3 in South Africa, while the demand for M1 and M2 display parameter instability following financial reforms since 1980. The analysis suggests that money demand becomes more stable as we move from a narrow to a broader definition of money, which may provide an explanation why Moll (1999) found no stable long-run demand function for narrower definitions of money.

The insignificance of the interest rate and inflation rate as opportunity cost variables implies that the transaction motive dominates other motives to hold money. However, the fact that interest rates were probably not market-related over the whole sample period, suggest an important area for future research to find a suitable opportunity cost variable. Given the ambiguous nature of money demand studies in South Africa, the objective of this chapter was primarily to determine whether a stable long-run relation does exist.

[15] Note that the magnitude of the income elasticity estimates supports our prior contention that money demand in South Africa is more stable for a broader definition of money. A close to unity parameter estimate for real income in the money demand function, can therefore be associated with a more conspicuous relationship between money income and the relevant monetary aggregate.

CHAPTER 4

THE RELATION BETWEEN MONEY, INCOME AND PRICES IN SOUTH AFRICA, 1966-1997

4.1 Introduction

The empirical results in Chapter 3 showed that the demand for real M3 money balances over the period 1965-1997 satisfies the theoretical propositions of a stable money demand function, while the demand for real M1 and M2 display instability features following financial reforms since 1980[1]. From a policy point of view a stable money demand function becomes more relevant when the parameter estimates entering the money demand function are relatively small[2] in order to depict a close relationship between money and money income and, more importantly, when the direction of causation runs from the money supply to money income, i.e. the money supply is exogenously determined.

The main purpose of this chapter is to determine whether inflation in South Africa has been caused by excessive monetary expansion over the period 1966-1997[3], or whether the money supply has merely been passive in the inflationary process. An analysis of this nature is important for monetary policy, since it provides some guideline to determine the long-run causes of inflation in South Africa.

Studies that have attempted to determine the direction of causation between money, income and prices in South Africa, include those conducted by Barr and Kantor (1990),

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[1] According to Goodhart (1982), a suitable definition of money demand should clearly distinguish money from other assets. Such a distinction can be made by searching for a money demand definition that primarily reflects the role of money as a means of payment, which strongly favours an M1 definition. However, given the instability of M1 and M2 since 1980, M3 is the chosen money demand function.

[2] An income elasticity ranging between 0.5 and 1.0 or a little greater, and an interest rate elasticity between -0.1 and -0.5 (see Laidler, 1982).

[3] The data are annual and obtained from the South African Reserve Bank's historical data set published on the internet (http://www.resbank.co.za/Economics/econ.html).

Driscoll *et al.* (1981), Hurn (1991) and Moll (1999). With the exception of the former, most of these studies found little evidence of a causal relationship between money, income and prices. Two important issues need to be stressed here. First, a causal relationship will ultimately depend on whether the relevant monetary aggregate yields a stable money demand function. In this case the analysis in the Chapter 3 has shown that the relevant monetary aggregate is M3. Second, most of the studies in South Africa have based their causality tests on the standard Granger procedure. Although this procedure is useful to analyse short-run causality, it says little about long-run causality and the exogenous/endogenous nature of the money supply process. The econometric methodology employed in this chapter will specifically attempt to study long-run causal relations between money, income and prices.

Section 4.2 draws on Friedman and Schwartz's (1982) theoretical exposition to transform South Africa's stable M3 money demand function into a theory of money, income and prices. The analysis will emphasise why the magnitudes of the parameter estimates in the money demand function are important to establish a close link between the money supply and money income. Given the magnitude of the parameter estimates in the money demand function, section 4.3 estimates long-run price equations over the period 1966-1997. For policy purposes, the inflationary impact of money is only relevant if the money supply is exogenous. To determine the exogenous/endogenous nature of the money supply, section 4.4 discusses the relevant econometric methodology and section 4.5 presents the empirical results. The empirical results in section 4.5 will also consider the exogenous/endogenous nature of the money supply when broad definitions of inflation are included in the regressions, given that the original M3 money demand function is deflated by consumer price inflation. Section 4.6 provides some summary remarks.

4.2 The relation between money, income and prices[4]

To derive a theory of money, income and prices, the stable long-run M3 money demand function estimated in Chapter 3 can be replicated[5],

$$Lm3/p = -9.17 + 1.32Ly - 0.05Dum_{85}, \qquad (4.1)$$

where the interest rate elasticity is insignificantly different from zero[6] and the income elasticity significantly different from one.

Since our main interest is a theory of inflation, we transform the variables in equation (4.1) in rates of change and obtain the following estimation result

$$gm3/p = 1.26gy, \qquad (4.2)$$

where the null hypothesis of a unitary income elasticity is insignificantly different from one[7].

Subtract gy from both sides of equation (4.2) and reverse signs. Since gV (rate of change of velocity) = gy - *gm3/p* (where gy is real income growth and *gm3/p* is the growth of demand for real money balances), then equation (4.2) can be written as

$$gV = -0.26gy. \qquad (4.3)$$

---

[4] In addition to Friedman and Schwartz's (1982) theoretical exposition see also Friedman (1971).

[5] Definition of variables: *Lm3/p* = log-level of M3 money balances deflated by the consumer price index; *Ly* = log-level of real income; and Dum_{85} is a dummy variable that signifies the debt standstill in 1985 and takes the value of one for the period 1985-1997 and zero otherwise.

[6] The t-statistic of -0.67 indicates that the interest rate elasticity is insignificantly different from zero. From an empirical point of view an insignificant interest rate elasticity is not surprising given, that for a broad definition of money, the interest rate effect is largely captured by movements between current and time deposits. From a theoretical viewpoint monetarists would argue that money is not a substitute for a small range of financial assets, but for a wider range of assets that include real and financial assets (Goodhart and Crockett, 1970).

[7] The rate of change equation (4.2) yielded a statistically insignificant intercept and dummy variable. Equation 4.2 passed diagnostic tests such as serial correlation, functional form specification, normality and heteroschedasticity at the 5% significance level. It is also noteworthy that the rate of change money demand function performs better than the level function where the null of a unitary income elasticity estimate was rejected at the 5% level of significance.

Replace gV by gY-gM where gY and gM are the rate of change of nominal income and nominal money respectively, and transfer gM to the right-hand side,

$$gY = gM - 0.26gy. \tag{4.4}$$

Equation (4.4) depicts a relationship between nominal income and the nominal money stock. More specifically from a monetarist point of view, an exogenous nominal money stock determines nominal income. A direct relationship is only observable if it is assumed that the coefficient estimate of gy (0.26) is close to zero, so that no large error can be made if it is dropped from the equation. Instead, Friedman and Schwartz (1982) prefer the following equation derived from equation (4.4),

$$gY = \lambda gM + (1-\alpha)gy, \tag{4.5}$$

where λ is the parameter estimate of nominal income with respect to nominal money, and α the parameter estimate of real income in the money demand function. If the parameter estimate of real income is set to one (α=1) in equation (4.5), then the rate of change of nominal income is solely determined by the rate of change of nominal money. Similarly, the relationship will be equiproportionate (λ=1) only if the real income estimate in the money demand function is unity.

Figures 4.1-4.3 illustrate the relationship between the rate of change of nominal income and nominal money stock for the three different definitions of money in South Africa. A close relationship between M1, M2 and money income is only observable before 1980, and accords with the close to unity income elasticities in the rate of change money demand equations of 0.84 and 1.13 for M1 and M2 respectively in Chapter 3[8]. For the stable M3 money demand function the relationship between money and money income is fairly close over the whole period.

[8] It is important to note that all the money demand functions were deflated by the consumer price index. The relation depicted between the money supply and money income, where money income is defined as nominal GDP, therefore assumes that consumer price inflation is closely related to inflation measured by the GDP deflator.

Figure 4.1

Rate of Change of Nominal M1 and Nominal Income, 1966-1997

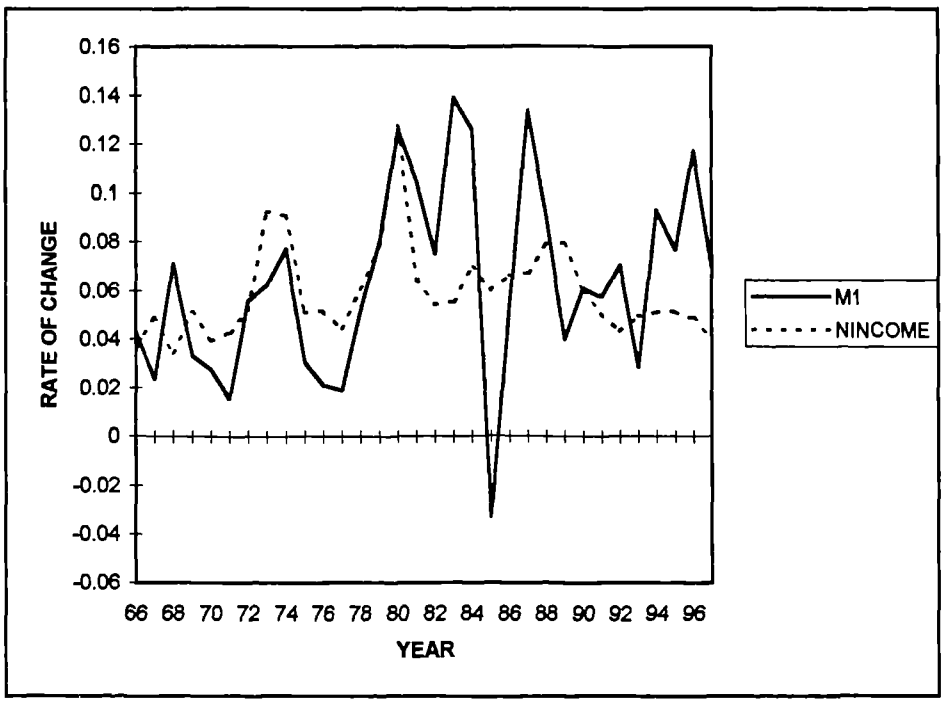


Figure 4.2

Rate of Change of Nominal M2 and Nominal Income, 1966-1997

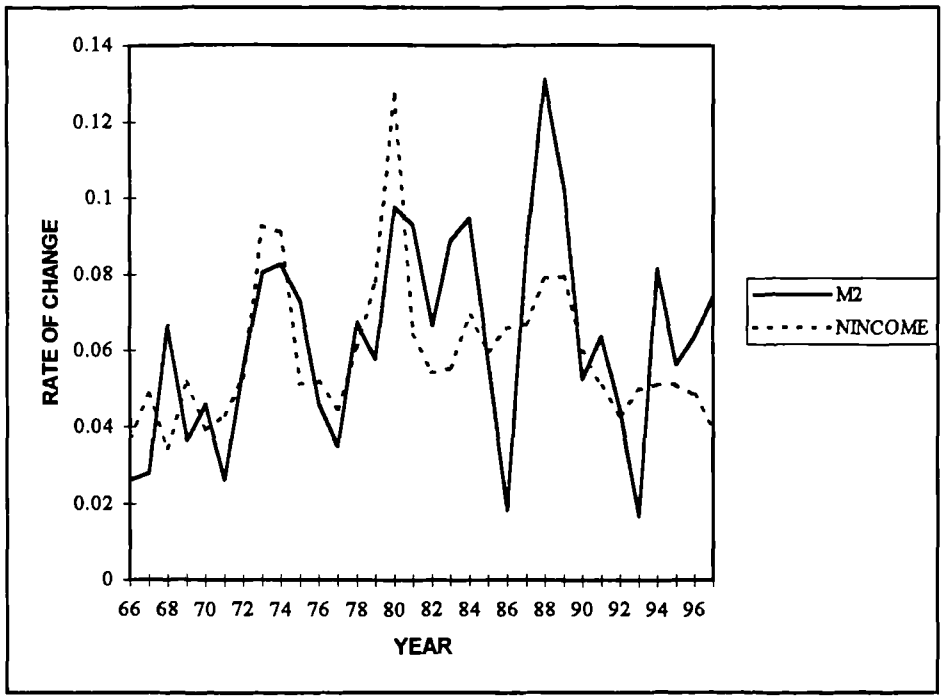
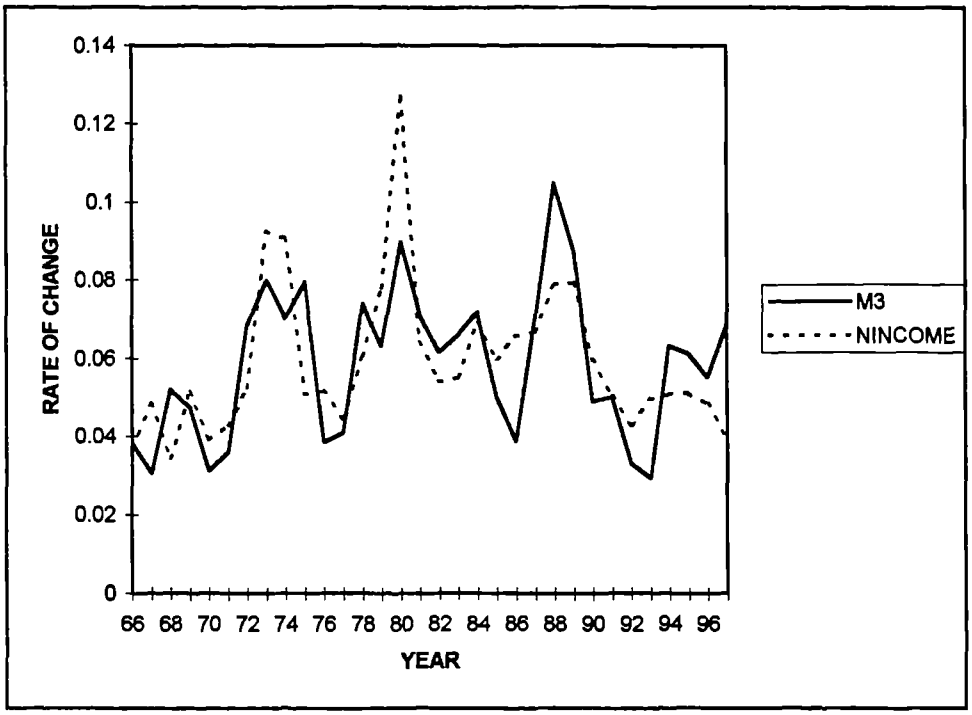


Figure 4.3

Rate of Change of Nominal M3 and Nominal Income, 1966-1997



Since the financial reforms in 1980, the high income elasticity estimates of 2.55 and 1.96 for the rate of change M1 and M2 money demand respectively, imply that the inflationary impact of increases in the rate of change of the M1 and M2 money stock were offset by an increase in the demand for money, so that the relationship between the relevant money stock and nominal income is less conspicuous compared to an M3 definition of money. Thus, changes in the M1 and M2 money stock will not be reliable predictors of the inflation rate.

To derive a price equation consider the following identity:

$$gP = gY - gy, \tag{4.6}$$

where gP is the rate of change of prices, gY the rate of change of nominal income and gy the rate of change of real income. Substitute (4.5) into (4.6):

$$gP = \lambda gM - \alpha gy . \tag{4.7}$$

If it is assumed that the money supply is exogenously determined, equation (4.7) reflects a positive relationship between the rate of change of prices and the nominal money stock. Equation (4.7) can also be written as an 'excess' money equation

$$gP = \lambda egM , \tag{4.8}$$

where 'excess' money is defined as the rate of change of the money supply minus the rate of change of real output ($egM = gM - gy$). Rewriting equation (4.7) as a theory of 'excess' money is only valid conditional on a unitary income elasticity estimate in the money demand equation (4.2), i.e. $\alpha = 1$. It also follows that a unitary income elasticity implies that the parameter estimates in equation (4.7) are of equal and opposite signs[9]. For example, if $\alpha = -1.20$ in equation (4.7), then $\lambda = 0.80$, because the higher than unity income elasticity in the money demand equation offsets some of the inflationary impact of money supply growth. However, if $\alpha = -1$ then it follows that $\lambda = 1$, so that equations (4.7) and (4.8) are exactly the same. An exogenous increase in 'excess' money will therefore cause an equiproportionate increase in the inflation rate. Since the income elasticity in equation (4.2) is insignificantly different from unity, equation (4.8) will be considered in the empirical section.

---

[9] It can be shown formally that equations (4.7) and (4.8) are only the same if the parameters in equation (4.7) are of equal and opposite signs. Consider equation (4.7):

$$gP = \lambda gM - \alpha gy \tag{1}$$

$$\text{where } egM = gM - gy \tag{2}$$
$$\text{and } gM = egM + gy. \tag{3}$$

Substitute (3) into (1) and rearrange to obtain

$$gP = \lambda egM + gy\,(\lambda - \alpha). \tag{4}$$

Thus, equations (4.7) and (4.8) are only the same if the parameters in (4.7) are of equal and opposite signs, i.e. $\lambda - \alpha = 0$ in equation (4).

From an extreme monetarist point of view output (unemployment) is determined by real factors in the long-run, so that deviations from its natural rate will only be transitory (Friedman, 1970a; Friedman,1977). Equation (4.7) states that inflation will be equiproportionate to the rate of change of the money stock if it is assumed that real output growth is constant over the long-run. If output growth does not vary, it means that the income elasticity of money demand remains constant, so that the inflationary impact of changes in the money supply are not offset by an increase in money holdings. Equation (4.7) can therefore simply be rewritten as

$$gP = \lambda gM . \tag{4.9}$$

Friedman and Schwartz (1982) do not actually estimate real income (output) directly in their price equations since they expect simultaneity problems between prices and real income. Separately they show that for the United Kingdom there is a negative relationship between prices and output. However, according to Friedman and Schwartz (1982) a negative long-run correlation between prices and output could be explained by statistical and economic reasons without invalidating the monetarist belief of money neutrality. The negative correlation can mainly be attributed to measurement errors, while adverse supply shocks could also account for the negative relationship.

4.3 Long-run price equations

Table 4.1 reports standard Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) test statistics for the variables in equations (4.8) and (4.9). Test statistics based on Perron (1990) are also reported since we suspect that the inflation time series may contain a structural break following the oil price shock in 1973. If this is the case, standard DF and ADF tests may be biased by not rejecting the null hypothesis of a unit root. The third unit root test statistic reported is the non-parametric correction to the DF test proposed by Phillips and Perron (1988).

Table 4.1

Unit Root Test Statistics, 1966-1997

Variables	DF-test	ADF-test	Perron test (1990)	Phillips-Perron test (1988)
gP_{CPI}	-1.79	-2.10	-3.64**	-2.74
$gP_{GDP\ def}$	-2.90	-2.45	-3.32**	-2.34
$gP_{GDE\ def}$	-2.21	-2.03	-2.38	-2.97**
gM	-3.61**	-4.16**		
gy	-3.73**	-3.27**		
egM	-4.13**	-3.38**		

Notes:

1. All the variables are in log-difference form, i.e. the first difference of the log-level variables.
2. Definition of variables:

gP_{CPI} = the inflation rate as measured by the consumer price index (CPI).

$gP_{GDP\text{-}def}$ = the inflation rate as measured by the gross domestic product (GDP) deflator.

$gP_{GDE\text{-}def}$ = the inflation rate as measured by the gross domestic expenditure (GDE) deflator.

gM = the rate of change of the M3 money stock.

gy = the rate of change of real income (output).

egM = 'excess' money which is defined as $gM - gy$.

3. ** denotes that the null hypothesis of a unit root is rejected at the 5% level of significance.

The DF and ADF tests reject the null hypothesis of a unit root at the 5% level of significance for all the variables except the inflation variables. The Perron (1990) test rejects the null hypothesis of a unit root for consumer price inflation as well as the GDP deflator. When ADF tests (not reported here) are conducted over the period 1973-1997 for consumer price inflation and the GDP deflator, the ADF tests reject the null hypothesis of a unit root at the 5% level of significance. The rejection of a unit root for the two inflation series over this period, seems to confirm our prior belief that there is a structural break in the inflation series following the oil price shock in 1973.

The final test proposed by Phillips and Perron (1988) rejects the unit root hypothesis for the GDE deflator. Overall the unit root tests indicate that all the variables are I(0),

although some uncertainty exists about the exact order of integration of inflation measured by the GDE deflator.

All the estimations of the long-run price equations will be based on the Auto Regressive Distributed Lag (ARDL) procedure proposed by Pesaran and Shin (1999), where the optimal the lag-length is chosen by the Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC). Consider the following ARDL representation of equation (4.9):

$$gP_t = \alpha_0 + \sum_{i=1}^{r} \alpha_{1i} gP_{t-i} + \sum_{i=0}^{s} \alpha_{2i} gM_{t-i} + \varepsilon_t \,, \tag{4.10}$$

where all the variables are defined as before, and the long-run solutions of (4.10) are given by $\theta_0 = \dfrac{\alpha_0}{1 - \sum_{i=1}^{r} \alpha_{1i} gP_{t-i}}$ and $\theta_1 = \dfrac{\sum_{i=0}^{s} \alpha_{2i} gM_{t-i}}{1 - \sum_{i=1}^{r} \alpha_{1i} gP_{t-i}}$.

Similarly, consider the following ARDL representation of equation (4.8):

$$gP_t = \beta_0 + \sum_{i=1}^{w} \beta_{1i} gP_{t-i} + \sum_{i=0}^{x} \beta_{2i} egM_{t-i} + \xi_t \,, \tag{4.11}$$

where all the variables are defined as before, and the long-run solutions of equation (4.11) are given by $\vartheta_0 = \dfrac{\beta_0}{1 - \sum_{i=1}^{w} \beta_{1i} gP_{t-i}}$ and $\vartheta_1 = \dfrac{\sum_{i=0}^{x} \beta_{2i} egM_{t-i}}{1 - \sum_{i=1}^{w} \beta_{1i} gP_{t-i}}$. The standard errors of the ARDL models in equations (4.10) and (4.11) are computed by the variance formula in Pesaran and Pesaran (1997), and allow for possible non-zero covariances between the short-run and long-run coefficients. The standard errors of the long-run estimates are computed using Bewley's regression approach (Pesaran and Pesaran, 1997).

According to Pesaran and Shin (1999), the ARDL procedure yields consistent estimates of the long-run coefficients irrespective of whether the underlying regressors are I(1) or I(0). Moreover, even if the right-hand side variables in equations (4.10) and (4.11) are endogenous, valid asymptotic inferences on the short-run and long-run parameters can be drawn once an appropriate choice of the lag lengths is made (Pesaran, 1997).

Similar to the M3 money demand function, Table 4.2 reports parameter estimates when consumer price inflation is the dependent variable. All the long-run price equations are well-determined and the ARDL models pass all the diagnostic tests with ease. The first long-run price equation reflects an extreme monetarist version where real output growth is held to be constant and inflation is perceived to be solely determined by the rate of change in nominal money. From Table 4.2, the long-run parameter estimate derived from equation (4.10) shows that a one percent increase in the nominal money stock will lead to a 0.82 percent increase in the inflation rate. However, the Wald test shows that the null hypothesis of a unitary long-run parameter estimate for nominal money is insignificantly different from one.

On a more intuitive level, it seems unrealistic to regard real output growth as constant in a developing country like South Africa. Since the early 1970s the country has been suffering from severe unemployment, while the economy has historically been extremely vulnerable to external factors such as the dollar gold price and agricultural commodity prices. Real output growth therefore varies on a regular basis in reaction to technological development and external factors.

Table 4.2

Long-run Price Equations, 1966-1997

Variables	Eqn 4.10 ARDL (1, 1)	Eqn 4.10 Long-run Solution	Eqn 4.11 ARDL (2, 2)	Eqn 4.11 Long-run solution
gP^{CPI}_{t-1}	0.79 (9.22)		0.95 (5.66)	
gP^{CPI}_{t-2}			-0.44 (-2.74)	
gM	-0.002 (-0.02)	0.82*** (6.11)		
gM_{t-1}	0.17 (1.89)			
egM			0.12 (1.39)	0.98*** (16.00)
egM_{t-1}			0.15 (1.62)	
egM_{t-2}			0.20 (2.18)	
Diagnostic tests				
LM-test Ramsey's Reset Normality Heteroscedasticity	$\chi^2(1) = 2.19$ $\chi^2(1) = 0.47$ $\chi^2(2) = 1.64$ $\chi^2(1) = 0.03$		$\chi^2(1) = 2.46$ $\chi^2(1) = 0.00$ $\chi^2(2) = 2.48$ $\chi^2(1) = 0.49$	
Wald tests				
Wald test $\chi^2(1)$: ($\theta_1 = 1$ and $\vartheta_1 = 1$)		1.59		0.07
Non-nested tests				
Test statistic	**Eqn (4.10) versus Eqn (4.11)**		**Eqn (4.11) versus Eqn (4.10)**	
N-test	-5.71***		0.24	
NT-test	-2.39**		0.34	
W-test	-2.09**		0.35	
J-test	3.14***		-0.22	
Encompassing F(1, 29)	2.20		0.02	

Notes:

1. t-statistics in parentheses.

2. (***) denotes significance at the 1% level and (**) at 5% level.

Although equation (4.7) essentially reflects the inflationary impact of 'excess' money, real output growth yielded an insignificant result when entered independently (not reported here). This result strongly supports a monetarist theory of inflation, where

inflation is perceived to be solely determined by the rate of change in the money supply. However, the result could be misleading and may merely indicate that real output growth does not exert an independent exogenous influence on inflation. For example, when real output growth enters the equation independently the insignificant result could capture a Phillips curve-type relationship subject to various structural breaks over the sample period. Thus, 'excess money' may still be an important explanatory variable, but only if we endogenise real output growth as in equation (4.11). Relaxing the assumption that real output growth is constant over the long-run and given that the income elasticity in the money demand function is unity, Table 4.2 shows that the inflationary impact of 'excess money' (*egM*) is almost equiproportionate. The corresponding Wald test statistic indicates that the null hypothesis of a unitary parameter estimate for 'excess money' is insignificantly different from one. Moreover, with the exception of the encompassing test in Table 4.2, the non-nested tests[10] all show that we can reject equation (4.10) in favour of equation (4.11) at the 5% level of significance, while we cannot reject equation (4.11) in favour of equation (4.10). Two inferences can be drawn from the non-nested test results. First, that 'excess' money is the relevant variable despite an insignificant result when real output growth enters the equation independently. Second, that real output growth is not constant in South Africa and that equation (4.10) may be misspecified.

4.4 Econometric methodology

In this section an attempt is made to establish whether money and 'excess money' are at the very least *weakly exogenous* to inflation[11]. Hendry and Ericsson (1991) base their approach on instrumental variable methods to show that inflation is super exogenous[12] to money in a money demand equation. Given the super exogenous nature of prices for the United Kingdom over the period 1878 to 1970, they argue that it is invalid to invert the money demand equation

[10] See Pesaran and Pesaran (1997: 359-370) for a description of all the non-nested tests.

[11] A formal definition of *weak exogeneity* states that a variable y is said to be *weakly exogenous* for estimating a set of parameters (λ), if inference on λ conditional on y involves no loss of information (see Charemza and Deadman, 1997; Maddala, 1988: 328).

[12] Super exogeneity means that the variables used for instruments, should not have been used in model design (Hendry and Ericsson, 1991: 30).

conditional on money being exogenous.[13, 14, 15] The methodology and analytical approach followed in this paper, will primarily be based on causality tests to determine the exogenous/endogenous nature of money in South Africa[16].

The most popular method employed over the years has been causality tests based on the standard Granger procedure, while more recently, Miller and Russek (1990) show how the standard Granger procedure can be incorporated into an error correction model (also see Miller, 1991). The main advantage of this procedure is that it not only detects causality through the standard Granger procedure, but also explores an additional channel through cointegration analysis (see Engle and Granger, 1987; Granger, 1988).

Tests for cointegration unequivocally support or repudiate the prior belief that the long-run movements of the relevant variables are related. So, if cointegration tests indicate that there exists a long-run relationship between two variables, causality must exist at least in one direction which is not always detectable if results are only based on standard Granger causality tests (Granger, 1988). Such causality can be detected if the error term in the error correction model is statistically significant. However, standard cointegration tests such as Engle and Granger's (1987) two-step procedure and the full information maximum likelihood systems procedure developed by Johansen and Juselius (1990), require variables to be I(1).

Since all the variables are I(0) in Table 4.1, standard cointegration tests are inappropriate to test whether there exists a long-run relationship between variables. Alternatively, causality tests can exclusively be based on the standard Granger procedure. The main drawback of this procedure is that it only detects short-run causality but fails to capture long-run causality effects (see Hall and Wickens, 1993). Standard Granger causality tests are only indicative whether one variable *precedes* another. Although it is useful as a

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[13] See Friedman and Schwartz (1991) for their reply.
[14] Applying the same methodology, Macdonald and Taylor (1992) reach the same conclusion for the United States over the period 1871-1975.
[15] See Brown (1983) for a descriptive evaluation of the Friedman and Schwartz (1982) analysis.
[16] One of the main criticisms levelled against the Friedman-Schwartz analysis was the absence of Granger-Sims causality tests (see Goodhart's 1982 book review of *Monetary Trends in the United States and the United Kingdom*).

descriptive devise it says nothing about the exogenous status of a variable (Maddala, 1988; Urbain, 1992; Wu, 1983).

A useful alternative approach is the unrestricted error correction procedure developed by Pesaran *et al.* (1996) and discussed in Pesaran and Pesaran (1997). The main advantage of this procedure is that irrespective of the order of the regressors, it is nevertheless possible to determine whether the variables are related over the long-run and at the same time to infer which variables are the 'long-run forcing'[17] variables in a given equation. It is therefore possible to draw valid inferences on the exogenous/endogenous nature of inflation measured by the GDE deflator, even though some uncertainty exists about the exact order of integration of this variable.

For example, the first step of this procedure involves estimating equation (4.11) as a dynamic error correction model (i.e., the short-run part of the model),

$$\Delta gP = a_0 + \sum_{i=1}^{n} b_i \Delta gP_{t-i} + \sum_{i=1}^{n} c_i \Delta egM_{t-i} + \lambda U_{t-1} + \varepsilon_t, \qquad (4.12)$$

where all the variables are defined as before; ε_t is the short-run random disturbance term; and U_{t-1} the lagged value of the long-run random disturbance term[18]. The parameter λ is the error correction coefficient. Thus far, equation (4.12) is almost similar to the causality procedure adopted in Miller and Russek (1990) if it is assumed that all the variables are I(1) and that cointegration tests reject the null hypothesis of no-cointegration. The U_{t-1} term then reflects the lagged values of the residuals obtained from the cointegrating vector. If the coefficient (λ) of the error correction term (U_{t-1}) is statistically significant and correctly signed, then it is an indication that the endogenous variable adjusts towards its long-run equilibrium value in reaction to changes in the exogenous variables. In many studies causality through the error correction term is used

[17] The term 'long-run forcing' implies that the tests indicate whether the variables are related over the long-run and, if the variables are related , which variables are the long-run exogenous variables.

[18] According to Pesaran and Pesaran (1997: 309), due to the high levels of cross-sectional and temporal aggregations involved, it is not possible to know *a priori* whether egM is the 'long-run forcing' variable for gP, so the current values for ΔegM are excluded from equation (4.12).

as a test for *weak exogeneity*, since the error term shows how the short-run coefficients adjust towards their long-run equilibrium values (see e.g., Demetriades and Hussein, 1996; Engle and Granger, 1987; Harris, 1995; Urbain, 1992). However, since the rate of change variables are I(0), it is not possible to use standard cointegration tests to ascertain whether the variables are related over the long-run, and hence to determine whether a significant error correction term in equation (4.12) is indicative of adjustment in one variable towards its long-run equilibrium value.

Alternatively, the second step of the unrestricted error correction procedure is to replace the U_{t-1} term in equation (4.12) by the lagged levels of the variables (the long-run part of the model) to obtain a model that estimates the long-run and short-run parameters jointly (also see Mehra, 1991),

$$\Delta gP = a_0 + \sum_{i=1}^{n} b_i \Delta gP_{t-i} + \sum_{i=1}^{n} c_i \Delta egM_{t-i} + \delta_1 gP_{t-1} + \delta_2 egM_{t-1} + \varepsilon_t, \qquad (4.13)$$

where Ho: $\delta_1 = \delta_2 = 0$

and Ha: $\delta_1 \neq 0$, $\delta_2 \neq 0$

To test the Ho that the lagged levels of the variables are not jointly significant, the statistic is the standard F-test. Since this statistic has a non-standard distribution the critical value bounds given in Pesaran and Pesaran (1997: 484) are used. If the F-statistic rejects the Ho, we can conclude that there exists a long-run relationship between gP and egM with egM as the 'long-run forcing' variable[19]. By treating each variable in equation (4.12) as the dependent variable the procedure can be repeated to draw some inferences on the conditions necessary for efficient estimation.

[19] The joint significance of the variables in lagged levels, implies that the error correction coefficient (δ_1) shows that there is adjustment in the endogenous variable towards its long-run equilibrium value in reaction to changes in the exogenous variables. It is also possible to derive long-run parameter estimates directly from equation (4.13), by dividing δ_2 through by δ_1 (see Mehra, 1991, p.5).

4.5 Causality tests

Table 4.3 reports the causality tests based on the unrestricted error correction procedure. The first set of tests for equations (4.10) and (4.11) include consumer price inflation as the relevant inflation measure.

Table 4.3

Causality Tests Based on the Unrestricted Error Correction Model, 1966-1997

Regression	F-test	Causality Results
With gP_{CPI} as the inflation variable		
gP on gM gM on gP	4.46 9.49*** [7.81]	$gP \Rightarrow gM$
gP on egM egM on gP	6.99** [5.76] 9.02*** [7.81]	$gP \Leftrightarrow egM$
With $gP_{GDE\ def}$ as the inflation variable		
gP on gM gM on gP	4.10 7.68** [5.76]	$gP \Rightarrow gM$
gP on egM egM on gP	2.83 6.66** [5.76]	$gP \Rightarrow egM$
With $gP_{GDP\ def}$ as the inflation variable		
gP on gM gM on gP	3.50 9.82*** [7.81]	$gP \Rightarrow gM$
gP on egM egM on gP	4.64 7.19** [5.76]	$gP \Rightarrow egM$

Notes:

1. In all the regressions equation (4.12) is estimated as a first-differenced model of order one.
2. Similar results were obtained when a time variable was included in the unrestricted error correction model.
3. Three asterisks (***) denote significance at the 1% level and two asterisk (**) at the 5% level.
4. The numbers in brackets [ ] are critical values for I(1) variables reported in Pesaran and Pesaran (1997). Since there is some degree of uncertainty about the orders of integration of the variables in Table 4.1, the causality tests are not based on the critical values for I(0) variables in Pesaran and Pesaran (1997). However, even when the critical values for I(0) variables are used, the causality results do not change.

The results show that the interpretation attached to the long-run price equation derived from equation (4.10) in section 4.3, is not valid from a policy point of view, if we condition on money being exogenous. Consumer price inflation on the other hand determines an endogenous money supply, where the null hypothesis is rejected at the 1% level of significance. Money seems to have an exogenous element, but only when 'excess' money is used as the exogenous variable. The results for consumer price inflation essentially point to bi-directional long-run causality between consumer price inflation and 'excess' money.

The most striking feature of the results in Table 4.3 is uni-directional causality from inflation to money and 'excess' money when broad measures of inflation are used. In contrast to the results for consumer price inflation, the results suggest that 'excess' money is completely endogenous to broad measures of inflation. It is important to note, however, that money is endogenous to inflation for all the different measures. Causality from 'excess' money to consumer price inflation therefore seems to be the outcome of an endogenously determined money supply and not as a result of direct control measures by the monetary authorities.

The visual displays in Figures 4.4 show that there is a close contemporaneous relation between 'excess' money and broad measures of inflation over the period 1966-1997. Although the relation between consumer price inflation and 'excess' money in Figure 4.5 are not contemporaneously correlated, there seems to be a definite long-run relation based on the similar trends shared by both variables.

The visual evidence tends to support the econometric analysis that there exists a long-run relation between money, income and prices in South Africa. The empirical evidence in Chapter 3, which showed that there exists a stable long-run M3 money demand function for South Africa, also supports this contention.

Figure 4.4

The Relation Between 'Excess' Money and Broad Measures of Inflation

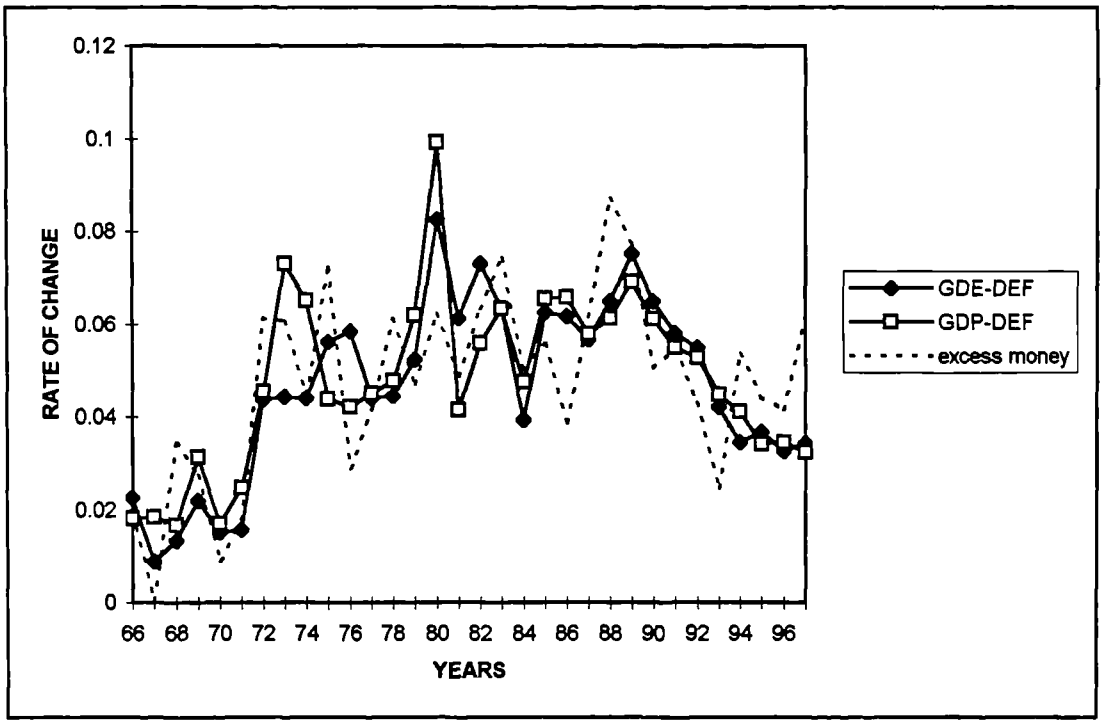
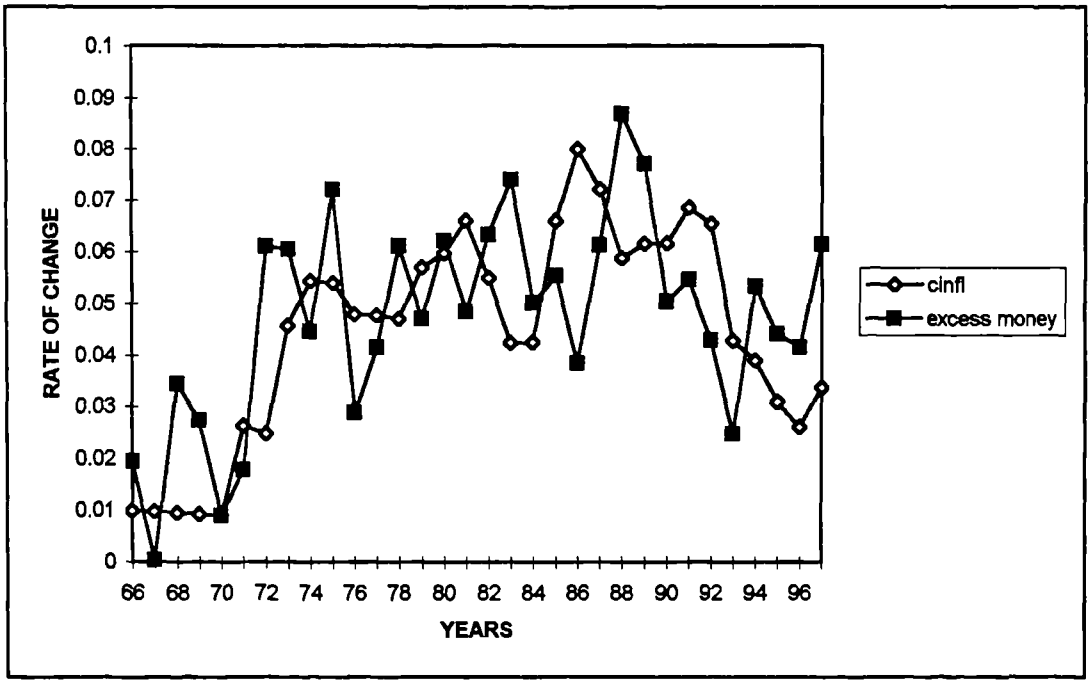


Figure 4.5

The Relation Between 'Excess' Money and Consumer Price Inflation (cinfl)



4.6 Conclusion

The main findings of this chapter have shown that money and 'excess' money are endogenous to broad and narrow measures of inflation. Although there exists a stable long-run money demand function for South Africa and thus a predictable link between money and money income, the endogenous nature of money over the period 1966-1997 refutes a monetarist belief that excessive monetary expansion is the underlying cause of inflation in South Africa.

The results further show that the exogenous nature of 'excess' money to consumer price inflation need not necessarily be indicative of direct control by the monetary authorities, but could be the result of a process where 'excess' money may come into existence even under an endogenously determined money supply. The next chapter will develop and extend the main findings of this chapter by focusing on the direct control monetary authorities have on high powered money, in order to determine whether 'excess' money may come into existence under an endogenous money supply.

CHAPTER 5

THE ENDOGENOUS/EXOGENOUS NATURE OF SOUTH AFRICA'S MONEY SUPPLY UNDER DIRECT AND INDIRECT MONETARY CONTROL MEASURES

5.1 Introduction

Following the significant financial reforms in 1980, the South African Reserve Bank (SARB) adopted a policy of setting predetermined monetary growth targets for M3 since the mid 1980s[1]. In contrast to empirical studies which have found evidence of a stable M3 money demand function[2], Moll (1999) recently identified the presence of an unstable M3 velocity over the period 1960-1996 as one of the underlying causes to explain the failure of the SARB to reach predetermined monetary growth targets on a regular and consistent basis.

After the publication of Kaldor's seminal work in 1982, it became apparent that although a stable money demand function is a necessary condition for there to be a stable and predictable link between money and money income, it does not necessarily validate the monetarist contention that the money supply is causal in the process of inflation[3]. Thus, even when velocity is perceived to be stable, one way causality from money income to money or even bi-directional causality could provide alternative explanations why monetary growth targeting was less successful in South Africa. A stable velocity implies that the relevant monetary aggregate could serve as a *broad* indicator for monetary

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[1] It is important to note that monetary growth targeting since the mid 1980s has not been based on direct monetary control measures as proposed by the orthodox monetarist approach , but indirectly through the SARB's interest rate policy. A more detailed discussion of the different monetary systems that characterised the period 1966-1997 will be presented in section 5.4.

[2] Hurn and Muscatelli (1992) provide evidence of a cointegrating relationship between M3, income, prices and interest rates. In Chapter 3 we find evidence of a stable real M3 money demand function over the period 1965-1997.

[3] Hendry and Ericsson (1991), for example, finds a stable real money demand function for the United Kingdom over the period 1878 to 1970, but at the same time show that money is endogenously determined. By applying the same methodology, Macdonald and Taylor (1992) find similar results for the United States.

policy, but that it loses its effectiveness as a *leading indicator* when the money supply is endogenous or partly endogenously determined.

The main objective of this chapter is to supplement the analysis in Chapter 4 which showed that money has been endogenous in the inflationary process. In an attempt to provide a more rigorous analysis of South Africa's money supply process, this chapter describes South Africa's money supply process along several competing, but not mutually exclusive, theoretical paradigms over the period 1966-1997. Similar to Chapters 3 and 4, we will again show that M3 velocity is indeed stable over the period 1966-1997 when the broadest definition is considered, and that a stable velocity necessitates a reassessment of the endogenous/exogenous nature of M3 money to provide a possible explanation for the failure of monetary growth targeting in South Africa. A thorough theoretical and empirical analysis of South Africa's money supply process will not only provide useful insights to assess the effectiveness of monetary policy in South Africa, but also provide a useful starting point to analyse the long-run causes of inflation. An endogenously determined money supply process implies that monetary policy will be less effective in maintaining price stability, because inflation is not caused by excessive monetary expansion, but a wider range of factors which include structural and/or cost-push forces of inflation.

According to Niggle (1991), over a long period the money supply may be regarded as exogenous or endogenous depending on the degree of financial development and the nature and conduct of monetary policy. To determine the exogenous/endogenous nature of South Africa's money supply over the period 1966-1997, Niggle's (1991) analysis suggests a periodisation over the sub-periods 1966-1979 and 1980-1997 to capture the impact of direct and more market-oriented monetary control measures respectively.

The chapter is organised as follows. Section 5.2 draws a distinction between two main competing theoretical views on the endogenous/exogenous nature of the money supply. A distinction will also be drawn between the dissident views that remain within the post-Keynesian school of thought on the nature of the endogeneity of the money supply. Section 5.3 discusses the hypotheses to be tested. Section 5.4 provides a brief overview of the salient features of monetary policy in South Africa. Section 5.5 outlines the

econometric methodology and section 5.6 presents the empirical results. Section 5.7 concludes with some policy implications.

5.2 Monetarists versus Post-Keynesians

In this section a distinction will be drawn between two divergent theoretical views on the endogenous/exogenous nature of the money supply. Moreover, while there is widespread agreement among post-Keynesians that the money supply is endogenous, there is some disagreement about the nature of the endogeneity.

5.2.1 An orthodox monetarist approach of the money supply process

Monetarists see the money supply process as some multiple of the monetary base,

$$M = mH \tag{5.1}$$

where; M = money supply

m = money multiplier

H = base money (consists of currency in circulation and reserves held by Commercial banks)

From equation (5.1), monetarists assert that the monetary authorities can directly control the money supply by manipulating base money, given that the money multiplier is stable and predictable, so that restrictive (expansionary) monetary policy will not be offset by an increase (decrease) in the money multiplier (Lavoie, 1984).

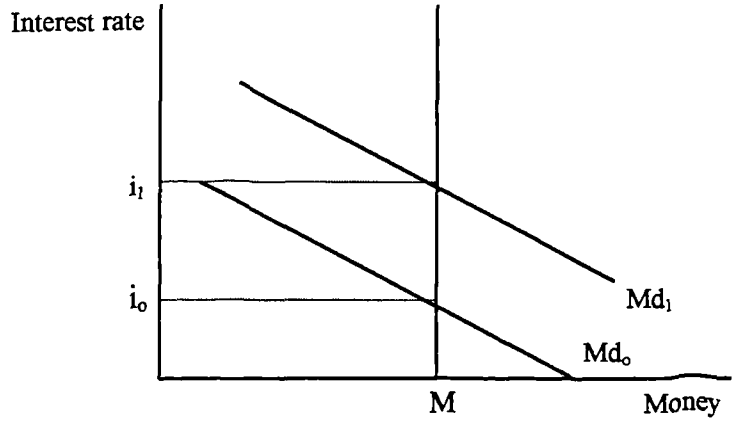
In the monetarist version of the money supply process, the money supply is independent of loan demand. Expansionary monetary policy (an increase in base money) will, through the money multiplier, lead to an increase in deposits. *Reserves* therefore make *deposits*, while excess cash reserves that result from more expansionary monetary policy are lent out to the general public. Even though the monetarist version of the money supply

process depicts an increase in bank lending, the money supply is exogenously determined, i.e. under the direct control of the monetary authorities.

The money supply process depicted by monetarists can be represented graphically as in Figure 5.1 (Kaldor, 1982; Palley, 1994).

Figure 5.1

The Monetarist Money Supply Process



From Figure 5.1 it can be seen that the money supply is fixed at a given level by the monetary authorities and represented by a vertical line. Believers in this view Moore (1988) refers to as *Verticalists*. A monetarist version of the money supply process can thus be associated with a perfectly inelastic money supply curve (Davidson, 1988). Furthermore, since the money supply is directly controlled by the monetary authorities, the money supply is independent of the demand for money function. If the demand for money is a function of real income and the interest rate, an increase in real income will cause an increase in the demand for money (from Md_0 to Md_1 in Figure 5.1), which will not be met by a similar increase in the exogenously determined money supply. In order to meet their liquidity requirements, households will sell interest-bearing assets which, in turn, will increase the yield on these financial assets (from i_0 to i_1 in Figure 5.1). The

endogenously determined money supply will then adjust back to the fixed (exogenous) money supply[4].

Monetarists such as Friedman (1959) view the demand for money primarily as a function of real income and insensitive to the rate of interest. The theoretical motivation for an inelastic interest rate money demand function can be found in the extreme monetarist view that money is not a close substitute for a small range of financial assets, but for a much wider range that includes real and financial assets. Typically, monetarists base their policy prescriptions on a moderate, but predetermined monetary growth rule, in order to subdue inflationary expectations and to create a stable macroeconomic environment (Friedman, 1970b).

5.2.2 A Post-Keynesian approach to the money supply process

A post-Keynesian approach of the money supply process can broadly be divided into three categories: the accommodationist view; the structuralist view; and lastly a view that incorporates the liquidity preferences of the public into an endogenously determined money supply process. As mentioned before, while there is common consensus on the endogenous nature of the money supply, there are important differences between the three views related to the nature of the endogeneity of the money supply.

5.2.2.1 The Accommodationist view

The main exponents of this view can be found in the writings of Kaldor (1982); Kaldor and Trevithick (1981); and Moore (1988, 1989a). The accommodative endogeneity approach argues that the monetarist approach is not compatible with the real world situation where banks are in fact in the business of selling credit. Banks are therefore price setters and quantity takers (Moore, 1989b). In addition, it is also argued that the demand for credit is normally accommodated by lenders due to overdraft facilities, prearranged credit lines and credit card agreements (see e.g., Niggle, 1991).

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[4] The same argument could be applied if the vertical money supply is not given. A rightward shift in the vertical money supply (without a shift in money demand) would reduce the interest rate and increase the demand for money.

If banks are in the business of selling credit, Central Banks inevitably play a crucial role in supplying the necessary currency and reserves on demand. According to Moore (1989c), reserves must always be provided on demand by Central Banks. Central Banks have no alternative but to supply currency and reserves on demand to ensure the liquidity of the financial system and to fulfil their role as lender of last resort (Moore, 1989a). Accommodation generally occurs through the discount window or open market operations. The supply of reserves is very elastic in the short-run, although Central Banks have the option to control the supply price of reserves at the discount window by setting the discount rate of borrowed funds (Niggle, 1991). In sharp contrast to monetarists, the base and money stock are endogenous.

Moore (1989a) further argues that if commercial banks are reserve constrained by the Central Bank, liability management practices enable commercial banks to supply reserves on demand; where liability management refers to the issue by banks of their own negotiable debt instruments. A related development, is that banks arrange off-balance-sheet financing for their clients such as loan commitments, the selling of assets under repurchase agreements to the non-banking private sector and bankers' acceptances (Black and Dollery, 1989; Moore, 1989a). However, for reasons mentioned above, Central Banks generally fully accommodate the demand for reserves, so that the loan supply curve of banks is horizontal and the level of bank lending is determined by the level of loan demand.

Given that the demand for credit is not quantity constrained by Central or commercial banks, the endogenous money supply process can be described as follows (see Lavoie, 1984: 774). When firms want to increase their outlays, they need to extend their credit lines and loans from the banking sector. The flow of credit then appears as deposits on the liability side of the balance sheet of banks. Thus, an endogenously determined money supply explicitly implies that *loans* make *deposits* (Moore, 1989a). It follows that changes in the money supply are a *result* and not a *cause* of changes in money income, and varies in relation to prices and output (Kaldor and Trevithick, 1981). The money supply is credit-driven and demand determined.

The accommodative endogenous approach can be represented graphically as in Figure 5.2 (Kaldor, 1982).

Figure 5.2

The Accommodative Endogenous Approach of the Money Supply Process

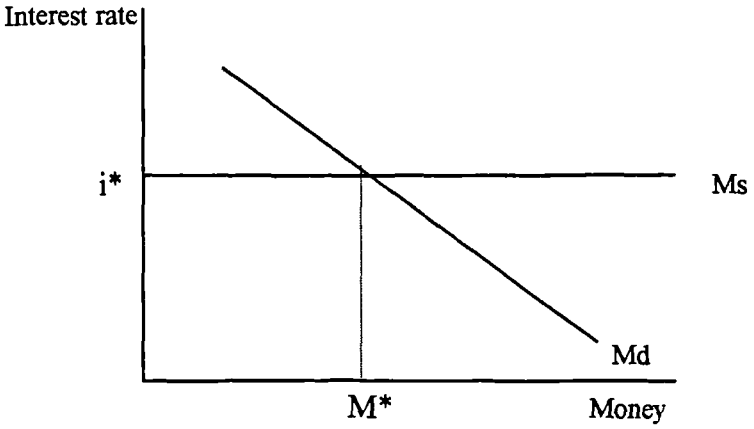

Figure 5.2 shows that under full accommodation the money supply curve is horizontal, i.e. perfectly elastic (Davidson, 1988). An exogenous money demand determines an endogenous money supply. Believers in this view, Moore (1988) refers to as *Horizontalists*.

Kaldor and Trevithick (1981) further assert that credit money that comes into existence as a result of borrowing from banks is extinguished due to the repayment of previous debt. Thus, in a credit economy the money stock can never be in excess of the amount individuals wish to hold, and hence can never cause a rise in spending.

Important contributions have also been made by Moore to develop the Kaldor-Trevithick view that money can never be in excess supply. According to Moore (1988, 1991, 1997), the demand for deposits is dependent on the supply of deposits created by bank lending. There is no independent money demand function, so that the supply of deposits are willingly held by individuals ("convenience lending") without affecting output and prices. The rationale for this extreme view, lies in Moore's (1991) belief that there is no unique general equilibrium towards which the economy adjusts. Since money is only required in an uncertain world, any notion of an equilibrium stock of money

demanded is automatically ruled out. In the absence of an equilibrium money demand position, there is no need to reconcile the demand with the supply of deposits (newly created by bank lending).

Moore (1997) makes his views more explicit by stating that *"... depositors can only "supply" banks with deposits if they have somehow previously acquired them, either by selling goods or services or assets in exchange for money, or by receiving them as a gift or transfer. One cannot supply a bank with money unless one already owns it. It is therefore fundamentally mistaken to view depositors as having an independent demand for deposits" (p.426).*

By dismissing the idea that excess money exists, views about the underlying causes of inflation naturally differ widely from those held by monetarists. Inflation is seen as the result of excess growth in money wages which is not commensurate with the rate of growth of labour productivity. Changes in an endogenously determined money supply are the *result* and not the *cause* of changes in labour unit costs (Moore, 1989b).

Returning to Figure 5.2, the accommodationist view postulates that the ability of the monetary authorities to control the money supply will largely depend on the interest elasticity of the demand for money (Kaldor and Trevithick, 1981; Kaldor, 1982). Since monetarists such as Friedman regard the demand for money as interest inelastic, control over the money supply will only materialise at the expense of large changes in the interest rate. In turn, large interest rate changes are disruptive to the free working of financial markets[5].

If the demand for money is perfectly inelastic and thus represented by a vertical line in Figure 5.2, monetary authorities can only control the money supply indirectly. Restrictive monetary policy will cause a parallel upward shift in the horizontal money supply curve. The subsequent higher interest rate level will, through the multiplier process, cause a slow-down in economic activity and a concomitant fall in real income. The vertical money demand curve will shift to the left and the money supply will fall. Therefore,

[5] In a monetarist version of the money supply process, an interest inelastic money demand function plays an important role to establish a direct link between money income and the money stock.

under a perfectly interest inelastic money demand curve, monetary authorities will only be able to control the money supply at the cost of a recession and economic stagnation.

The theoretical exposition of the money supply process set forth by the accommodationist view can be summarised as follows: Banks are not reserve constrained by the Central Bank and base their lending rate as some mark-up over the discount rate. From the banks' point of view the loan supply schedule is horizontal and therefore all loan demands are met. Loans make deposits and the resulting quantity of deposits is endogenous.

5.2.2.2 Liquidity preference of individuals

This approach fully supports the accommodationists' core theoretical arguments in favour of an endogenously determined money supply process. However, the accommodationists' view that money can never be in excess supply and hence that there is not an independent money demand function that plays its traditional role, has been challenged by various economists (see e.g., Arestis and Howells, 1996; Howells, 1995; Howells, 1997; Palley, 1991).

According to Howells (1995), the main controversy revolves around the identification of a reconciliation mechanism to ensure that the supply of new deposits created by the flow of new net lending is just equal to the quantity demanded. To identify an appropriate reconciliation mechanism, the traditional role played by the demand for money function cannot be neglected. As Palley (1991) states: *"...having received a deposit, what will agents do with it? Spend it, repay existing loans, buy bonds, or simply hold it?" (p. 397).*

Kaldor and Trevithick (1981) identify the automatic repayment of loans as an appropriate reconciliation mechanism. The main criticism raised by Howells (1997) is that not everyone has an outstanding debt. Even if one is sympathetic to Moore's (1997) view that all one has to do is assume that all business units have an outstanding credit line, Howells (1997) again raises some practical difficulties with this assumption:

"...anyone with "excess" deposits must dispose of them in such a way that a loan is extinguished before the spending can have any effect" (p.431).

Furthermore, Moore's (1991) neglect of a demand for money function based on the view that we don't have a world of general equilibrium, is also questioned. Again, the only assumption needed is that individuals have preferences about the amount of wealth they wish to hold which does not in any way require assumptions about general equilibrium (Howells, 1997).

Lastly, Moore (1991) argues that even if the supposition is made that individuals have excess deposits and henceforth buy interest bearing assets, the quantity of deposits will remain unchanged since only the ownership of the deposits has changed. The relevant question that Howells (1997) poses, is what happens to prices and yields and what effect will this have on reconciling the supply with the demand for deposits?

In Howells (1995), several reconciliation mechanisms are considered in addition to the Kaldor-Trevithick view and Moore's rejection of an independent money demand function. These include Chick's income multiplier process that will automatically increase the demand for money balances and Laidler's buffer stock demand for money. While Laidler's buffer stock demand for money remains unsympathetic to the endogeneity thesis, Chick's analysis implicitly offers some reconciliation mechanism (see Howells, 1995). If the initial motivation for borrowing is spending, then this could cause a multiple increase in income and a subsequent increase in the demand for active balances. Through this mechanism excess money that resulted from an initial increase in loans could partly be absorbed. However, there is no *a priori* way to know whether the initial increase in borrowing reflects people's desire to spend or to buy existing securities.

In Howells (1995) and Arestis and Howells (1996), the idea is developed that some of the excess money resulting from an expansion in loans causes a switch from money to financial assets with a subsequent rise in prices and lower yields, that may induce a further change in real expenditure. Although this procedure is the familiar Keynesian transmission mechanism, Arestis and Howells (1996) in particular focus on the structure

of interest rates and how interest rate differentials could reconcile the excess supply of deposits with the demand for deposits.

To summarise, the reconciliation problem can be explained in terms of a demand for money function and a demand for loans function which both include prices and real income. Under an endogenously determined money supply the demand for loans will be driven by prices and income. Without a reconciliation problem we would expect identical price and income elasticities in the money demand and loan functions, so that the deposits created by loans are willingly held by deposit holders. If the elasticities are not similar, then there is a reconciliation problem which may induce new deposit holders to dispose of any excess by either spending it or buying bonds. The actions by deposit holders could trigger further price and income changes so that the supply of deposits is eventually reconciled with the demand for deposits. The reconciliation problem is further exacerbated when it is considered that the individuals or agents who demand loans, are different than the set of agents who eventually hold the deposits created by loans (Howells, 1995).

5.2.2.3 The Structuralist view

While it is fully acknowledged that the endogenous nature of the money supply process has its origins in the views expressed by the accommodationist approach, structuralists argue that full accommodation is an unrealistic real world assumption, and assert that the demand for credit is at least, to some extent, quantity constrained by the Central Bank and commercial banks[6].

Structuralists such as Palley (1994) and Pollin (1991), argue that accommodation depends on both the stance of the monetary authorities and the private initiatives of

[6] Davidson (1988) for example, associates an exogenous money supply with a perfectly inelastic money supply function, and an endogenous money supply with a less than perfectly inelastic money supply function. Thus, an endogenous money supply, does not necessary imply that the money supply function should always be perfectly elastic (Davidson, 1989; Goodhart, 1989; Rousseas, 1989; Wray, 1992).

banks. Central Banks have the option through open market operations, to place significant quantity constraints on reserve availability (Pollin, 1991)[7]. In the structuralist view, discount window borrowing is not a close substitute for nonborrowed funds restricted by open market operations. Structuralists stress that the marginal cost of borrowing from the discount window rises each time banks use this option, since the discount rate is positively related to the level of borrowed funds (Palley, 1991) . In contrast to the accommodationist approach, the loan supply schedule of banks is positively sloped and not horizontal.

An important feature of the structuralist endogeneity approach is their emphasis on liability management practices that allow banks to partly overcome quantity constraints imposed by Central Banks (Palley, 1994; Pollin, 1991). It is important to note that although the accommodationist view mentions liability management as an option, this is not a main feature in their theoretical analyses. More so, their theoretical arguments are primarily based on reasons why Central Banks will always fully accommodate increases in the demand for reserves.

Although liability management can go a far way to overcome reserve constraints, it ultimately depends on the stance taken by banks at the time (Goodhart, 1989). Structuralists emphasise that liability management need not necessarily create an adequate supply of reserves to meet demand (Pollin, 1991). A related idea presented by Dow (1996), although not pertinent in the writings of structuralists, is that banks express their liquidity preferences in terms of risk assessment. Credit rationing occurs with respect to particular classes of borrowers and during the downturn of the business cycle.

If liability management does not fully offset reserve constraints imposed by Central Banks, the structuralist endogeneity approach differs in another important respect from the accommodationist view. Reserve constraints imposed by Central Banks imply that the money supply curve depicted in Figure 5.2 is not horizontal, but positively sloped.

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[7] According to Palley (1991), Central Banks do not always fully accommodate increases in the demand for reserves. During abnormal times of severe liquidity shortages, Central Banks will be compelled to accommodate increases in the demand for reserves while, during normal times, Central Banks may exert more restrictive monetary policy measures.

5.3 The empirical hypotheses

Table 5.1 summarises the hypotheses of three empirical studies which are representative of three theoretical views on the exogenous/endogenous nature of the money supply. The main empirical content of each study is based on Granger causality type tests.

Table 5.1

Three Empirical Hypotheses on the Exogenous/Endogenous Nature of the Money Supply

Accommodationist view (Moore, 1989b)	**Structuralist view (Palley, 1994)**	**Liquidity preference view (Howells and Hussein, 1998)**
LM3 $\Rightarrow$ *Lh*	*Lcredit* $\Leftrightarrow$ *Lm, Lh*	*Lcredit* $\Leftrightarrow$ *LM3*
Lcredit $\Rightarrow$ *LM3*	*Lmi* $\Leftrightarrow$ *LM3*	
Lmi $\Rightarrow$ *LM3*		

Notes:

1. Definition of variables:
   - *Lcredit* = log-level of total bank credit.
   - *Lh* = log-level of the monetary base (currency and reserves held by commercial banks).
   - *Lm* = log-level of the M3 money multiplier.
   - *LM3* = log-level of the M3 money supply.
   - *Lmi* = log-level of money income (nominal GDP).

If reserves are fully accommodated by the Central Bank and the loan supply schedule of commercial banks is horizontal, then the empirical hypotheses of the accommodationist view in Table 5.1 predict unidirectional causality from the M3 money supply (*LM3*) to base money (*Lh*), and unidirectional causality from total bank credit (*Lcredit*) to *LM3*. Although not explicitly included in Moore's empirical study (1989b), the accommodationist approach implies that there is unidirectional causality from money income (*Lmi*) to *LM3*.

The structuralist hypothesis in Table 5.1 can be described as a mixed model which incorporates some of the ideas of the monetarist approach and the accommodationist view. The accommodationist part of the model depicts causality from *Lcredit* (total bank credit) to *Lh* and the monetarist part of the model causality from *Lh* to *Lcredit*. The monetarist part of the model also depicts causality from the *Lm* (M3 money multiplier) to *Lcredit*. Although the relations described by the accommodationist view in Table 5.1 could be used to test the structuralist view, Palley's (1994) relations tests the monetarist version indirectly, where it is assumed that excess reserves that result from expansionary monetary policy ($Lh \Rightarrow LM3$) are lent out to the general public (i.e. $Lh \Rightarrow Lcredit$). If the structuralist view holds true, then an additional test should indicate bi-directional causality between money income (*Lmi*) and *LM3*. Finally, if *Lh* does not proportionately support an increase in the demand for *Lcredit*, i.e. a less than unitary long-run elasticity conditional on *Lcredit* being exogenous, then structuralists identify liability management practices as an alternative to supplement the shortage in reserves. Increased lending causes liability transformations so that *Lcredit* causes an increase in *Lm*. Given that the main components of the money multiplier consist of the currency deposit ratio (*cd*) and reserve deposit ratio (*rd*), Palley's test implies that liability management - bidding up rates to attract funds from demand deposits with high reserve requirements into time deposits with lower reserve requirements - frees up reserves which subsequently alters *cd* and *rd*[8].

The empirical hypothesis of the liquidity preference view in Table 5.1 predicts causality from *Lcredit* to *LM3* if the money supply is endogenously determined. However, if the demand for money and the demand for loans are *independent*, it follows that the supply of deposits created by the net flow of new bank lending are not willingly held by new deposit owners who have liquidity preferences about the amount of money they wish to hold. If this is the case, then the demand for money places a constraint on the ability of loans to create deposits so that causality can also be expected from *LM3* to *Lcredit*.

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[8] According to Pollin (1991), one way to describe liability management is by attracting funds out of demand deposit accounts which have relatively high reserve requirements, into instruments within the short-term money market. When banks borrow short-term money market instruments the reserve requirement associated with their liability will be lower compared to demand deposits. One implication of liability management as described by Palley (1994) and Pollin (1991), is that the former case implies a rise in the velocity for a narrow definition of money while the latter case may be associated with a rise in velocity for a broader definition of money.

5.4 Monetary policy in South Africa over the period 1966-1997

This section provides a brief overview of the salient features that characterised monetary policy over the sub-periods 1966-1979 and 1980-1997. An analysis of this nature will clearly show why it is necessary to test the empirical hypotheses in Table 5.1 over two different sub-periods.

5.4.1 Direct control measures: 1966-1979

Direct control measures were mainly based on credit ceilings, cash reserve requirements, liquid asset reserve requirements and interest rate control measures. In its Final Report, the De Kock Commission (1985) mentioned several reasons why monetary policy based on direct control measures was less successful in moderating and controlling credit expansion and money supply growth[9].

First, it is widely acknowledged that liquid asset reserve requirements during this period did not prevent large expansions in credit and money supply growth (Gidlow, 1995; Meijer, 1992). Second, direct control measures such as credit ceilings and liquid asset reserve requirements, led to 'disintermediation' since the mid 1970s[10]. In addition to primary lenders and ultimate borrowers, banks also participated in 'disintermediation' on a large scale by entering money broking fields and arranging off-balance-sheet financing for their clients (Black and Dollery, 1989).

The 'disintermediation' phenomena is captured in Figure 5.3 by the movements in the velocities (in logarithms) for the different monetary aggregates over the period 1966-1997 using quarterly data.

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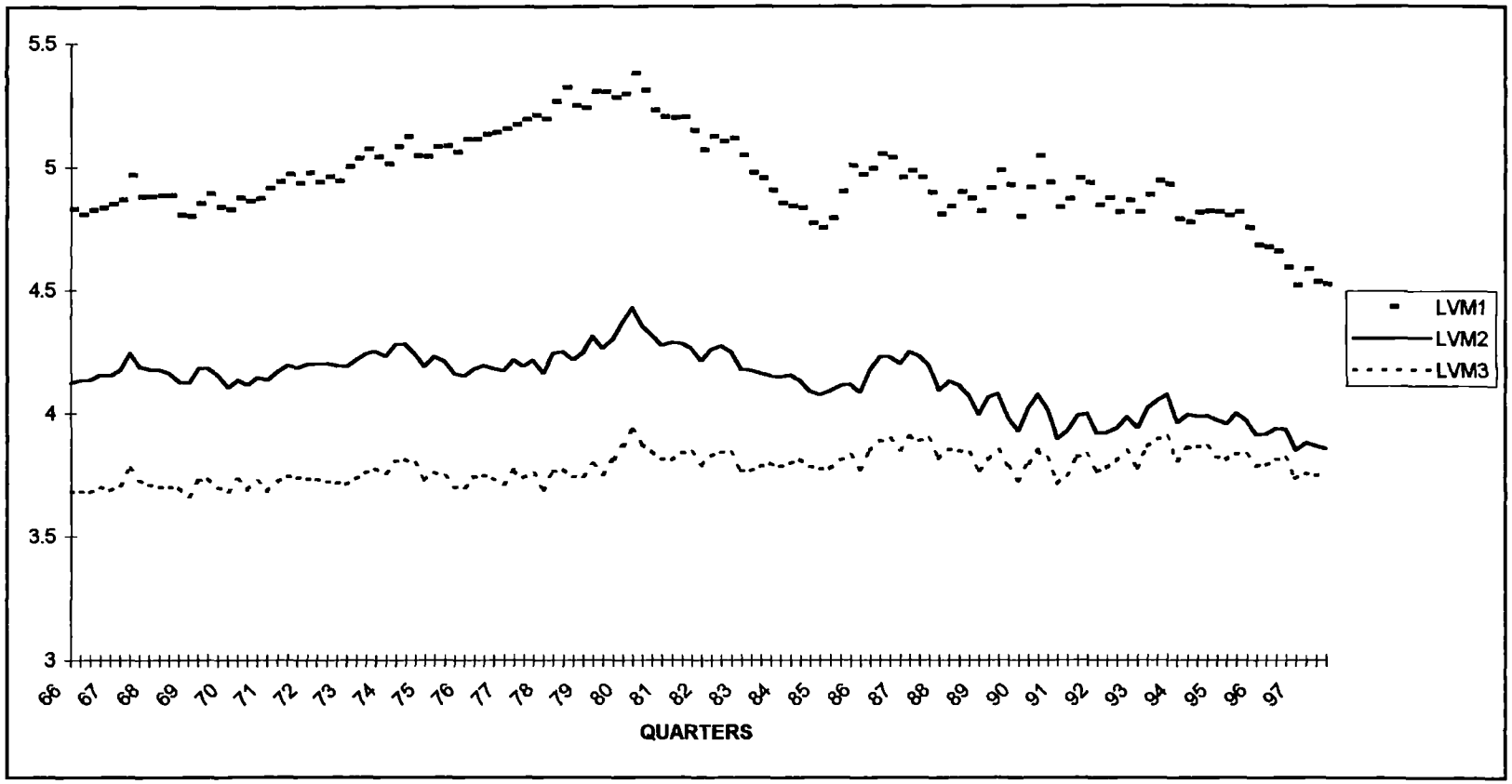
[9] See Black and Dollery (1989) for a summary of the Final Report.

[10] Recall from Chapter 3 that 'disintermediation' refers to the replacement of credit normally extended by banks, by non-intermediated credit extended between primarily lenders and ultimate borrowers. Liquid asset reserve requirements forced banks to use some of their own deposits to buy low-yielding statutory liquid assets. This caused banks to offer a low interest on deposits and a higher charge to borrowers. Liquidity constraints imposed by banks through higher lending rates and additional direct control measures such as credit ceilings could largely explain the 'disintermediation' phenomena experienced over the period 1976-1979.

Figure 5.3

Nominal Velocities (VM) of the Different Definitions of Money, 1966q1-1997q4



Two striking features stand out. Similar to the descriptive analysis presented in Chapter 3 when annual data was used, Figure 5.3 shows a gradual increase in the M1 and M2 velocities (trended) during the 1960s, whereas the increases become more precipitous since the mid 1970s. After the financial reforms in 1980, the decline in M1 and M2 velocities describes the 'reintermediation' phenomena where credit extensions outside the banking system returned to the balance sheets of banks. One implication is that the M1 and M2 velocities are not stable over the period 1966-1997, nor over the sub-periods 1966-1979 and 1980-1997. Second, the M3 velocity remains fairly stable along its trend value over the whole period under analysis. As before, the descriptive evidence using quarterly data suggests that velocity becomes more stable as we move from a narrow to a broader definition of money, and further implies that the instability in the different velocities can be found in the demand for deposits and currency components which define a narrow M1 definition of money. It is of paramount importance to note that a stable velocity over the period 1966-1997 will ultimately depend on whether we use the broadest definition or not.

The analysis thus far suggests that the unstable and stable velocities for M1, M2 and M3 respectively, may have an important bearing on the interpretation of the empirical hypotheses described in Table 5.1. Over the period of direct monetary control measures the relation between the M3 money multiplier and total credit may not necessarily describe liability management, but rather the growth of off-balance-sheet items. If credit extensions took place outside the banking system to overcome reserve constraints imposed by the Central Bank, then the relevant question is what happens when the loans are spent? A possible answer is that some of the funds find their way back to the balance sheet of banks and appear as deposits on the liability side. The potential implication is that in the long-run banks can fulfil their role as financial intermediaries despite loan arrangements initially taking place outside the banking system. Thus, in the short-run we would expect that an increase in the demand for credit causes the *cd* and *rd* ratios in the M3 money multiplier to rise (rise in velocity), so that an increase in credit demand impacts negatively on the M3 money multiplier. In the long-run, if some of the credits extended outside the banking system find their way back as deposits on the balance sheet of banks, we would expect the *cd* and *rd* ratios in the M3 money multiplier to fall (fall in velocity), so that credit demand impacts positively on the M3 money multiplier.

5.4.2 Indirect monetary control measures: 1980-1997

Following the De Kock Commission's recommendations in its Interim Report in 1978 and eventually its Final Report in 1985, the period after 1979 witnessed a significant change in monetary policy from direct control measures to more market-oriented measures. Some of the major changes included the abolition of deposit rate controls in March 1980, the abolition of bank credit ceilings from September 1980, and lower liquid asset and cash reserve requirements. In addition, the SARB abolished the direct link between its rediscount rate and the prime overdraft rate of banks' in 1982.

With the exception of some minor amendments over the period 1980-1997 (Schoombee, 1996), the SARB's monetary policy was primarily based on the cost of borrowing from the discount window[11]. Through its open market operations the SARB always ensures that financial institutions remain indebted to it. When financial institutions seek accommodation at the discount window, the SARB can charge an interest rate slightly above or equal to its chosen bank rate (Whittaker, 1992). Short-term market interest rates will closely approximate the discount rate since financial institutions will not lend at a rate which is below the discount rate nor will they borrow at a rate which is higher than the prevailing discount rate[12].

In 1985 the SARB adopted a policy of setting predetermined monetary growth targets for M3. According to the SARB, however, monetary growth targeting has never been based on a rigid monetary growth rule as proposed by monetarists, but could rather be described as a more flexible approach (Mohr and Rogers, 1995).

It should be clear from the above that the market-oriented monetary policy measures adopted since 1980 closely reflect an accommodationists' view of how the banking system operates (Rogers, 1985, 1986; Moore and Smit, 1986). The Central Bank will set

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[11] In March 1998, the SARB adopted the repo rate system which is a more flexible system compared to the old system where the SARB set its lending rate at the discount window. The cost of borrowing under this new system is determined by daily tenders, so that the cost of borrowing ultimately depends on the amount of money the SARB is willing to make available to commercial banks on a daily basis.

[12] Nel (1994) showed that after the gradual implementation of the current monetary policy in the early 1980s, the SARB established a closer link between the bank rate and short-term market interest rates during the later part of the 1980s.

the supply price of reserves and be ready to supply any amount of reserves on demand. Commercial banks, who are in the business of selling credit, will then base their lending rates as some mark-up over the cost of borrowing from the discount window and supply any amount of credit on demand. Structuralists, however, will argue that the marginal cost of borrowed funds increases, which induces banks to seek alternative options such as liability management practices.

5.5 Econometric methodology

To test the different models outlined in Table 5.1, all the empirical tests will be based on Granger causality type tests. By adopting the approach proposed by Granger (1988), the empirical tests will not only detect *short-run* causality through the standard Granger procedure, but also *long-run* causality through cointegration analysis. Given that all the models in Table 5.1 are bivariate, it is important that the procedure used to estimate the single cointegrating vectors complies with the basic criteria for efficient estimation (Gonzalo, 1994:224)[13]. In this regard, the analysis will consider the Auto Regressive Distributed Lag (ARDL) procedure developed by Pesaran and Shin (1999).

Consider the following ARDL(p,q) model when the underlying variables are I(1) and there exists a stable long-run (cointegrating) relationship between y_t and x_t:

$$y_t = \alpha_0 + \sum_{i=1}^{p} \phi_i y_{t-i} + \beta' x_t + \sum_{i=0}^{q-1} \beta_i^{*'} \Delta x_{t-i} + \eta_t, \qquad (5.1)$$

where x_t is the I(1) variable and η_t the disturbance term.

The long-run relationship between y_t and x_t solved from equation (5.1) is given by:

$$y_t = \alpha_1 + \delta x_t + \mu_t, \qquad (5.2)$$

[13] Inder (1993), for example, shows that the omission of dynamics in the first-step static OLS procedure may be detrimental to the performance of the estimator in finite samples. Inder also shows that the inclusion of dynamics corrects for the endogeneity bias.

where α_1 is the long-run parameter estimate of the constant, δ is the long-run parameter estimate of the variable x_t, and μ_t is the long-run random disturbance term.

Pesaran and Shin (1999) have shown that even when the x_t's are endogenous, valid asymptotic inferences on the short-run and long-run parameters can be drawn once an appropriate choice of the order of the ARDL model is made. According to Pesaran (1997), the Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC) perform relatively well in small samples, although the SBC is slightly superior to the AIC (Pesaran and Shin, 1999).

By utilising the residuals from equation (5.2) consider the following error correction model:

$$\Delta y_t = \alpha_2 + \sum_{i=1}^{r} \beta_{yi} \Delta y_{t-i} + \sum_{i=0}^{s} \beta_{xi} \Delta x_{t-i} + \alpha_3 \mu_{t-1} + \varepsilon_t, \qquad (5.3)$$

where μ_{t-1} is the lagged error correction term obtained from the residuals in equation (5.2) and ε_t the short-run random disturbance term. From equation (5.3), the null hypothesis that x does not Granger cause y would be rejected if the lagged coefficients of the β_{xi}'s are jointly significant based on a standard F-test (or Wald test). Conversely, when Δx_t replaces Δy_t as the left-side variable, then the null hypothesis that y does not cause x would be rejected if the lagged coefficients of the β_{yi}'s are jointly significant.

The error correction term (μ_{t-1}) in equation (5.3) provides a useful alternative to the standard Granger causality test described above. The standard Granger causality procedure is based on *past changes* in one variable explaining *current changes* in another. If, however, variables share a common trend (long-run relationship), then *current* adjustment in y towards its long-run equilibrium value are partly the result of *current* changes in x. Such causality can be detected if the error correction term in equation (3) is statistically significant. So, if the relevant variables are cointegrated, then

causality must exist in at least one direction which is not always detectable if the results are only based on the standard Granger procedure (Granger, 1988)[14].

It is important to highlight some caveats related to the concepts of causality and exogeneity. Standard Granger causality tests are only indicative whether one variable *precedes* another (Maddala, 1988; Urbain, 1992). In many empirical studies causality through the error term is used as a test for *weak exogeneity*, since it shows how the short-run coefficients of the variables adjust towards their long-run equilibrium values (Engle and Granger, 1987; Harris, 1995). Since weak exogeneity is a necessary condition for efficient estimation, more weight will be attached to causality through the error correction term as opposed to causality through the standard Granger procedure, which only detects short-run causality.

5.6 Empirical results

All the data are quarterly and seasonally unadjusted over the sub-periods 1966q1-1979q4 and 1980q1-1997q4[15]. Before we apply the ARDL procedure outlined in the previous section, it is first necessary to determine whether the variables in Table 5.1 are I(1) and whether the I(1) variables cointegrate to form an I(0) time series. Standard Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests in Tables 5.2 over the two sub-periods, show that all the variables in levels are non-stationary but stationary in first differences[16].

[14] The standard procedure to follow when testing for Granger causality is to difference non-stationary variables. However, after the publication of Engle and Granger's (1987) two-step procedure it became apparent that these models could be misspecified, since they omit the error correction term.

[15] The data are available from the SARB's historical data series published on the internet. Data for the monetary base (see Table 5.1) are obtained from International Financial Statistics (various issues). Based on Ericsson *et. al's* (1994) assertion that variance dominance is not always a necessary condition for encompassing, all the data are seasonally unadjusted.

[16] Similar results were obtained when the DF and ADF tests included seasonal dummies.

Table 5.2

Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests

Variables	DF statistics	ADF statistics
1966Q1-1979Q4		
Lcredit	0.78	0.16
Lh	0.32	0.25
LM3	1.53	0.52
Lmi	0.76	0.95
Lm	-0.71	0.28
ΔLcredit	-6.68**	-3.08**
ΔLh	-7.33**	-6.55**
ΔLM3	-7.78**	-4.21**
ΔLmi	-10.78**	-6.08**
ΔLm	-11.99**	-3.40**
1980Q1-1997Q4		
Lcredit	-1.48	-1.49
Lh	-0.83	-0.88
LM3	-1.81	0.90
Lmi	-1.42	-1.91
Lm	-2.96	2.26
ΔLcredit	-8.42**	-4.67**
ΔLh	-8.54**	-2.94**
ΔLM3	-6.24**	-4.10**
ΔLmi	-9.33**	-8.74**
ΔLm	-10.13**	-8.76**

Notes:

1. ** denotes significance at the 5% level based on the response surface estimates given in Mackinnon (1991).

2. The optimal lag length was determined by three different criteria: Akaike Information Criterion; Hannan-Quinn Criterion; and Schwartz Bayesian Criterion.

Following Granger's (1997) suggestion, preliminary cointegration tests were based on the simple first step procedure proposed by Engle and Granger (1987). The cointegration tests indicated that most of the relations in Table 5.1 are cointegrated at least at the 10% significance level. However, Kremers *et. al.* (1992) have shown that their error correction procedure can generate more powerful cointegration tests than those based on Engle and Granger's first step procedure, because the residuals of the static cointegrating relationship ignore valuable information[17]. An application of the error correction procedure showed that all the relations in Table 5.1 are cointegrated at the 5% significance level although, according to Kremers *et. al.* (1992:341), the critical values based on Mackinnon (1991) are only a 'conjecture'.

Note that the Kremers *et. al.* (1992) procedure is similar to the Pesaran *et. al.* (1996) procedure of testing for long-run relations described in Chapter 4. The only difference is that the Kremers *et. al.* (1992) procedure tests for the significance of the error correction coefficient, while the Pesaran *et. al.* (1996) procedure tests for the joint significance of the error correction coefficient and the lagged level of the explanatory variable. These results are not reported, because the unrestricted error correction procedure in Chapter 4 and the ARDL procedure described in the previous section are similar – the unrestricted error correction procedure captures the short-run and long-run effects in one model, while the ARDL procedure first estimates the long-run coefficients and then obtains the error correction model. By applying the ARDL procedure described in the previous section, the empirical results (Tables 5.4 and 5.5 in the next section) will capture short-run causality effects, while a significant error correction coefficient will capture long-run causality effects, but at the same time, indicate that the variables are cointegrated.

Table 5.3 reports cointegration tests based on Johansen's maximum likelihood systems procedure[18]. The maximum eigenvalue and trace test statistic verify that all the variables

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[17] The Kremers *et. al.* (1992) procedure is based on the significance of the error correction coefficient rather than the residuals in a static long-run relationship as proposed by Engle and Granger (1987). The loss of power arises because the residual based tests assume that the dynamics are error dynamics, rather than structural dynamics.

[18] See Johansen and Juselius (1990). Although the Johansen procedure is generally seen as one of the most powerful tests for cointegration (Harris, 1995), an insufficient lag length (over-parameterisation) could lead to the over-rejection of the null hypothesis (Boswijk and Franses, 1992). However, this could effectively be avoided with a rigorous pre-testing procedure of the optimal lag length (see the endnote of Table 5.3).

in the bivariate models are cointegrated at the 5% significance level. Moreover, evidence of cointegration also implies that causality must exist in at least one direction.

Table 5.3

Johansen's Cointegration Tests

Johansen's cointegration tests for the period 1966q1-1979q4			
Variables included in VAR	λ Max eigenvalue	λ Trace	*k*
1) *Lh, Lcredit*	19.57**	25.52**	2
2) *LM3, Lh*	20.65**	35.26**	6
3) *Lm, Lcredit*	29.42**	34.42**	2
4) *LM3, Lcredit*	16.17**	21.50**	4
5) *Lmi, Lm3*	33.30**	38.80**	6
Johansen's cointegration tests for the period 1980q1-1997q4			
Variables included in VAR	λ Max eigenvalue	λ Trace	*k*
1) *Lh, Lcredit*	69.36**	75.31**	1
2) *LM3, Lh*	25.05**	28.35**	2
3) *Lm, Lcredit*	67.42**	78.20**	1
4) *LM3, Lcredit*	30.64**	34.44**	2
5) *Lmi, LM3*	27.86**	31.69**	2

Notes

1. ** denotes significance at the 5% level where Ho: r = 0 and Ha: r = 1and k is the order of the VAR model. The 5% critical values for the max eigenvalue and trace test statistics are 15.87 and 20.18 respectively.
2. The critical values computed by Osterwald-Lenum (1992) were used to determine the deterministic components in the underlying VAR model (Harris, 1995). In each case the constant was restricted to lie inside the cointegration space without a trend. In addition, three seasonal dummies were included in all the VAR models.
3. The Akaike Information and Schwartz Bayesian selection criteria were used to determine the order of the VAR. In cases where the two selection criteria contradicted each other, a likelihood ratio test was performed to eliminate lags from a general to a more specific model.

5.6.1 Empirical results under direct control measures: 1966q1-1979q4

The long-run elasticity estimates and the corresponding error correction models based on the ARDL procedure are reported in Table 5.4. From the first set of regressions it can be seen that there is bi-directional causality between *Lh* and *Lcredit*. Thus, under direct control measures the monetary authorities managed to exert some direct influence on the expansion of total credit through their control over the monetary base. However, even under direct control measures credit also determined the monetary base. The long-run elasticity estimate shows that a one percent increase in *Lcredit* only leads to 0.75 percent increase in *Lh*. The corresponding Wald test statistic indicates that the long-run elasticity estimate of 0.75 is significantly different from unity (or less than proportionate), which supports the contention that the monetary authorities exerted some direct control over the money supply.

The second set of causality tests in Table 5.4 shows that there is unidirectional causality from *LM3* to *Lh*. This is an interesting result, given that the first and second set of causality tests are theoretically equivalent, although the second set is a direct test of the money supply process proposed by monetarists. The distinguishing feature between the first and second set of causality tests could be that in the second set the money multiplier plays an important role, whereas in the first set the role of the money multiplier is effectively circumvented. If the money multiplier is unstable, causality will not be detected *directly* from *Lh* to *LM3*, but *indirectly* from *Lh* to *Lcredit*. One important similarity between the first and second set of causality tests is that the 0.78 elasticity estimate in the second set, conditional on *LM3* being exogenous, again reflects that the amount of reserves was not enough to support increases in the money supply.

Table 5.4

Causality Results based on Error Correction Models (ECM), 1966q1-1979q4

Regression	Long-run elasticities solved from ARDL models	Wald tests for unitary long-run elasticities	Order of lags in ECM	Joint significance (β_{yi} and β_{xi})	Error term (α_3)	Final results
1) *ΔLh on ΔLcredit*	0.75*** [18.90]	36.87***	(0,0)	–	2.91*	
ΔLcredit on ΔLh	1.35*** [26.89]	48.39***	(2,0)	–	7.62***	*Lcredit ⇔ Lh*
2) *ΔLh on ΔLM3*	0.78*** [31.13]	75.81***	(0,3)	4.94	7.71***	
ΔLM3 on ΔLh	1.36*** [5.03]	na	(3,0)	–	0.01	*LM3 ⇒ Lh*
3) *ΔLcredit on ΔLm*	6.51*** [2.76]	na	(2,0)	–	0.76	
ΔLm on ΔLcredit	0.21*** [60.04]	na	(0,4)	9.23*	12.63***	*Lcredit ⇒ Lm*
4) *ΔLmi on ΔLM3*	1.02*** [140.00]	8.84***	(4,0)	–	27.39***	
ΔLM3 on Δ Lmi	0.98*** [163.37]	6.60**	(5,5)	14.82**	17.80***	*Lmi ⇔ LM3*
5) *ΔLM3 on ΔLcredit*	0.95*** [29.61]	1.81	(3,3)	11.99***	3.89**	
ΔLcredit on ΔLM3	1.05*** [44.19]	6.14**	(2,0)	–	12.12***	*Lcredit ⇔ LM3*

Notes:

1. Table entries for β_{yi}, β_{xi} and α_3 are Wald test statistics which have a chi squared distribution.
2. The table entry 'na' indicates that the relevant variable is either not weakly exogenous, or the elasticity is sufficiently small or statistically insignificant, so that the Wald test for a unitary long-run elasticity is not reported.
3. Three asterisks (***) denote significance at the 1% level; ** at the 5% level; and * at the 10% level.
4. The AIC and SBC were used to determine the optimal lag-lengths in the ARDL and error correction models.
5. The numbers in [ ] brackets are t-statistics to test whether the long-run elasticities are significantly different from zero.
6. Seasonal dummies (when significant) were included as deterministic components in the ARDL models.

The third set of tests in Table 5.4 shows unidirectional causality from *Lcredit* to *Lm*. From Table 5.4, a one percent increase in total credit leads to a 0.21 percent increase in the money multiplier. The importance of this test is that it may explain how agents effectively avoided the direct control measures imposed by the monetary authorities. When reserve shortages developed under direct control measures, loan arrangements initially took place outside the banking system. Once the loans were spent, they re-entered the banking system as deposits; reduced the *cd* and *rd* ratios in the money multiplier, and eventually led to an increase in the money multiplier[19]. The 0.21 elasticity estimate therefore acts as a supplement to the 0.75 elasticity estimate in the first regression (or the 0.78 elasticity in the second regression), so that credit demand is supported by an almost proportionate increase in the level of reserves.

The absence of causality from *Lm* to *Lcredit*, may support our previous contention that the monetary authorities' control over the money supply is not directly observable if the regressions are based on the second set in Table 5.4, but only indirectly through the first set of regressions. This result does not imply that the monetary authorities had no direct control over the money supply, but merely suggests that the money multiplier is unstable.

The fourth set of regressions provides a summary of the results obtained thus far. Bi-directional causality between *Lmi* and *LM3* first reiterates the direct control monetary authorities exerted over the money supply. Second, through the mechanisms described previously, agents effectively avoided direct control measures so that that *Lmi* also determines *LM3*. The long-run elasticity estimates are very close to unity, although the Wald tests show that the exogenous impact of the money supply is slightly higher than the exogenous impact of money income.

The final causality tests in Table 5.4 supports the contention that the money supply is endogenously determined, with *Lcredit* causing a proportionate increase in *LM3*. Causality from *LM3* to *Lcredit* may be interpreted in two ways. First, it could reflect the

[19] The negative coefficient in the error correction model (not reported here), reflects the short-run where credit extended outside the banking system initially increases the *cd* and *rd* ratios in the money multiplier (see the theoretical discussion in section 5.4.1). The positive long-run coefficient is indicative of credit extended outside the banking system returning to the balance sheet of banks.

exogenous influence of the monetary authorities on the money supply. Second, the result may support the theoretical suppositions of the liquidity preference view, where agents do not willingly absorb any amount of new deposits created by bank lending. The result may therefore be interpreted as evidence of a demand for money function which acts independently from a demand for loans function. Since the results earlier suggested that the money multiplier is unstable, the cointegrating relationship between *Lcredit* and *LM3* may well support the liquidity preference view, rather than being reflective of direct control by the monetary authorities.

5.6.2 Empirical results under indirect control measures: 1980q1-1997q4

The long-run elasticity estimates and the corresponding causality results from the error correction models for the second sub-period are given in Table 5.5. The results from the first regressions reflect the significant change towards more market-oriented monetary policy measures, with unidirectional causality from *Lcredit* to *Lh*.

Similarly, the second set of regressions shows unidirectional causality from *LM3* to *Lh*, while the elasticity estimate of 0.98 (and corresponding Wald test) indicates that reserves proportionately supported increases in the money supply. Thus far, the results clearly support the accommodationist view of how the banking system operates under indirect control measures.

Although the third set of regressions in Table 5.5 depicts unidirectional causality from *Lcredit* to *Lm*, the magnitude of the long-run elasticity of 0.03 suggests that unlike the period of direct control measures, more market-oriented monetary policy measures did not induce agents to seek finance outside the banking system or encourage liability management practices.

Table 5.5

Causality Results based on Error Correction Models (ECM), 1980q1-1997q4

Regression	Long-run elasticities solved from ARDL models	Wald tests for unitary long-run elasticities	Order of lags in ECM	Joint significance (β_{yi} and β_{xi})	Error term (α_3)	Final results
1) *ΔLh on ΔLcredit*	0.92*** [17.53]	1.87	(3,0)	–	5.94**	
ΔLcredit on ΔLh	0.97*** [8.93]	na	(2,0)	–	2.61	*Lcredit ⇒ Lh*
2) *ΔLh on ΔLM3*	0.98*** [25.15]	0.20	(4,0)	–	9.69***	
ΔLM3 on ΔLh	0.79** [2.16]	na	(0,1)	7.84***	0.01	*LM3 ⇒ Lh*
3) *ΔLcredit on ΔLm*	-29.30 [-0.64]	na	(1,0)	–	0.47	
ΔLm on ΔLcredit	0.03* [1.67]	na	(5,0)	–	10.35***	*Lcredit ⇒ Lm*
4) *ΔLmi on ΔLM3*	0.87*** [5.97]	na	(4,0)	–	0.82	
ΔLM3 on Δ Lmi	1.00*** [77.37]	0.01	(2,1)	22.91***	23.54***	*Lmi ⇒ LM3*
5) *ΔLM3 on ΔLcredit*	0.92*** [41.91]	10.91***	(2,2)	6.62**	4.01**	
ΔLcredit on ΔLM3	1.05*** [45.86]	4.81**	(0,0)	–	5.01**	*Lcredit ⇔ LM3*

Notes:

1. Table entries for β_{yi}, β_{xi} and α_3 are Wald test statistics which have a chi squared distribution.
2. The table entry 'na' indicates that the relevant variable is either not weakly exogenous, or the elasticity is sufficiently small or statistically insignificant, so that the Wald test for a unitary long-run elasticity is not reported.
3. Three asterisks (***) denote significance at the 1% level; ** at the 5% level; and * at the 10% level.
4. The AIC and SBC were used to determine the optimal lag-lengths in the ARDL and error correction models.
5. The numbers in [ ] brackets are t-statistics to test whether the long-run elasticities are significantly different from zero.
6. Seasonal dummies (when significant) were included as deterministic components in the ARDL models.

The fourth set of regressions in Table 5.5 again provides a summary of the results presented thus far. Unidirectional causality from *Lmi* to *Lm3* reflects the endogenous nature of the money supply over the period of more market-oriented monetary policy measures[20].

Since the results unconditionally show that the SARB imposed no direct liquidity constraints, bi-directional causality between *LM3* and *Lcredit* in the fifth set of regressions supports the theoretical propositions of the liquidity preference view. Causality from *Lcredit* to *LM3* emphasises the endogenous nature of the money supply, while reverse causality can again be interpreted as evidence of an independent money demand function.

5.7 Conclusion

The different theoretical approaches tested in the empirical analysis have proved to be most informative in describing South Africa's money supply process over the periods of direct and indirect monetary control measures. The analysis further suggests that it is a combination, rather than a single approach, which enables us to draw some concrete conclusions on the endogenous/exogenous nature of the money supply:

i) From a long-run perspective, the most important conclusion to be drawn from the empirical results is that irrespective of the monetary regime system at the time, the money supply in South Africa is endogenously determined over the period 1966-1997. The endogenous nature of the money supply supports the empirical analysis in Chapter 4 which showed that the money supply has been passive in the inflationary process. From a monetarist perspective, the inflationary impact of excessive monetary expansion by the monetary authorities is only relevant over the period of direct control measures. Whether excessive monetary expansion can be regarded as one of the underlying causes of inflation during the period 1966-1979 is debatable, because the money supply is also endogenous over this period. During the period of direct control measures, liquidity

[20] The results for the first, second and fourth regressions all yield consistent results, insofar as the null hypothesis of a unitary long-run elasticity cannot be rejected conditional on *Lcredit*, *LM3* and *Lmi* as the exogenous variables.

constraints imposed by the Central Bank were largely ineffective in controlling the money supply. Disintermediation, together with an ineffective liquid asset reserve system, were some of the underlying reasons why the money supply was mainly credit-driven and beyond the direct control of the Central Bank.

The period of indirect control measures closely reflects an accommodationist's view of how the banking system operates and how the money supply process comes about. In sharp contrast to the period of direct control measures, more market-oriented measures over the period 1980-1997 ensured that loan arrangements took place within the banking system. The results suggest that the Central Bank fulfilled its role as lender of last resort and supplied reserves on demand.

ii) Over the two sub-periods under analysis the empirical results further show that even under an endogenously determined money supply, 'excess' money may come into existence because agents do not automatically absorb any amount of deposits created by the flow of new bank lending. In Chapter 4 it was shown that there is bi-directional causality between consumer price inflation and 'excess' money, and unidirectional causality from consumer price inflation to money. This result suggests that 'excess' money can be created under an endogenously determined money supply which induces spending and further price increases so that the demand for deposits is eventually reconciled with the supply of deposits created by bank lending. It is also interesting to note from the analysis in Chapter 4 that 'excess' money created under an endogenously determined money supply is spent on consumer goods and services, and not broader indexes such as the GDP and GDE deflators, since the results showed unidirectional causality from broad measures of inflation to 'excess' money.

iii) One of the underlying reasons to explain the failure of the SARB to reach predetermined M3 monetary growth targets on a consistent basis since the mid 1980s can be found in the endogenous nature of the money supply and not, as Moll's (1999) study claims, because of an unstable M3 velocity. Although the M3 velocity is stable over the whole period under analysis, the stable long-run relationship between money and money income is only valid conditional on money income being exogenous, while it

is invalid to regard money as exogenous over the whole period 1966-1997[21]. Over the period of monetary growth targeting, money income determined an endogenous money supply, so that the M3 money supply lost its effectiveness as a *leading indicator* for monetary policy. The most important policy implication is that the SARB controlled the money supply indirectly during the period 1980-1997, through an increase in interest rates, and at the potential cost of a slowdown in economic activity. The potential cost of restrictive monetary policy during this period becomes even higher if it is taken into account that the demand for M3 money balances is insensitive to the rate of interest.

iv) Since South Africa's money supply appears to have been endogenously determined over the period 1966-1997, it follows that any control by the Central Bank, albeit of a direct or indirect nature, must have addressed the symptoms of inflation and not its underlying causes. A thorough long-run analysis of inflation in South Africa will have to search beyond the realms of the Central Bank and focus on the potential inflationary impact of cost-push and/or structural forces in the South African economy.

[21] The empirical evidence supports the stable long-run relationship (cointegrating) between money and money income over the two sub-periods. First, money income remains exogenous to the M3 money supply irrespective of the monetary system. Second, the long-run elasticities of 0.98 and 1.00 conditional on money income being exogenous are indicative of parameter constancy over the whole period under analysis.

PART 2

THE CAUSES OF INFLATION IN SOUTH AFRICA

CHAPTER 6

THE INFLATIONARY IMPACT OF NET 'EXCESS' DEMAND, DISPERSION OF DEMAND AND AGRICULTURAL DEMAND IN SOUTH AFRICA

6.1 Introduction

The main purpose of this chapter is to analyse three different types of demand inflation in South Africa over the period 1962-1997. The first type of demand inflation is a pure demand-pull theory of inflation. Although a Phillips curve is strictly speaking a hybrid model of inflation which incorporates demand and supply elements (Thirlwall, 1974), throughout this chapter demand-pull inflation will be referred to as a Phillips curve model, assuming that pressure in the product market is a good proxy for pressure in the labour market.

The main motivation for analysing two additional sources of demand inflation lies in the endogenous nature of South Africa's money supply over the period 1966-1997. The inflationary impact of the dispersion of demand and 'excess' demand for agricultural products originates from structuralist writings who believe that these sources of demand inflation are more persistent and likely to occur under an endogenously determined money supply. The dispersion of demand between sub-markets, which is distinctly different from generalised net 'excess' demand, has been developed in the theoretical and empirical literature to capture an additional explanation of inflation other than a conventional Phillips curve relation. The second structuralist demand factor of inflation emphasises the inflationary impact of 'excess' demand for agricultural products due to supply inelasticities in this sector.

In the context of this chapter, it is acknowledged that a purely demand-pull inflation could still characterise an economy where the money supply is endogenously determined. Contractionary or expansionary monetary policy will then be based on indirect control of the money supply rather than direct control as advocated by monetarists. However, as

soon as we introduce an endogenously determined money supply it becomes important to establish empirically whether inflation is purely demand-pull or whether structural and/or cost-push forces provide alternative explanations of inflation. It is more likely in a country where the money supply is endogenously determined and structural and/or cost-push forces of inflation are persistent, that a Phillips curve relation may not necessarily provide a stable relation between inflation and net 'excess' demand. Thus, under an endogenously determined money supply monetary policy will prove to be less effective in stabilising and reducing the inflation rate if structural forces and/or cost-push forces of inflation are persistent and, at the same time, it will also become increasingly difficult for monetary authorities to assess the cost of their disinflation policies. The degree of instability, or whether a Phillips curve relation is unstable at all, will largely depend on how severe and persistent structural and/or cost-push forces of inflation are.

Against this background, the chapter is organised as follows. Section 6.2 provides a theoretical and empirical exposition of a Phillips curve relationship in South Africa. Section 6.3 investigates two potential structural sources of inflation in South Africa. Section 6.4 incorporates the Phillips curve relationship developed in section 6.2 and the dispersion of demand in section 6.3 into one model. Finally, section 6.5 ends with some conclusions.

6.2 A Phillips curve relationship in South Africa, 1962-1997

In this section an attempt will be made to distinguish between two main approaches in analysing and testing a Phillips curve relationship. The first approach is based on the existence of a stable short-run Phillips curve, while the second approach assumes that the Phillips curve is inherently unstable. In addition, we will also present an overview of two issues which have attracted a great deal of attention and controversy over the years: an appropriate measure of inflation expectations and the natural rate hypothesis. The overview of existing studies will provide a useful theoretical and empirical framework on which to base a Phillips curve relationship for South Africa. The final part of this section tests a Phillips curve relation for South Africa over the period 1962-1997.

6.2.1 A stable short-run Phillips curve relation

To derive an expectations-augmented Phillips curve we can first write the following price and wage equations which correspond to a demand wage and supply wage relation respectively (Blanchard and Katz, 1997),

$$\dot{p}_t = \alpha_p + \dot{w}_t + \varepsilon_{pt} \tag{6.1}$$

$$\dot{w}_t = \alpha_w + \dot{p}_t^e + \beta(\dot{y} - \bar{\dot{y}}) + \varepsilon_{wt}, \tag{6.2}$$

where $\dot{p}$ is price inflation, $\dot{w}$ wage inflation, p^e inflation expectations of wage setters and the output gap ($e\dot{D}^{gap}$) is defined as the actual real output growth rate ($\dot{y}$) minus the potential (or natural) real output growth rate ($\bar{\dot{y}}$).

Substitute equation (6.2) into equation (6.1) to obtain the following reduced-form expectations-augmented Phillips curve

$$\dot{p}_t = \alpha + \dot{p}_t^e + \beta(\dot{y} - \bar{\dot{y}}) + \varepsilon_t, \tag{6.3}$$

where $\alpha = \alpha_p + \alpha_w$ and $\varepsilon_t = \varepsilon_{pt} + \varepsilon_{wt}$. Although equations (6.2) and (6.3) are similar to the original Phillips curve developed in 1958 they differ in three important aspects. First, unemployment is substituted with output if it is assumed that pressure in the product market is a good proxy for pressure in the labour market (e.g., Gordon, 1977; Laxton *et al.*, 1995). These studies have mainly been concerned with the output cost of disinflation policies, but the main motivation for using output as a proxy in the case of South Africa lies in the inaccurate nature of unemployment data over a long and extended period. Before 1983 unemployment data were only available for Whites, Colourds and Asians, but not for Blacks. Alternatively, researchers constructed their own unemployment series which subsequently led to large discrepancies in the results reported in different studies (Bromberger, 1989; Fallon and de Silva, 1993; Mohr and

Rogers, 1995)[1]. Second, the original Phillips curve depicts a relation between wage inflation and the *level* of unemployment. However, according to Gordon (1977, 1997) empirical studies should also consider the *rate of change* of unemployment or output since the exclusion of the *rate of change* variables could lead to misspecification bias. Third, following the pioneering work of Friedman (1968) and Phelps (1968), by introducing inflation expectations the Phillips curve no longer depicts a stable long-run relationship between inflation and unemployment (or output). Deviations from the natural unemployment rate will only be transitory and mainly reflect expectation errors on behalf of workers. Workers are not interested in nominal wages and will always bargain to maintain a constant real wage. Once expectations are realised in the long-run the actual unemployment rate reverts back to the natural rate. In the long-run the Friedman-Phelps analysis implies that $\dot{p} = \dot{w} = \dot{p}^e$, which is then associated with a constant or non-accelerating inflation rate. Policy makers can only reduce unemployment below the natural rate at the cost of an ever-accelerating inflation rate.

Since the publication of the original Phillips curve in 1958 a voluminous literature has emerged to explain wage and price inflation according to the natural rate hypothesis in equations (6.2) and (6.3). The main point of departure of these studies is that a stable short-run Phillips curve not only provides a useful tool for policy makers to determine the output cost of disinflation policies, but the acceptance of the natural rate hypothesis implies that an unemployment rate below the natural rate can only be achieved at the cost of accelerating inflation (Gordon, 1997; Stiglitz, 1997). In other words, no long-run benefits in terms of a permanently higher output and lower unemployment rate can be

[1] Earlier work on Phillips curve relations in South Africa during the 1950s and 1960s typically used unemployment measures which excluded Blacks. The main motivation for such an exclusion can be found in Hume's (1970) empirical work which showed that a Phillips curve relation exists for Whites but not for Blacks. According to Hume (1970) the absence of a Phillips curve relation for Blacks may be the result of a highly elastic supply of black labour. We can also add to this that South Africa's history of racial discrimination effectively reduced the bargaining power of Blacks in labour markets.

However, over a long time period the exclusion of Blacks in an unemployment series could lead to erroneous inferences in a Phillips curve relation. As time evolved Blacks gained bargaining power following political upheavals such as the Sharpville incident in 1960 (which was a direct result of stagnant Black real wages); labour unrest during the mid 1970s; and the legalisation of Black trade unions in 1980.

reaped from inflationary policies (Smyth, 1992)[2]. However, although the long-run benefits of inflationary policies are negligible according to these studies, high and variable inflation rates could have detrimental effects in the long-run

6.2.2 The instability of the Phillips curve relation

Although the foregoing analysis of a stable Phillips curve is very appealing in terms of its simplicity and clear choices it presents to policy makers, Alogoskoufis and Smith (1991) show that a standard Phillips curve relation over the period 1857-1987 for the United Kingdom and 1892-1987 for the United States displays two major structural breaks. They base their analysis on the well-known Lucas critique (1976) which states that agents' expectations are sensitive to changes in the policy regime system being implemented at a specific point in time. Phillips curve relations are therefore subject to a changing policy environment and hence changing expectations, which render a standard Phillips curve relation inappropriate on which to base policy decisions. Their empirical analysis shows that major shifts in the Phillips curve have occured following the abandonment of the gold standard in 1914 and the breakdown of the Bretton Woods system in the early 1970s[3].

A different monetary system and supply shocks such as those experienced to oil prices in 1973, suggest a leftward shift in the Phillips curve inflation-output trade-off as a result of different inflation expectations. The view that structural and/or cost-push forces of inflation cause shifts in a Phillips curve relation, was popularised during the 1970s by Keynesian economists who sought to explain the stagflation phenomena experienced by many countries at the time (Mohr and Rogers, 1995).

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[2] Chiarini and Piselli (1997) find an interesting result for the Italian economy over the period 1976q1-1993q4. Their empirical evidence point to the existence of a long-run Phillips curve while the relation disappears in the short-run.

[3] Useful applications of this approach can be found in Anderton (1997) and Turner (1997).

6.2.3 Inflation expectations

Since the introduction of the expectations-augmented Phillips curve in the late 1960s, a vast amount of empirical and theoretical literature has emerged to approximate an appropriate inflation expectation measure. In its simplest form, researchers who have used adaptive expectations in their models have proxied it by the lagged value of inflation,[4] while more sophisticated adaptive expectation models can be found in Filardo (1998) and Pesaran and Pesaran (1997). Others have attempted to improve backward looking models by additionally including forward looking expectations which have typically been based on survey measures of inflation such as the Livingston and Michigan forecast measures (Smyth, 1992, Clark *et al.*, 1996)[5]. However, the commonality shared by all these studies is a basic refinement of the expectations-augmented Phillips curve without considering the implications of an unstable relation.

Because extensive survey measures of inflation are not available in South Africa and, more importantly, since our main interest is to determine whether a stable Phillips curve relation for South Africa exists, we will first adopt a simple procedure to measure inflation expectations proposed by Alogoskoufis and Smith (1991). First consider the following versions of an expectations-augmented price and wage equation

$$\dot{p}_t = \alpha_0 + \alpha_1 \dot{p}_t^e + \alpha_2 (e\dot{D}^{gap}) + \varepsilon_{1t} \tag{6.4}$$

$$\dot{w}_t = \beta_0 + \beta_1 \dot{p}_t^e + \beta_2 (e\dot{D}^{gap}) + \varepsilon_{2t}. \tag{6.5}$$

Next, assume that inflation follows a simple AR(1) process so that inflation expectations are

$$\dot{p}_t^e = \pi(1-\rho) + \rho \dot{p}_{t-1} + \mu_t, \tag{6.6}$$

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[4] Gordon (1970) and Rissman (1993) provide good examples of distributed lag models.

[5] Debelle and Laxton (1997) utilise information from the bond market to proxy long-term inflation expectations.

where π is the steady-state inflation rate and ρ is inflation expectations or the inflation persistence[6] coefficient.

Substitute equation (6.6) into (6.4) and (6.5):

$$\dot{p}_t = \alpha'_0 + \alpha_1 \rho \dot{p}_{t-1} + \alpha_2 (e\dot{D}^{gap}) + \varepsilon_{1t} \tag{6.7}$$

$$\dot{w}_t = \beta'_0 + \beta_1 \rho \dot{p}_{t-1} + \beta_2 (e\dot{D}^{gap}) + \varepsilon_{2t}, \tag{6.8}$$

where $\alpha'_0 = \alpha_0 + \alpha_1 \pi(1-\rho)$ for the price equation (6.7) and $\beta'_0 = \beta_0 + \beta_1 \pi(1-\rho)$ for the wage equation (6.8). Shifts in the Phillips curve relations will occur if the $\alpha_i's$ in equations (6.7) are unstable; a shift in the steady-state price inflation rate π; or a change in inflation expectations and persistence ρ (Alogoskoufis and Smith, 1991). The same arguments can be applied to wage equation (6.8).

To test whether the variables in equations (6.7) and (6.8) are stationary, Table 6.1 provides unit root tests based on standard Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests. The DF and ADF tests only reject the null hypothesis of a unit root for the output gap variable ($e\dot{D}^{gap}$). In addition, Table 6.1 also reports Perron (1990) tests to capture the impact of structural breaks in the series. If the time series contain a structural break then standard DF and ADF tests may lead to an upward bias in ρ. After including dummy variables in the standard ADF equation to capture the oil price shock in 1973, the Perron tests reject the null hypothesis of a unit root for the remaining time series which suggest that all the variables in equations (6.7) and (6.8) are I(0).

[6] A high degree of inflation persistence means that a temporary upward shock to inflation in the current period will result in a high inflation rate for a long-period (Anderton, 1997: 23).

Table 6.1

Unit Root Test Statistics, 1962-1997

Variables	DF-test (1962-1997)	ADF-test (1962-1997)	Perron test (1962-1997)
$e\dot{D}^{gap}$	-6.08**	-7.14**	
$\dot{p}$	-1.81	-2.08	-3.77**
$\dot{w}$	-2.42	-2.75	-4.44**
$\dot{y}$	-3.33**	-2.89	-3.85**
$\dot{D}_U$	-8.02**	-5.15**	
$\dot{D}_W$	-11.26**	-7.66**	

Notes:

1. (˙) over a variable denotes growth rate.
2. (**) denotes significance at the 5% level and (*) at the 10% level.
3. DF and ADF tests for the dispersion measures include a trend.
4. Definition of variables:

   $e\dot{D}^{gap}$ = 'excess demand', i.e. actual output growth ($\dot{y}$) minus potential output growth rate ($\bar{\dot{y}}$).

   $\dot{p}$ = consumer price inflation.

   $\dot{w}$ = growth rate of nominal wages in the private sector (including the agricultural sector).

   $\dot{y}$ = growth rate of real gross domestic product (GDP).

   $\dot{D}_U$ = Unweighted dispersion of the output gap.

   $\dot{D}_W$ = Weighted dispersion of the output gap.

5. Unit root tests for the dispersion measures cover the period 1963-1996.

Theoretically, if wage setters suffer no money illusion, then α, β, and ρ will be equal to one, i.e. inflation contains a unit root. If inflation contains a unit root then wage setters' expectations will be based on inflation in the previous year plus a random shock to

capture the error in last year's expectations from the actual rate[7]. The adaptive expectation process just described, implies that shocks to inflation will have permanent effects if $\rho = 1$; if $\rho = 0$ then inflation is a pure white noise process. Thus, after an initial upward shock in inflation, inflation expectations will remain high for a longer time period the closer ρ is to one ($\rho \Rightarrow 1$)[8].

The AR process followed by inflation can formally be shown in Table 6.2 for annual data.

Table 6.2

Inflation Expectations Based on an Auto Regressive Process, 1962-1997

Dependent variable	*intercept*	$\dot{p}^{e}_{t-1}$	R^2	Durbin Watson	Durbin's h	Standard error
$\dot{p}_t$	1.23 (1.58)	0.88 (12.67)***	0.82	1.51	1.58	2.40

Note:

1) t-statistics in parentheses.

2) (***) denotes significance at the 1% level.

4) A time trend yielded an insignificant result.

The most striking feature in Table 6.2 is the high magnitude of the lagged inflation coefficient, which may be the result of an upward bias following the oil price shock in 1973.

---

[7] The main criticism against models that only include a backward looking expectation component is that, without money illusion, agents always forecast inflation as if it contained a unit root (Debelle and Laxton, 1997: 252). However, Gordon (1997) states that "*Much attention was diverted during the late 1960s and early 1970s to the interpretation of the lagged effect of prices on wages as reflecting adaptive lags in the formation of expectations. Since then, it has become clear that price and wage inertia is compatible with rational expectations... ...The role of the lagged inflation terms is to capture the dynamics of inertia, whether related to expectation formation, contracts delivery lags or anything else.*" *(pp.16-17).*

[8] These views are expressed in Anderton (1997: 24).

To summarise this section, recent studies have attempted to model inflation expectations by a backward and forward looking component. Besides the fact that extensive survey data are not available for South Africa, our inflation expectations model is first based on a simple approach to capture potential sources of instability in a Phillips curve relation for South Africa.

6.2.4 The natural rate hypothesis

Since the natural rate is an unobservable variable, much attention has been diverted to approximate a suitable natural rate time series. In this regard, Kuttner (1994) provides a useful survey of existing measures of potential and natural output. The most popular measures include the Hodrick Prescott Filter; a centred-moving average filter; an approach based on aggregate production functions (Clarke, 1979); and the more recent Kalman filter technique (Debelle and Laxton, 1997; Kuttner, 1994)[9].

All the measures share the advantage that they allow potential output to vary over time in contrast to some of the time invariant measures summarised in Staiger *et al.* (1997). Several factors could render a fixed potential output series inappropriate in developed and developing countries: cost factors such as productivity growth; technological progress, labour market rigidities; structural factors such as structural unemployment; and expansionary demand-side policies (inflation)[10]. Most of the studies which are based on a stable short-run Phillips curve for developed countries in section 6.2.1 include a time-varying potential output measure, even though the implicit assumption is made that potential output varies little and that inflation is purely demand-pull.

---

[9] The Hodrick Prescott and centred-moving average technique have been criticised on the basis that the Hodrick Prescott filter acts as a smoother over most of the sample (Razzak, 1997). Harvey and Jaeger (1993) also show that simple filters may induce spurious regressions.

[10] Most of the studies cited in section 6.2.1 emphasise the negative impact of inflationary finance on potential output. In contrast, Thirlwall (1974) presents theoretical arguments in favour of demand-side policies which reduces the natural unemployment rate, while Leon-Ledesma and Thirlwall (1998) conduct empirical tests for 15 OECD countries and find that the natural rate of growth is responsive to the actual rate of growth.

The choice of an appropriate potential output measure for South Africa will be based on two considerations. First, to capture the inflationary impact of demand inflation the measure will be time-varying. Presumably, potential output is subject to wide fluctuations in a developing country like South Africa and we therefore need to assess the inflationary impact of 'excess' demand net of factors (mentioned earlier) that could induce changes in potential output. Second, in the empirical work presented later, output gaps in *levels* yielded unsatisfactory results. To capture the impact of time variation and a measure in rates of change, potential output is measured as a simple two-sided filter (Clark *et al.*, 1996)

$$\bar{\dot{y}} = \frac{1}{2k+1}\left[\dot{y}_t + \sum_{i=1}^{k}(\dot{y}_{t+i} + \dot{y}_{t-i})\right], \tag{6.9}$$

where $\bar{\dot{y}}$ is potential output; $\dot{y}$ is actual output; and $k = 2$[11]. The output gap ($e\dot{D}^{gap}$) is defined as $\dot{y} - \bar{\dot{y}}$. By adopting a two-sided filter measure we utilise data until 1998, so that our sample period effectively stretches from 1962 until 1996.

6.2.5 Empirical results for a Phillips curve relation in South Africa, 1962-1997

In this section we estimate the coefficients of equations (6.7) and (6.8) recursively to determine whether the parameters are constant. The recursive least squares procedure starts with an initial sample size of n > k, where n is the sample size and k the number of parameters in the model. The initial sample size is then extended by n +1, n + 2.....T observations, and the corresponding coefficients with their ± two standard errors are plotted.

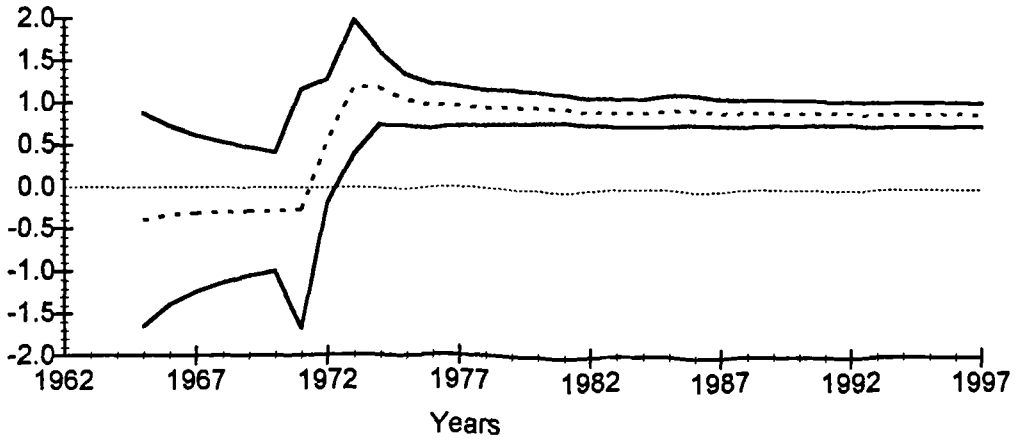
The recursively estimated coefficients in Figures 6.1-6.3 suggest that Phillips curve relations based on equations (6.7) and (6.8) may be unstable over the period 1962-1996.

---

[11] Different values of k were used to obtain a result most consistent with a Phillips curve relation. On the one extreme a value of $k = 0$ implies that potential and actual output are the same so that a Phillips curve relation disappears, but on the other extreme a very high value of k suggests that most of the movements in business cycles are associated with actual output and not potential output (Clark *et al.*, 1996).

Figure 6.1

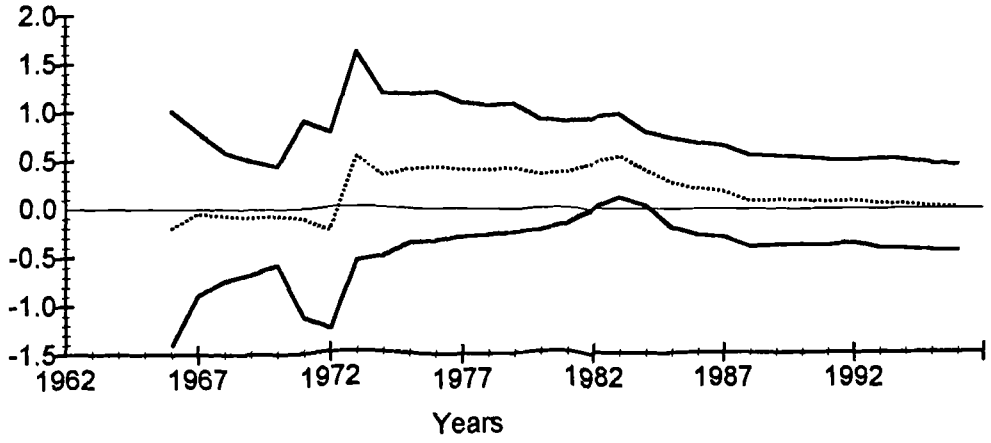
Recursively Estimated Coefficient of p^e_{t-1} in Equation (6.6)



Note: '—' ± 2 standard errors; '.....' coefficient estimate

Figure 6.2

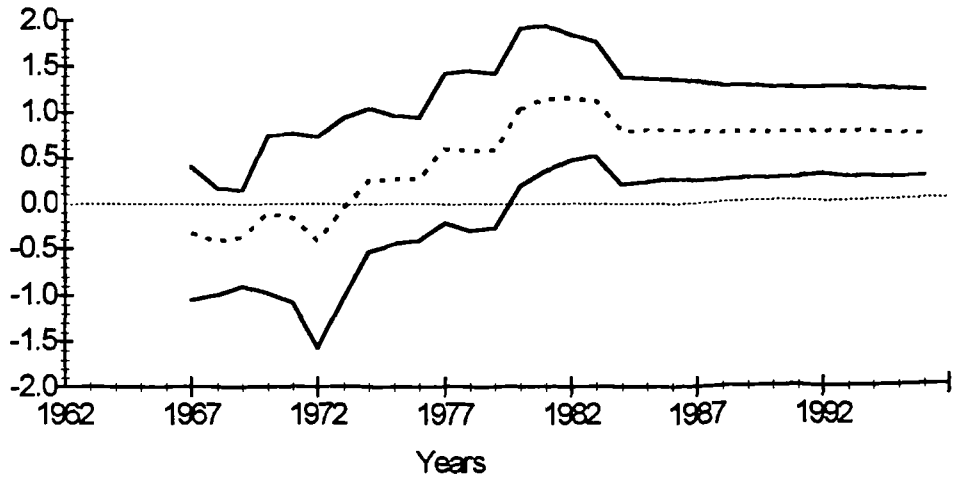
Recursively Estimated Coefficient of $e\dot{D}^{gap}$ in Price Equation (6.7)



Note: '—' ± 2 standard errors; '.....' coefficient estimate

Figure 6.3

Recursively Estimated Coefficient of $e\dot{D}^{gap}$ in Wage Equation (6.8)



Note: '—' ± 2 standard errors; '.....' coefficient estimate

Figure 6.1 shows a clear upward shift in the lagged inflation coefficient in equation (6.6). Similar pictures (not reported here) were also presented when lagged inflation was estimated recursively in price equation (6.7) and wage equation (6.8). The upward shift of inflation expectations or persistence could be the result of a change in the international monetary system following the breakdown of the Bretton Woods system in 1971. Figure 6.1 further illustrates that the upward shift of inflation expectations reaches a ceiling in 1973 when the oil price shock occured, and then remains constant for the rest of the sample period.

According to Strydom (1976), successive devaluations of the rand introduced cost-push inflation which can be viewed as the most significant cause of an accelerating inflation over the period 1971-1973. However, it should also be recognised that the oil price shock in 1973 may have increased import prices and caused accelerating inflation, and not only exchange rate devaluations.

Figure 6.2 depicts the recursively estimated coefficient of the output gap ($e\dot{D}^{gap}$) in price equation (6.7). Before 1973 the gap is negative and seemingly insignificant, but since

1973 the gap becomes positive. Moreover, the output gap displays another potential breakpoint in 1983. Similar to price equation (6.7), wage equation (6.8) in Figure 6.3 yields a negative output gap before 1973, but form 1973 to 1983 the output gap becomes positive while there is also a clear breakpoint in 1983. However, in contrast to the price equation over the period 1973-1983, the output gap in the wage equation is non-constant and spirals upwards. The upward spiral could reflect the behaviour of workers who, in the face of an accelerating inflation, attempted to maintain a constant real wage.

The visual analysis suggests three potential breakpoints in a Phillips curve relation for South Africa. In addition, Table 6.3 summarises various macroeconomic indicators to capture the impact of these potential breakpoints. The first sub-period 1962-1972 was characterised by mild price inflation which averaged around 2.77 percent per annum. Exchange rate devaluations and the oil price shock in 1973 signified a substantial increase in price inflation during the sub-period 1973-1983. On average, however, price inflation remained virtually the same over the sub-periods 1973-1983 and 1984-1997. It is also noticeable from Table 6.3 that there is a close correlation between real output growth and employment growth, where the decline in real output growth since the sub-period 1962-1972 has generally been followed by a similar pattern in employment growth.

Table 6.3

Macroeconomic Indicators for South Africa (annual averages), 1962-1997

Indicators	1962-1972	1973-1983	1984-1997	1994-1997
$\dot{p}$	2.77	12.85	13.21	7.77
$\dot{y}$	5.39	2.82	1.52	2.80
$\dot{e}$	2.38	1.89	-0.82	-1.13

Note:

1. $\dot{e}$ is the growth rate of employment in the private sector.

In the econometric analysis that follows, an attempt will be made to capture the impact of all the potential breakpoints identified by the visual displays and the macroeconomic indicators.

6.2.5.1 A Phillips curve relation over the period 1962-1972

Table 6.4 reports the estimation results for equations (6.7) and (6.8) over the period 1962-1972. Given the small sample size for annual data, the price equation is estimated for annual and quarterly data to assess the robustness of the results[12]. The potential output series for quarterly data is measured as an two-sided filter, i.e. $k = 2$ in equation (6.9).

Table 6.4

Phillips Curve Results for Price and Wage Equations, 1962-1972

Variables	Price equation 1962q1-1970q4 ARDL (1,0)	Price equation 1962-1972 ARDL (1,0)	Wage equation 1962-1972 ARDL (1,0)
intercept	5.41***	1.78	8.64***
	(6.49)	(1.31)	(5.99)
$\dot{P}_{t-1}$	-0.56***	0.40	-0.06
	(-3.64)	(0.80)	(-0.11)
$e\dot{D}^{gap}$	0.04	-0.24	-0.41
	(0.46)	(-0.47)	(-0.76)

Notes:

1) t-statistics in parentheses.

2) (***) denotes significance at the 1% level.

As suggested by the recursively estimated output gaps in Figures 6.2 and 6.3, the output gaps in Table 6.4 yield insignificant coefficients for price equation (6.7) and wage

[12] Due to the lack of quarterly data for wages a similar exercise could not be performed for the wage equation.

equation (6.8) over the period 1962-1972 using annual and quarterly data[13]. The results imply that actual output growth is a close proxy for potential output growth, so that the two-sided filter in equation (6.9) tends to overestimate the difference between actual and potential output growth. However, the results did not change when potential output growth was constructed as a one-sided filter. Alternatively, the results may indicate that pressure in the product market is not a good proxy for pressure in the labour market during the period 1962-1972.

The insignificant inflation expectations coefficient in Table 6.4 is also in accordance with the recursively estimated coefficient in Figure 6.4, which showed that inflation expectations are insignificant before 1973. Although lagged inflation is significant in the price equation for quarterly data, the coefficient contains the incorrect theoretical sign.

Given the inconclusive nature of the results in Table 6.4, it is instructive to look at previous studies on Phillips curve relations in South Africa. Typically, these studies have used unemployment data which excluded Black unemployment. For the period 1948-1964 Galloway *et al.* (1970) estimated a wage inflation equation and obtained a significant unemployment coefficient of 1.28. Strydom and Steenkamp's (1976) price and wage equations covered the period 1958/59-1974/1975. Their results support the existence of a Phillips curve relation over this period but, at the same time, they show that inflation expectations played an insignificant role during the period 1960-1970 and only became more significant during the period 1971-1975.

Based on previous studies, it would thus appear as if a conventional Phillips curve relation characterised the South African economy during the period 1962-1972. Furthermore, it is important to stress that the results in this section show that inflation expectations played a negligible role during the period 1962-1972.

---

[13] Note that the price equation for quarterly data is only estimated until the fourth quarter in 1970. DF and ADF unit root tests (not reported here) could not reject the unit root hypothesis for quarterly inflation. However, the Perron (1990) test statistic of –3.67 shows that the unit root hypothesis is rejected at the 5% significance level. The breakpoint, however, is 1970q4 and not 1972 as with the annual inflation series. The quarterly inflation series seems to be sensitive to the breakdown of the Bretton Woods system in 1971.

6.2.5.2 A Phillips curve relation over the period 1973-1996

Compared to the period 1962-1972, the visual analysis showed that inflation expectations may well have played a role in a Phillips curve relation over the period 1973-1996. In addition, 1983 signifies another potential breakpoint where the output gap coefficients changed in the price and wage equations. To estimate price and wage equations over the period 1973-1996, we modify equations (6.7) and (6.8) by adopting the dummy variable approach which estimates the equations over the whole period and thus preserves observation points. The estimation results in Table 6.5 include slope dummies ($Dum_{84} \times e\dot{D}^{gap}$) for the price and wage equations, where the dummy variable takes the value of one for the period 1984-1996 and zero otherwise. We also add a dynamic component to the wage equation by including the lagged value of wage inflation ($\dot{w}_{t-1}$).

Several interesting inferences can be drawn from the results in Table 6.5:
1) The inflation expectations coefficient is statistically significant in both the price and wage equation following the upward shock in price inflation since 1973.
2) The statistically significant slope dummies indicate that the Phillips curve relation has changed again since 1984. The magnitude and sign of the coefficients on the output gap ($e\dot{D}^{gap}$) in the price and wage equations over the period 1973-1983 show that a Phillips curve still exists, although the negative relation in the price equation and the sharp drop in magnitude in the wage equation over the period 1984-1996, indicate that a Phillips curve relation may well have disappeared over this sub-period.

Overall, the results suggest a leftward shift in the wage/price inflation-output trade-off between the sub-periods 1962-1972 and 1973-1983[14]. The shift is the result of an upward revision of inflation expectations following the breakdown in the Bretton Woods System, the subsequent exchange rate devaluations and the oil price shock in 1973. In contrast, the sub-period 1984-1996 seems to signify the breakdown of the Phillips curve.

[14] This leftward shift may explain the stagflation phenomena experienced during the 1970s and early 1980s. Table 6.3 shows the precipitous decline/increase in employment growth and price inflation respectively over the sub-period 1973-1983.

Table 6.5

Single Estimation Results for Price and Wage Equations, 1973-1996

Variables	Price equation	Wage equation
intercept	5.22***	2.29
	(2.94)	(1.15)
$\dot{P}^{e}_{t-1}$	0.66***	0.40**
	(5.20)	(2.66)
$\dot{w}_{t-1}$		0.48***
		(3.62)
$e\dot{D}^{gap}$	0.61**	1.63***
	(2.21)	(5.64)
$Dum_{84} \times e\dot{D}^{gap}$	-1.48***	-1.51***
	(-3.70)	(-3.62)
time trend	-0.09	
	(-1.59)	
Diagnostic tests		
R^2	0.71	0.76
LM-test	$\chi^2(1) = 4.14$	$\chi^2(1) = 1.62$
Ramsey's Reset	$\chi^2(1) = 0.95$	$\chi^2(1) = 0.00$
Normality	$\chi^2(2) = 0.16$	$\chi^2(2) = 1.16$
Heteroscedasticity	$\chi^2(1) = 0.00$	$\chi^2(1) = 0.16$
Standard error of regression	1.99	2.05

Notes:

1) t-statistics in parentheses.

2) (***) denotes significance at the 1% level and (**) at the 5% level.

Under a passive money supply, the purported shift in the Phillips curve relation since 1973 automatically introduces other potential causes of inflation other than demand-pull. Although we have stressed cost-push forces of inflation as the underlying cause for

triggering inflation expectations, the main focus in this chapter is on structural demand factors of inflation. The remaining part of this chapter will focus on structural demand forces of inflation as providing an explanation for the upward shift in price inflation since 1973. Particularly, section 6.3 looks at the inflationary impact of dispersion of demand and 'excess' demand for agricultural products. Section 6.4 incorporates the dispersion measure and the Phillips curve relations developed in this section into one model, followed by a more detailed discussion of the results to complement the inferences already drawn in this section.

6.3 A Structuralist theory of inflation

Structuralist theories of inflation gained prominence during the 1950s and 1960s when monetarist theories failed to explain high and volatile inflation experienced in Latin American countries at the time. The structuralist position was based on the basic premise that monetarist theories of inflation failed to explain inflation adequately in Latin American countries, where the money supply was perceived to be passive in the inflationary process and not its underlying cause (Baer and Kerstenetzky, 1964).

Essentially, structuralists see inflation as the natural concomitant of high growth in developing countries. According to structuralists, developing countries are typically characterised by various structural imbalances, rigidities and inelasticities which all lead to inflationary pressure. The build up of inflationary pressure therefore is not the result of slack monetary policy, but a natural by-product of the growth and development process in developing countries. According to Johnson (1984: 637), factor immobility and downward rigidity of prices require wage and price increases to reallocate labour and other resources. It is also inevitable that these factors together could lead to a rapid inflation and high unemployment (or low output growth) during certain stages of the development process. Premature restrictive monetary policy may therefore disturb and hamper the natural adjustment process.

Under an endogenously determined money supply, without direct control by the monetary authorities, money supply growth will tend to accommodate the inflationary

process described above. Depending on the degree and persistence of structural forces, indirect control by monetary authorities may reduce inflationary pressure, but at the cost of high and sustainable growth. The more severe the structural forces of inflation, the less likely it becomes that monetary authorities' demand management policies will have the desired effect in reducing or even stabilising inflation. Although structuralist theories prescribe some inflation for development, they concede that inflation should not be allowed to exceed a certain limit. Johnson (1966), for example, proposes an inflation limit of around 10% per annum.

From the foregoing analysis, a structuralist theory of inflation seems to have a particular bearing in a South African context to explain the stagflation phenomena experienced since 1973. The sections that follow analyse two potential structural demand forces of inflation[15] from a theoretical and empirical point of view.

6.3.1 Dispersion of demand between sub-markets

6.3.1.1 Theoretical issues

The dispersion of demand hypothesis, which is distinctly different from net 'excess' demand in a Phillips curve relation, predicts that the greater the dispersion of demand between sub-markets the higher the rate of inflation. Structuralists are of the view that a country may experience rapid inflation even when the economy is in balance on aggregate. As demand shifts from one sector to another as a result of changes in tastes and the distribution of income, prices will tend to rise in those sectors which are expanding, but not fall to the same extent in the declining sectors if prices are inflexible downwards.

To summarise, the dispersion of demand hypothesis predicts that the price level will tend to rise more under the following circumstances (Argy, 1970: 74-75):

1) the more passive or endogenous the money supply is to accommodate increases in the price level;

[15] Lim (1987) and Yeldan's (1993) analysis of structural inflation includes cost-push elements.

2) the more rigid the wages and prices are in the declining sector due to minimum wages, trade union strength, and other institutional factors;
3) the more immobile the factors of production;
4) the greater the difference in skills required in the expanding and declining sectors;
5) the greater the spread of wage and price movements from expanding sectors to others.

According to Argy (1970), (3) and (4) may be more conducive to price inflation in developing countries and (5) more applicable in developed countries. In this regard, Thirlwall (1969) provides empirical evidence that wage inflation over the period 1951-1966 is positively related to the dispersion of demand in the United Kingdom as a result of wage spread between expanding sectors and others. Price inflation could of course also be the result of a combination of (3), (4) and (5).

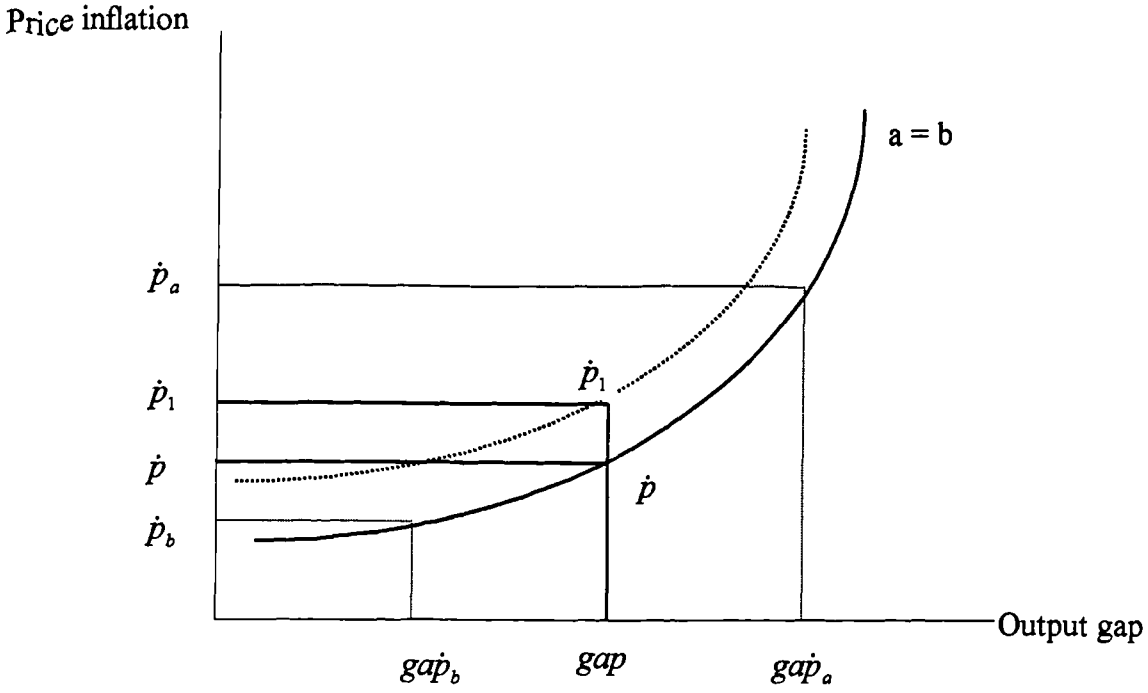
The demand shift hypothesis and its relation to a conventional Phillips curve can be illustrated in Figure 6.4 (Thirlwall, 1974). Assume that the output gap in the two sub-markets is equal at *gap*. The corresponding price inflation resulting from the aggregate gap in a Phillips curve relation is then given by $\dot{p}$. Now assume that the aggregate gap is the same but the gap in sub-market *a* rises to gap *a* and in sub-market *b* fall to gap *b*. Because of the non-linearity of the relationship between the rate of inflation and the size of the gap, the rise in inflation in market *a* is greater than the fall in market *b*, and the aggregate inflation is now $\dot{p}_1$. It follows that the greater the dispersion between sub-markets and the more non-linear the market curves, the higher the rate of price inflation for any aggregate gap. Dispersion of demand between sub-markets results in an upward displacement of the macro Phillips curve depicted by the upward sloping dotted line in Figure 6.4.

To capture the independent impact of the dispersion of demand, price or wage inflation is a function of the aggregate output gap and dispersion of demand (D)

$$\dot{p}/\dot{w} = f(e\dot{D}^{gap}, D) \tag{6.10}$$

Figure 6.4

A Phillip Curve Relation and Dispersion of Demand



The dispersion of demand can be constructed as the standard deviation of output gaps ($e\dot{D}^{gap}$) in selected industries[16]. To capture the inflationary impact of dispersion independently of cyclical fluctuations, we contruct the standard deviation of the output gaps ($e\dot{D}^{gap}$) for selected industries.

The unweighted dispersion measure (D_U) is given by:

$$\sqrt{\sum_{i=1}^{n} [(e\dot{D}_t^{gap} - e\dot{D}_{it}^{gap})^2]}, \qquad (6.11)$$

and the weighted dispersion measure (D_W) is given as:

[16] Based on the assumption that intersector shifts are more inflationary than intrasector shifts the following sectors are considered: agriculture, mining, manufacturing, transport, construction, services, government and 'other' (residual sectors).

$$\sqrt{\sum_{i=1}^{n} [(e\dot{D}_t^{gap} - e\dot{D}_{it}^{gap})^2 \; w_{it}]}, \qquad (6.12)$$

where $e\dot{D}_t^{gap}$ is the aggregate output gap growth rate.

$e\dot{D}_{it}^{gap}$ is the aggregate output gap growth rate in the ith sector.

w_{it} is an income-originating weight for the ith industry, obtained by dividing the income originating in industry i during period t by the total income originating in all n industries during period t.

A crucial issue, however, is whether the standard deviation of output gaps in several industries captures shifts in demand which is *independent* from cyclical fluctuations. By construction, the output gap in the Phillips curve captures pure cyclical influences, i.e. the inflationary impact of 'excess' demand net of other factors that could cause potential output to change. It is therefore possible that the standard deviation of output gaps in different industries could capture cyclical influences and not an independent cause of inflation[17]. In fact, our preliminary empirical results showed that there is a strong correlation between the above measures of dispersion and the aggregate output gap growth rate. Alternatively, we take the coefficient of variation to avoid multicollinearity between the aggregate output gap growth rate and dispersion. Furthermore, to interpret the results as average elasticities the dispersion measures are transformed into rates of change ($\dot{D}$).

According to Thirlwall (1969, p.69), the main motivation for using a measure of dispersion that squares deviations from the mean is that more than proportionate weight is assigned to the extreme observations, which would seem important if there are non-linearities (as shown in Figure 6.4) in the system. Moreover, the justification for including a weighted measure is that one would expect a direct relation between the size of an industry and its impact on wage and price inflation. In addition, if we accept that there is a close relation between the size of an industry and the amount of labour employed, wage spread is likely to be dictated by the industry that employs the most

[17] This important issue forms the basis of Lilien (1982) and Rissman's (1993) work.

labour in a country. However, as Thirlwall (1969) points out, if these assumptions are false then the unweighted dispersion measure should be considered.

6.3.1.2 Preliminary evidence on the inflationary impact of dispersion of demand

The main purpose of this section is to establish whether there exists a long-run relationship over the period 1973-1996 between the dispersion measures and wage/price inflation. The interpretation of the results will be left to a later section when we also consider the Phillips curve relation in one model.

The DF and ADF tests in Table 6.1 for the weighted and unweighted dispersion measures show that the null hypothesis of a unit root can be rejected at the 5% significance level. Formal tests for long-run relationships can also be conducted by applying the Pesaran *et al.* (1996) methodology discussed in Chapter 4. The tests for long-run relationships in Table 6.6 are based on the critical values for I(0) variables in Pesaran and Pesaran (1997).

Table 6.6

Testing for the Existence of Long-run Relationship, 1973-1996

Regression	F-test with an intercept
$\dot{p}$ on $\dot{D}_W$	5.22**
$\dot{p}$ on $\dot{D}_U$	5.40**
$\dot{w}$ on $\dot{D}_W$	2.33
$\dot{w}$ on $\dot{D}_U$	1.53

Notes:

1) (**) denotes significance at the 5% level, where 4.93 is the 5 % critical value for I(0) variables.

2) The unrestricted error correction models were all estimated as order one models.

The F-tests indicate that there exists a long-run relationship between dispersion and price inflation at the 5% significance level, but that there is no long-run relationship between dispersion and wage inflation. The long-run results suggest that price inflation may be the result of supply bottlenecks and different skills in expanding and declining sector, and not necessarily the outcome of wage differences between expanding and declining sectors. Table 6.7 provides preliminary estimation results for the long-run relations solved from Auto regressive distributed Lag (ARDL) models and short-run relations based on error correction models.

Three notable features stand out. First, the significant error correction coefficients in all the models indicate that price inflation adjusts towards its long-run equilibrium value in reaction to changes in unweighted and weighted dispersion. Second, although dispersion provides a long-run explanation of price inflation, the small magnitudes of the long-run and short-run coefficients indicate that it cannot be regarded as one of the major causes of price inflation. Third, since the standard error in the error correction model for weighted dispersion is lower compared to unweighted dispersion, the former will be considered in section 6.5 when we consider the inclusion of the aggregate output gap and dispersion of demand in one model.

6.3.2 The inflationary impact of 'excess' demand for agricultural products

6.3.2.1 Theoretical issues

One of the more persistent ideas in a structuralist theory of inflation is that population growth, urbanisation and growth of living standards combine to make increased demands for food production (Argy, 1970). For various reasons supply in the agricultural sector may be inelastic to meet the demand for food. Prices of food will accordingly rise and if prices are inflexible downward in the industrial sector, then the absolute price level will rise.

Table 6.7

Long-run Price equations and Error Correction Models (ECM), 1973-1996

Long-run solutions of ARDL models		
Variables	**Model 1: Price equation ARDL (1,1)**	**Model 2: Price equation ARDL (1,1)**
intercept	13.57***	12.38***
	(13.15)	(11.06)
$\dot{D}_W$	0.02**	
	(2.73)	
$\dot{D}_U$		0.01**
		(2.59)
ECM of price equations		
intercept	4.99***	4.56**
	(3.08)	(2.73)
$\Delta\dot{D}_W$	0.004***	
	(4.05)	
$\Delta\dot{D}_U$		0.002***
		(3.57)
ecm_{t-1}	-0.36***	-0.36***
	(-3.10)	(-2.99)
Diagnostic tests of ECM		
R^2	0.61	0.58
LM- test: χ^2 (1)	3.63	3.54
Standard error	1.84	1.92

Notes:

1) t-statistics in parentheses

2) (***) denotes significance at the 1% level; (**) at the 5% level.

Several reasons have been advanced in structuralist writings to explain structural bottlenecks in the agricultural sector. Specifically in the context of Latin American countries, structuralist point to an inadequate land tenure system as one of the underlying causes of structural bottlenecks (Edel, 1969). Most of the large estates in Latin American countries are owned by landlords who don't utilise it for productive purposes, but rather see land ownership as a symbol of status. Land reforms are generally seen as the solution to create a more equal distribution of land. However, small land holdings could also be unproductive because owners typically lack the technical skill to utilise the land productively, while the size also inhibits large-scale production. In addition, an underdeveloped agricultural sector could also be the result of government policy which actively promotes industrialisation at the expense of the agricultural sector.

South Africa could arguably be placed in exactly the same category as Latin American countries. The unequal distribution of land ownership in the country is a direct outgrowth of the apartheidregime that effectively discriminated against Black ownership of land. In a comprehensive overview of the South African economy over the period 1960-1991, Fallon and de Silva (1994) describe the agricultural sector as a capital intensive and highly regulated and protected sector for white farmers. In this environment the agricultural sector benefited from large-scale investments but, because of its capital-intensive nature, failed to absorb South Africa's surplus labour force. From this brief overview it is uncertain whether the agricultural sector in South Africa is characterised by structural bottlenecks as a result of an unequal distribution of land, or whether the government's strive for self-sufficiency effectively avoided potential bottlenecks that could have resulted from an unequal distribution of land. These issues will be left to the emprical part of this section.

Thus far the theoretical overview has mainly described how supply inelasticities could lead to an overall increase in the price level. Formal models developed by Canevese (1982); Cardosa (1981) and Johnson (1984) have focused on a specific transmission mechanism to describe how price level increases can lead to a self-perpetuating inflationary process. Generally, these models predict that an increase in the price level induces workers in the industrial sector to claim nominal wage increases to maintain a 'desired' or 'targeted' real wage. Under wage indexation and assuming that producers

base their prices on some constant markup over wage costs, a self-perpetuating inflationary process would evolve. In these models it is also assumed that the money supply is passive to accommodate nominal wage increases. A further distinction can also be drawn between conditions necessary for steady inflation and accelerating inflation. The former would occur if wages were fully indexed, while the latter describes a process where wage increases exceed price increases.

A country has various options available to avoid rapid price inflation emanating from severe structural bottlenecks in the agricultural sector (Argy 1970). First, in a country which exports agricultural products, exports could be allowed to fall. Second, imports of food could increase (Mueller, 1965). Third, the government may subsidise food production or impose price controls. Presumably, if imports rise or exports fall, price inflation can only be controlled if other imports fall to maintain equilibrium in the balance of payments.

The approach adopted in the empirical analysis will first develop a demand-supply model for the agricultural sector as a whole. Such an approach will allow us to assess the structuralist hypothesis directly by inspecting the magnitude of the elasticities in the demand-supply model. Furthermore, by constructing a demand-supply model a proxy for 'excess' demand can be derived to estimate the inflationary impact of supply inelasticities directly in a price equation.

First, consider the following demand model:

$$\dot{D}^{agric} = \alpha_0 + \beta_1(D_{t-1}^{agric}) + \beta_2(D_{t-2}^{agric}) + \beta_3(\dot{rap}) + \beta_4(\dot{ipc}) + \varepsilon_1, \qquad (6.13)$$

where $\dot{D}^{agric}$ is the demand for agricultural products (real output growth in agricultural sector); $\dot{rap}$ is the relative price of agricultural products defined as the GDP deflator for agricultural products divided by the total GDP deflator; and $\dot{ipc}$ is income per capita. All the variables are measured in growth rates.

Next, consider the following supply model:

$$\dot{S}^{agric} = \alpha_1 + \beta_5(\dot{rap}_{t-1}) + \varepsilon_2, \tag{6.14}$$

where $\dot{S}^{agric}$ is the growth rate of supply of agricultural products.

The long-run estimates of equations (6.13) and (6.14) can be utilised to construct a time series for 'excess' demand for agricultural products ($e\dot{D}^{agric} = \dot{D}^{agric} - \dot{S}^{agric}$). If supply inelasticities in the agricultural sector are conducive to price inflation in South Africa, one would expect an inelastic price elasticity in the demand equation (6.13) and an inelastic price elasticity in the supply equation (6.14).

6.3.2.2 Empirical results

To identify (6.13) as a demand function, the equation is estimated by two stage least squares (2SLS) using D^{agric}_{t-1}, D^{agric}_{t-2}, $\dot{ipc}$ and $\dot{rap}_{t-1}$ as instruments[18]. Equation (6.14) is identified as a supply equation by lagging the value of relative agricultural prices. Table 6.8 reports the long-run results for the demand and supply equations.

Although equation (6.13) was estimated by 2SLS, identical short-run and long-run results were obtained when the equation was estimated by Pesaran and Shin's (1999) ARDL procedure. Recall from Chapter 4 that the ARDL procedure corrects for the endogeneity bias once an appropriate choice of the lag length is made. Valid asymptotic inferences on the short-run and long-run parameters can be made even if the right-hand side variables in equation (6.13) are endogenous.

[18] Sargan's corresponding test statistic $\{\chi^2(1)\}$ of 0.21 shows that the set of instruments is valid.

Table 6.8

Demand and Supply of Agricultural Products, 1973-1997

Demand for agricultural products (D^{agric})	
Variables	**Long-run solution of (2SLS) and/or ARDL (2,0) model**
intercept	2.31* (1.96)
ràp	-0.55*** (3.12)
ìpc	1.36*** (3.12)
Supply of agricultural products (S^{agric})	
Variables	**Long-run result**
intercept	4.99* (1.72)
$ràp_{t-1}$	0.72* (2.02)
Wald tests for restrictions on the long-run demand and supply models	
Unitary income elasticity:	0.68
Unitary price elasticity in supply model:	0.61

Notes:

1. All the models pass diagnostic tests such as serial correlation, normality, heteroscedasticity and functional form specification at the 5% significance level.
2. (***) denotes significance at the 1% level and (*) at the 10% level.

The price inelastic coefficient in the demand model supports a structuralist hypothesis to some extent, but the Wald tests in Table 6.8 show that the null hypothesis of a unitary income elasticity in the demand model and a unitary price elasticity in the supply model cannot be rejected. Thus, the results at this stage give no support to a structuralist hypothesis of supply inelasticities in South Africa's agricultural sector.

The long-run estimates in Table 6.8 are utilised to construct a proxy for 'excess' demand in the agricultural sector ($e\dot{D}^{agric}$). Column 1 in Table 6.9 shows that the short-run coefficient of 0.16 is statistically significant in the price equation. Alternatively, column 2 constructs 'excess' demand in a similar way but includes population growth in the

demand model[19]. The coefficient loses some of its significance but the short-run magnitude of the parameter estimate is very close to that obtained in column 1.

Table 6.9

The Inflationary Impact of 'Excess' Demand in the Agricultural Sector and Alternative Models, 1973-1997

Short-run models			
Variables	**Column 1 ARDL (1,0)**	**Column 2 ARDL (1,0)**	**Column 3 ARDL (1,0)**
intercept	1.86 (0.90)	1.45 (0.67)	4.24** (2.18)
$\dot{p}_{t-1}$	0.84*** (5.64)	0.84*** (5.55)	0.67*** (4.66)
eD^{agric}	0.16** (2.10)		
eD^{pop}		0.17* (1.98)	
$r\dot{a}p^{food}$			0.13 (0.69)
Diagnostic tests			
R^2	0.60	0.59	0.50
LM-test	$\chi^2(1) = 1.83$	$\chi^2(1) = 2.03$	$\chi^2(1) = 8.69$
Ramsey's Reset	$\chi^2(1) = 0.02$	$\chi^2(1) = 0.05$	$\chi^2(1) = 0.03$
Normality	$\chi^2(2) = 3.97$	$\chi^2(2) = 3.44$	$\chi^2(2) = 0.83$
Heteroscedasticity	$\chi^2(1) = 0.59$	$\chi^2(1) = 0.69$	$\chi^2(1) = 0.31$
Standard error	2.33	2.35	2.56
Long-run models			
Variables	**Column 1**	**Column 2**	**Column 3**
intercept	3.66*** (12.13)	9.42* (1.72)	7.82*** (12.86)
eD^{agric}	1.09 (0.82)		
eD^{pop}		1.10 (0.80)	
$r\dot{a}p^{food}$			0.39 (0.67)

Notes:

1. t-statistics in parentheses.

2. (***) denotes significance at the 1% level; (**) a the 5% level; and (*) at the 10% level.

[19] The assumption is made that there is a unitary long-run relationship between population growth and demand for agricultural products.

To determine directly the inflationary impact of food prices, column 3 shows that the relative price of food ($\dot{rap}^{food}$), defined as the price of food relative to consumer prices, is statistically insignificant although the sign is positive and the magnitude of the coefficient is similar to those in columns 1 and 2[20].

The most important results are contained in the long-run solutions of the ARDL models. All the models are statistically insignificant, which suggest that the agricultural sector fully adjusts over the long-run to meet demand. The results in Table 6.8 and 6.9 find no support for the structuralist hypothesis that the agricultural sector in South Africa is constrained by supply inelasticities in the long-run. In addition, similar regressions for wage inflation (not reported here) yielded insignificant short and long-run results, which imply that the transmission mechanism identified by structuralists to trigger a self-perpetuating inflationary process is absent in South Africa.

6.4 The dispersion of demand and the Phillips curve relation

To capture the impact of dispersion and a Phillips curve relation in one model over the period 1973-1996, consider the following price and wage equations:

$$\dot{p} = \alpha_0 + \beta_1(\dot{p}^e_{t-1}) + \beta_2(e\dot{D}^{gap}) - \beta_3(Dum_{84} \times e\dot{D}^{gap}) + \beta_4(\dot{D}_w) + \xi_1, \qquad (6.15)$$

$$\dot{w} = \alpha_1 + \beta_5(\dot{p}^e_{t-1}) + \beta_6(e\dot{D}^{gap}) - \beta_7(Dum_{84} \times e\dot{D}^{gap}) + \beta_8(\dot{w}_{t-1}) + \xi_2. \qquad (6.16)$$

Equations (6.15) and (6.16) are estimated by the Seemingly Unrelated Regression Estimation (SURE) technique where gains in efficiency can be obtained if the errors in (6.15) and (6.16) are contemporaneously correlated and by imposing plausible restrictions on the parameters. Table 6.10 reports the results together with Wald test

[20] An 'excess' demand variable was also constructed for food production. In the demand equation the price elasticity was insignificant, but the income elasticity of 0.69 was significant. 'Excess' demand for food was constructed by using the estimates in the demand model minus actual food production. However, the results in the short and long-run models yielded insignificant results.

restrictions to test whether the change in magnitude of the slope coefficients since 1984 are the same in equations (6.15) and (6.16).

Table 6.10

Restricted SURE Estimation Results (converged after five iterations) for the Price and Wage Equation, 1973-1996

Variables	Price equation	Wage equation
intercept	5.06***	2.72
	(3.87)	(1.50)
$\dot{p}^{e}_{t-1}$	0.63***	0.45***
	(6.64)	(3.32)
$e\dot{D}^{gap}$	0.60***	1.45***
	(3.21)	(6.29)
$Dum_{84} \times e\dot{D}^{gap}$	-1.14***	-1.14***
	(-4.23)	(-4.23)
$\dot{D}_{W}$	0.004**	
	(2.80)	
$\dot{D}_{W\,t-1}$	0.003***	
	(3.74)	
$\dot{w}_{t-1}$		0.41***
		(3.47)
Restrictions based on Wald tests: χ^2		
Restrictions	Test statistic	
$\beta_3 = \beta_7$	1.29	
Diagnostic tests		
R^2	0.81	0.75
Durbin Watson	1.77	1.50
Standard error	1.43	1.87

Notes:

1. t-statistics in parentheses.

2. (***) denotes significance at the 1% level and (**) at the 5% level.

The Wald test shows that the restriction cannot be rejected. All the parameter estimates are similar in magnitude compared to the single equation estimates reported previously, but the lower standard errors of the regressions in the SURE model point to some efficiency gains.

The solved short-run and long-run solutions of the restricted SURE results are reported in Tables 6.11 and 6.12 respectively for the sub-periods 1973-1983 and 1984-1996. Following the shocks in the early 1970s and the subsequent rise in price inflation since 1973, inflation expectations became highly significant in a Phillips curve relation. The conventional Phillips curve relations reported by previous studies during the 1950s and 1960s seems to have disappeared as wage earners over the period 1973-1983 attempted to maintain the purchasing power of their nominal wages.

Table 6.11

Short-run Solutions of the Restricted SURE Results, 1973-1996

Price equation			
Variables	**1973-1996**	**1973-1983**	**1984-1996**
$e\dot{D}^{gap}$		0.60	-0.54
$\dot{D}_W$	0.004		
Wage equation			
Variables	**1973-1996**	**1973-1983**	**1984-1996**
$\dot{p}^{e}_{t-1}$	0.45		
$e\dot{D}^{gap}$		1.45	0.31

Table 6.12

Long-run Solutions of the Restricted SURE Results, 1973-1996

Price equation			
Variables	**1973-1996**	**1973-1983**	**1984-1996**
$e\dot{D}^{gap}$		1.62	-1.45
$\dot{D}_W$	0.02		
Wage equation			
Variables	**1973-1996**	**1973-1983**	**1984-1996**
$\dot{p}^e_{t-1}$	0.76		
$e\dot{D}^{gap}$		2.45	0.52

To formally test the money illusion hypothesis, the Wald test statistic of 6.16 shows that the inflation expectation coefficient in the price equation is significantly different from unity. Therefore, over the period 1973-1983 demand-pull inflation still characterised the South African economy, but at a much higher inflation rate compared to the period 1962-1972 when inflation expectations played a negligible role.

The results in Table 6.11 and 6.12 show that the dispersion of demand provides an additional explanation of price inflation other than the aggregate output gap growth rate. However, the short-run and long-run coefficients are similar in magnitude compared to those obtained in section 6.3.1.2. The low magnitude of the coefficients suggests that the dispersion of demand cannot be regarded as one of the major causes of price inflation over the period 1973-1996. It is interesting to note that although the aggregate output gap displays a structural break over the period 1973-1996, the dispersion of demand presents a long-run explanation of price inflation which acts independently from the aggregate gap.

An important observation to make about the Phillips curve relation over the period 1973-1983, is that once we introduce cost-push inflation that results from an increase in imported prices, it becomes more difficult to distinguish clearly between a demand-pull and a cost-push inflation. Inevitably demand-pull and cost-push forces are interdependent

causes of inflation, where an exchange rate devaluation and domestic demand pressure, for example, could lead to a self-perpetuating inflationary process. However, over the period 1973-1983 the Central Bank actively intervened in an attempt to keep the exchange rate at fixed par values, supported by a high gold price and substantial capital inflows at the time. The Phillips curve may therefore still be regarded as reflecting an independent cause of inflation, with a unique relation between output (unemployment), wage/price inflation and inflation expectations.

The period 1983 signified another breakpoint in the Phillips curve relation. From Tables 6.11 and 6.12 it can be seen that the output gap in the price equation becomes negative over the period 1984-1996, while there is a precipitous decline in magnitude of the output coefficient in the wage equation. From the results it is clear that a unique Phillips curve relation over the period 1984-1996 does not exist.

Several reasons may be advanced to explain why a unique Phillips curve relation ceased to exist in South Africa over the period 1984-1996. The most important difference compared to the sub-period 1973-1983, is that over the period 1984-1996 it became increasingly difficult to separate a pure demand-pull inflation from a cost-push inflation. First, the period 1983 witnessed the abolition of South Africa's blocked exchange rate mechanism that was in place to protect the country from capital outflows. Second, towards the end of 1983 the Central Bank ceased its policy of quoting the spot exchange rate and began to allow the exchange rate to be more market determined (Kahn, 1993). Third, the gold price dropped sharply since the early 1980s. Fourth, given the unstable political situation in the country, Western nations imposed a debt standstill which led to capital outflows of around 5 billion rand per annum since 1985. All these factors together imposed a balance of payments constraint and in the process exposed the country to imported inflation.

To protect the balance of payments from capital outflows, the Central Bank applied stringent demand-management policies since the mid 1980s. The overall recession and the slack demand conditions since 1984 are reflected in the wage equation where the coefficient of the output gap dropped substantially compared to the period 1973-1983 However, because the root cause of inflation was not demand related, the drop in the

output gap coeffcient in the wage equation was not accompanied by a similar decline in the price equation. The country's ability to grow above potential was entirely dictated by the balance of payments. Hence, it can be envisaged that a slight improvement in the balance of payments as a result of an increase in manufacturing exports to take advantage of the depreciating exchange rate or less capital outflow during a specific point in time, led to higher growth rates but, at the same time, reduced the country's tendency to import inflation. The negative relation in the price equation therefore reflects the balance of payments conditions that prevailed over this period.

6.5 Conclusion

The empirical analyses have shown that a Phillips curve relation in South Africa has been subject to various sources of instability over the period 1962-1996. The period 1962-1983 witnessed a leftward shift in the Phillips curve following an upward revision of inflation expectations. The argument was also held that demand inflation exerted an independent influence on inflation over the period 1973-1983, despite the presence of cost-push forces of inflation.

The analysis suggests that that the leftward shift in the Phillips curve may potentially be explained by cost-push forces of inflation which induced inflation expectations, and not necessarily structural demand forces of inflation. In the context of this analysis it was shown that 'excess' demand for agricultural products is only inflationary in the short-run, while supply fully adjust in the long-run to meet demand. Moreover, although the dispersion of demand provides a long-run explanation of inflation in South Africa, the low magnitude of the short-run and long-run coefficients indicate that it cannot be regarded as one of the major causes of price inflation.

The empirical analysis further indicated that a unique Phillips curve relation seems to have little relevance over the period 1984-1996. The balance of payments constraint experienced during this period implies that demand-pull and cost-push inflation increased their interdependence, so that a clear distinction becomes increasingly difficult. The impact of stringent deflationary policy by the Central Bank and general recessionary

conditions is reflected by the low output coefficient in the wage equation. Despite these tendencies, the price equation is sensitive to developments in the balance of payments and has no direct relation to the wage equation.

The analysis presented in this chapter provides a useful background for the next two chapters. Cost-push inflation induced by import prices and wage rate changes seems to be particularly relevant since 1973. Moreover, the fact that the Phillips curve relation displays another breakpoint in 1983, suggests that inflation expectations may have changed again. If this is indeed the case, then the short-run and long-run results reported in Tables 6.11 and Table 6.12 should only be regarded as 'indicative.' These issues will be explored in a more detailed and rigorous fashion in the next chapter.

CHAPTER 7

IMPORTED INFLATION IN SOUTH AFRICA

7.1 Introduction

The idea that price inflation is caused by exchange rate depreciation mainly originates from 'structuralist' economists who believe that export earnings in developing countries are generally not enough to finance imported capital and intermediate goods, which play an essential part in their development process (Taylor, 1983; Thirlwall, 1974)[1]. The lack of foreign exchange reserves and the high demand for imported goods, inevitably lead to exchange rate depreciations and a resulting rise in the price of imported goods. The inflationary process will become self-perpetuating when the initial rise in the price of imported goods triggers a wage-price spiral.

The main objective of this chapter is to analyse the inflationary impact of exchange rate depreciation in South Africa over the period 1984-1998 when the monetary authorities adopted a more market-oriented exchange rate system[2]. Although the empirical part of the chapter will extensively focus on this period, the results in Chapter 6 suggest that an analysis of imported inflation in the South African economy over the period 1984-1998 will become more consequential when it is compared to the period prior to 1984. The fact that South Africa experienced many structural and political changes over the period 1973-1998, suggests that the underlying causes of inflation have changed. To draw some concrete policy conclusions from the empirical analysis, it is hoped that a direct comparison of the underlying causes of inflation over the sub-periods 1973-1983 and 1984-1998 will illuminate some of the major structural changes that have occurred in the South African economy.

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[1] The shortage of foreign exchange earnings is mainly because many developing countries only export a few primary commodities for which there is a relatively low income elasticity, while the demand for imports has a relatively high income elasticity (Argy, 1970).

[2] For a descriptive analysis of imported inflation during the 1980s in South Africa, see Kantor (1989) Mohr's (1986) theoretical analysis on potential causes of inflation in South Africa, includes a discussion of imported inflation.

To assess the final, or long-run, inflationary impact of an exchange rate depreciation, two interrelated issues need to be developed in the theoretical and empirical parts of the chapter. First, the degree of import pass-through that results from an exchange rate depreciation – i.e. to what degree will an exchange rate depreciation be reflected in the price of imported goods ? Second, to what extent will the initial rise in import prices trigger a wage-price spiral ?

The plan of the chapter is as follows. Section 7.2 develops a simple wage and price model to determine the wage-price spiral that results from a shock to import prices. Section 7.3 sets out a theoretical import price equation to determine the magnitude of an exchange rate depreciation on import prices, i.e. the degree of import pass-through. Section 7.4 presents a brief overview of some of the key macroeconomic features that characterised the South African economy over the sub-periods 1973-1983 and 1984-1998. Based on the different sub-periods identified in section 7.4, empirical results for the wage-price models and the import price equation are presented in section 7.5. Section 7.6 incorporates the estimation results into one model to assess the long-run impact of an exchange rate depreciation on price inflation. Section 7.7 ends with some summary remarks and policy implications.

7.2 A simple wage and price model for the South African economy

The wage and price models in this section mainly originate from Lipsey and Parkin's (1970) theoretical analysis. Goldstein (1974) also adopted similar wage and price equations to analyse the inflationary impact of exchange rate devaluations in the United Kingdom. More recent studies have made some modifications to the basic price equation in an attempt to study a Phillips curve type relationship in a price, rather than a wage, equation (Clark *et. al.*, 1996; Filardo, 1998).

Consider the following price equation in its distributed lag form:

$$\dot{p}_t = \beta_0 + \sum_{i=0}^{p} \beta_{1i} \dot{w}_{t-i} + \sum_{i=0}^{r} \beta_{2i} \dot{e}D_{t-i}^{gap} + \sum_{i=0}^{s} \beta_{3i} \dot{q}_{t-i} + \sum_{i=0}^{x} \beta_{4i} \dot{imp}_{t-i} + \varepsilon_t, \qquad (7.1)$$

which yields the following long-run solution:

$$\dot{p}_t = \lambda_0 + \lambda_1 \dot{w} + \lambda_2 \dot{eD}^{gap} + \lambda_3 \dot{q} + \lambda_4 \dot{imp}, \ \lambda_1 > 0, \ \lambda_2 > 0, \ \lambda_3 < 0, \ \lambda_4 > 0, \tag{7.2}$$

where all the variables are in rates of change and $\dot{p}$ is consumer price inflation. The λ's are, respectively, the long-run estimates of the intercept (λ_0); the wage rate in the private sector ($\dot{w}$); 'excess' demand or output gap ($\dot{eD}^{gap}$); labour productivity ($\dot{q}$); and import prices ($\dot{imp}$).

Although the relationship between price inflation and 'excess' demand mainly describes a pure demand-pull model of inflation, it can also be analysed as a Phillips curve type relation if it is assumed that pressure in the product market is a good proxy for pressure in the labour market. The 'excess' demand variable is defined as the actual real GDP rate of change ($\dot{y}$) minus the rate of change of potential output ($\bar{\dot{y}}$). The rate of change of potential output is measured as a centred-moving average filter:

$$\bar{\dot{y}} = \frac{1}{2k+1}[\dot{y}_t + \sum_{i=1}^{k}(\dot{y}_{t+i} + \dot{y}_{t-i})], \tag{7.3}$$

where k = 8[3]. By adopting a simple filter measure, data in the empirical section are utilised from 1971 quarter one until the fourth quarter in 1998, so that the sample period effectively stretches from 1973q1 until 1996q4.

The wage equation in its auto regressive distributed lag form is given by:

$$\dot{w}_t = \alpha_0 + \sum_{i=1}^{z} \alpha_{1i} \dot{w}_{t-i} + \sum_{i=0}^{v} \alpha_{2i} \dot{p}_{t-i} + \xi_t, \tag{7.4}$$

where all the variables are defined as before. Equation (7.4) captures wage inertia and the wage formation process of wage earners which is based on price inflation in the past

[3] The value of k was determined by experimenting with different values in the empirical section of the chapter, and then choosing the value which was most consistent with a Phillips curve relation.

and current periods. The long-run solution of equation (7.4) reflects a relation between wages and inflation expectations ($\dot{p}^e$)[4]:

$$\dot{w}_t = \delta_0 + \delta_1 \dot{p}_t^e; \quad \delta_1 > 0, \tag{7.5}$$

where the δ 's are the long-run parameter estimates.

Finally, to capture the impact of the wage-price spiral on long-run equilibrium price inflation and assuming that $\dot{p}^e$ is a proxy for $\dot{p}$, substitute equation (7.5) into equation (7.2) to obtain the following reduced form equation:

$$\dot{p}_t = \frac{\sigma_0 + \lambda_2 \dot{e} D_t^{gap} + \lambda_3 q_t + \lambda_4 \dot{imp}_t}{(1 - \lambda_1 \delta_1)}, \tag{7.6}$$

where σ_0 is the intercept term ($=\lambda_0 + \lambda_1 \delta_0$). From equation (7.6) it can be seen that the inflation rate will become more explosive the closer the wage-price spiral ($\lambda_1 \delta_1$) is to one. If the wage-price spiral is equal to one ($\lambda_1 \delta_1 = 1$), then there is no long-run solution to equation (7.6) and the trade-off between price inflation and 'excess' demand disappears. Thus, the expectations augmented view of the Phillips curve held by Friedman (1968) and Phelps (1968) depicts a vertical long-run Phillips curve if the wage-price spiral is equal to one. In the long-run, inflation is non-accelerating with actual inflation equal to expected inflation ($\dot{p}_t = \dot{p}_t^e$).

[4] Inflation expectations models such as equation (7.5), have been criticised on the grounds that the model is only backward looking and excludes forward looking wage setters (Debelle and Laxton, 1997). However, despite the lack of inflation survey data over an extended period in South Africa, major structural and institutional changes that have occurred over the period 1973-1998 suggest that an analysis of inflation expectations should first be based on a more simple approach, rather than the more sophisticated methods that have been employed in developed countries.

7.3 Import pass-through

The import price coefficient λ_4 in equation (7.6) captures the inflationary impact of all the exogenous shocks to import prices. To specifically determine the long-run impact of an exchange rate depreciation on price inflation, an estimate of the degree of import pass-through is required. Import pass-through can be described as the degree to which exchange rate changes are reflected in the destination currency prices of imported goods (Menon, 1993). The higher the degree of import pass-through, the higher the long-run impact on price inflation following an exchange rate change.

7.3.1 Import price equation

Based on the elasticities approach, the measurement of the degree of import pass-through (P) can be expressed in the following way (Branson, 1972):

$$(\partial P_D / \partial exr) = (1 - \varepsilon_D / \varepsilon_S)^{-1} = P, \tag{7.7}$$

where P_D is the domestic currency price of the imported good, *exr* is the exchange rate (the foreign currency price of domestic currency), ε_D is the elasticity of the demand for imports and ε_s is the supply elasticity of imports. Equation (7.7) shows that the percentage change in the domestic currency price of the imported good following an exchange rate change is a function of the demand and supply elasticities (Menon, 1995a).

From equation (7.7) it can be seen that the degree of import pass-through will be higher the lower is the elasticity of demand and the higher the elasticity of supply. From a theoretical point of view, it is expected that the degree of import pass-through will be complete for a small open economy which is a price taker in world markets. In such a case, foreign suppliers will leave their foreign prices unchanged following an exchange rate depreciation, so that the exchange rate change is proportionately reflected in the domestic currency price of the imported good.

Alternatively, the degree of import pass-through can also be measured in an import price equation (Dwyer *et. al.*, 1994; Dwyer and Lam, 1995; Hooper and Mann, 1989; Menon, 1996). As a starting point, first consider the 'law of one price'. The law states that the price of a traded good (in this case an imported good) will be the same in both domestic and foreign countries when the imported good is expressed in a common currency. The following expression captures this relation:

$$imp = imp^* \, exr, \tag{7.8}$$

where *imp* is the price of the imported good, *imp** is the corresponding foreign price and *exr* is the exchange rate denoted in units of domestic currency per unit of foreign currency (an increase in *exr* indicates a depreciation). For a given foreign price, the law of one price will fail to hold when changes in the price of the domestic imported good are not proportional to changes in the exchange rate. If this is the case, then import pass-through following an exchange rate change is incomplete.

To estimate the long-run import pass-through relationship, equation (7.8) is transformed into a log-linear model which allows for a constant:

$$Limp_t = \alpha_0 + \alpha_1 Lexr + \alpha_2 Lppi; \alpha_1, \alpha_2 > 0, \tag{7.9}$$

where $Limp_t$ is an aggregate import price deflator.

$Lexr_t$ is the nominal exchange rate measured as a trade weighted index, with weights proportional to the import shares of South Africa's major suppliers[5].

$Lppi_t$ is the producer price index (a proxy for foreign prices) of South Africa's major suppliers weighted in the same way as $Lexr_t$. (Data source: OECD Statistical Compendium, 1997).

[5] South Africa's major suppliers include the United States, the United Kingdom, Japan, Germany, France, Italy and the Netherlands. The import weights were constructed from International Monetary Fund, Direction of Trade Statistics (various issues).

In many empirical studies it is common practice to use an import weighted export price index as a proxy for foreign prices. The major problem with this index is that it represents the pricing decision on exports to all markets (Menon, 1995b). The export price index may therefore not accurately reflect the supply price of exports to South Africa if there are different pricing-to-market strategies. Alternatively, as suggested by Menon (1996), an import-weighted cost of production index (producer price index) is used for South Africa which is unaffected by the pricing-to-market problem.

The long-run import pass-through relationship in equation (7.9) implies an important cross coefficient restriction to assess the theoretical and empirical validity of the model. Irrespective of whether import pass-through in South Africa is complete or not, the model implies that the exchange rate and producer price index coefficients should be equal in magnitude, i.e. $\alpha_1 = \alpha_2$.

7.3.2 Incomplete import pass-through in a small open economy: some theoretical considerations

In an extensive survey of the exchange rate pass-through literature, Menon (1995a) shows that small open economies have received little attention in the literature, although the existing studies indicate that import pass-through has generally been incomplete. Based on the empirical evidence for a wide range of countries, Menon (1995a, 1996) identifies various theoretical reasons why import pass-through may be incomplete even in a small open economy. Moreover, the elasticities approach in equation (7.7) can only give an accurate proxy for import pass-through in the absence of shocks. In an environment where macro and micro economic conditions dictate the degree of import pass-through, an import price equation such as (7.9) will give a more accurate and reliable estimate of the pass-through coefficient.

In a macroeconomic environment where domestic demand is buoyant, the degree of import pass-through is likely to be high irrespective of the demand and supply elasticities. Similarly, when domestic demand is low foreign suppliers may squeeze their profits to protect their market share. In this case, import pass-through is incomplete and may again not be captured accurately by the elasticities approach.

From a microeconomic perspective, import pass-through will be complete in a perfectly competitive environment where foreign and domestic goods are perfect substitutes, i.e. the law of one price in equation (7.8) will hold[6]. By contrast, in an imperfectly competitive environment the degree of import pass-through will depend on the degree of substitutability between the domestic competing good and the imported good, as well as the degree of market integration. The lower the degree of substitutability and the lower the degree of market integration, the higher the market power of sellers. When the degree of substitutability is low, foreign suppliers have some leverage to dictate the *market price* of their traded good. If foreign suppliers are profit maximisers, then import pass-through will inevitably be high, while the degree of pass-through will be lower when agents seek to maximise their market share. With a low degree of market integration, some discrimination may occur between different markets. The pricing-to-market rule will then lead to different degrees of pass-through across segmented markets.

In addition to micro and macro considerations, there are several other reasons why import pass-through may be incomplete (Menon, 1995a: 204-207). Among others, these include multinational corporations who employ intra-firm pricing policies to absorb some of the impact of exchange rate changes, and the existence of non-tariff barriers which reduces the premium on imports after an exchange rate depreciation, rather than increasing its price.

7.3.3 The long-run inflationary impact of an exchange rate depreciation

From equation (7.6), the long-run inflationary impact of an increase in import prices and the subsequent wage-price spiral that it triggers can be written as[7]:

$$\frac{\partial \dot{p}_t}{\partial \dot{imp}_t} = \frac{\lambda_4}{(1-\lambda_1\delta_1)} \qquad (7\ 10)$$

The import pass-through equation expressed in rates of change is given by:

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[6] Webber (1995) presents a theoretical analysis to determine the sensitivity of pass-through to the microeconomic environment.

[7] The theoretical exposition in this section draws largely on Goldstein (1974).

$$\dot{imp}_t = K(\dot{exr}_t + \dot{ppi}_t)\,. \tag{7.11}$$

Differentiating equation (7.11) with respect to $\dot{exr}$ yields:

$$\frac{\partial \dot{imp}_t}{\partial \dot{exr}_t} = K\,, \tag{7.12}$$

where K is the import pass-through estimate. The long-run inflationary impact of an exchange rate depreciation will depend on the degree of import pass-through and the wage-price spiral as in equation (7.13):

$$\frac{\partial \dot{p}_t}{\partial \dot{exr}_t} = \frac{\partial \dot{p}_t}{\partial \dot{imp}_t} \cdot \frac{\partial \dot{imp}_t}{\partial \dot{exr}_t} \tag{7.13}$$

Substituting (7.10) and (7.12) into (7.13) gives:

$$\frac{\partial \dot{p}_t}{\partial \dot{exr}_t} = \frac{\lambda_4}{(1-\lambda_1\delta_1)} \;.\; K \tag{7.14}$$

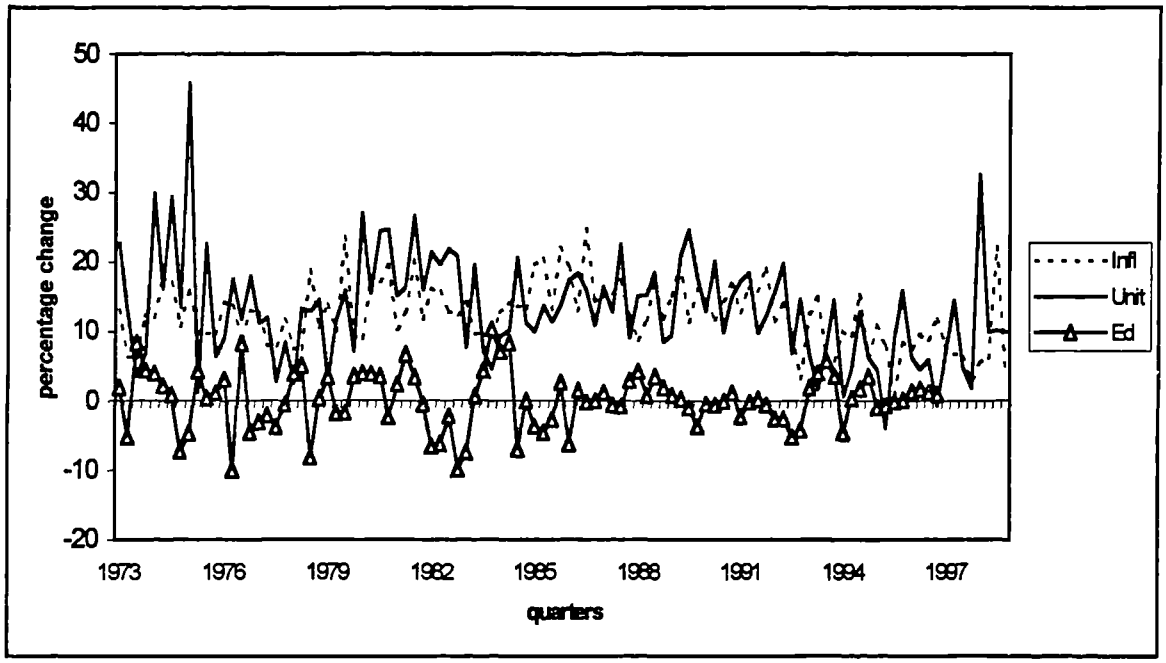
7.4 Macroeconomic features of the South African economy, 1973-1998

From the theoretical models outlined in the previous sections it is clear that wages, prices, the exchange rate and import prices are all inextricably linked, so that instability in one variable will invariably have a ripple effect on all the others. Since the main objective of this chapter is to analyse the inflationary impact of exchange rate depreciations over the period 1984-1998 when the exchange rate was more market-oriented, it is important to provide some descriptive evidence to determine whether the relevant variables under analysis are stable. It is also envisaged that significant structural, political and institutional changes over the period 1973-1998 have played a major role in changing the underlying causes of inflation over the sub-periods 1973-1983 and 1984-1998.

Figure 7.1 displays plots in annualised quarterly rates of change for price inflation (Infl), unit labour costs (Unit) and 'excess' demand (eD) over the period 1973-1998[8].

Figure 7.1

Inflation, Unit Labour Cost and 'Excess' Demand, 1973q1-1998q4



During the sub-period 1973-1983, it can be seen that the rate of change of unit labour costs consistently exceeded price inflation, especially during the early 1970s and early 1980s. These features could be the result of the oil price shock in 1973-1974 and exchange rate devaluations during the early 1970s, which increased South Africa's inflation rate from an annual rate of around 2.5% during the 1960s to double digit figures since the early 1970s[9]; nominal wage increases following the sharp increase in the gold price in 1979; and the legalisation of Black trade unions in 1980. By contrast, over the period 1984-1998 there seems to be a much closer and stable relation between unit labour cost and price inflation. The 'excess' demand variable displays cyclical fluctuations from 1973 until the mid 1980s, but thereafter seems to fade away considerably.

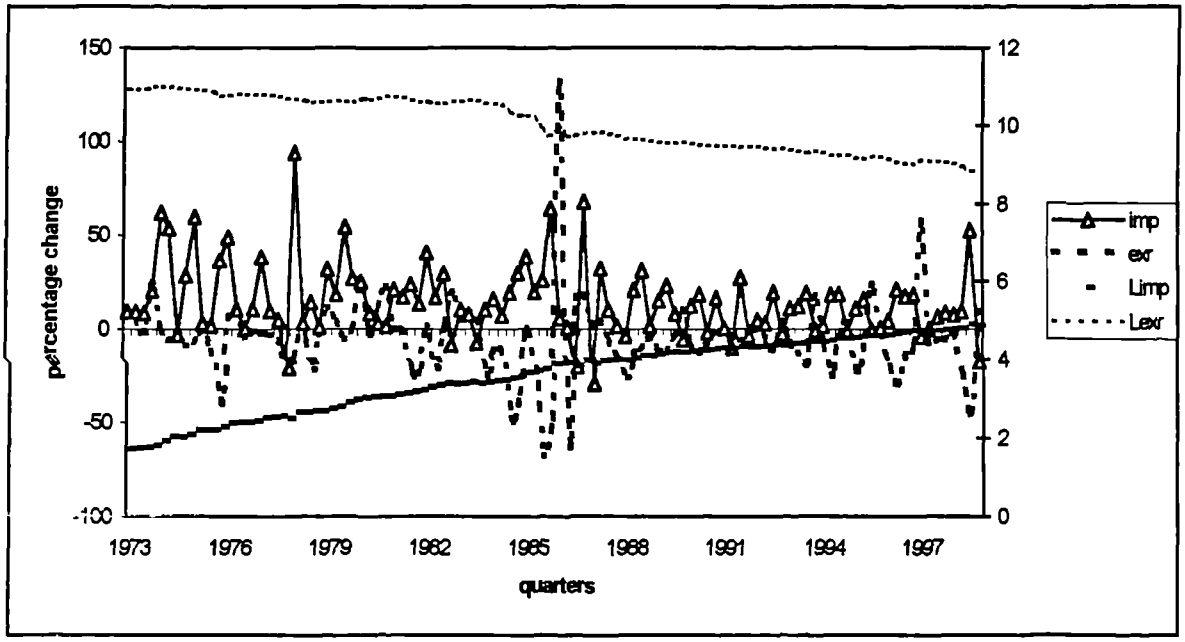
[8] Unless stated otherwise, all the data in this chapter are quarterly and obtained from the South African Reserve Bank's historical data set published on the internet (http//www.resbank.co.za/Economics/econ.html).

[9] Strydom and Steenkamp (1976) showed that successive exchange rate devaluations during the early 1970s increased import prices, which subsequently led to a sharp increase in price inflation.

Figure 7.2 depicts the relation between the annualised quarterly rates of change of import prices (imp) and exchange rate, and the level of import prices (Limp) and exchange rate (Lexr)[10].

Figure 7.2

Exchange Rate and Import Prices, 1973q1-1998q4



From 1973 until 1978 the monetary authorities adopted a fixed exchange rate system which pegged the rand to the US dollar. In 1979, a policy of variable dollar pegging was adopted which led to a more market-oriented exchange rate system. Towards the end of 1983, the Reserve Bank ceased to quote the spot exchange rate and allowed the exchange rate to be determined directly by the market (Kahn and Parikh, 1998). Furthermore, the exchange rate was subjected to a high degree of variability when capital controls on non-residents were abolished in 1983, but subsequently reinstated in 1985.

[10] The exchange rate is a trade weighted index (exports plus imports) and is denoted in units of foreign currency per unit of domestic currency, so that a decrease is a depreciation.

The significant changes in the exchange rate system are captured in Figure 7.2. From 1973-1983 the exchange rate in levels and rates of change remained fairly stable. The ability of the Reserve Bank to maintain a fixed exchange rate system (albeit to different degrees) over this period, was mainly supported by substantial capital inflows and a high gold price. After 1983 the drop in the dollar gold price, substantial capital outflows following increased political instability and the immediate repayment of foreign debt in 1985, were all factors that contributed to a depreciating exchange rate. It is also noticeable that after the adoption of a market determined exchange rate in 1983, both the level and rate of change of the exchange rate showed a greater degree of stability from 1987 onwards.

From the brief descriptive analysis it is clear that a structuralist theory of imported inflation may not necessarily be a characteristic feature of the South African economy over the period 1973-1983 when the exchange rate was fixed, but only after 1983 when the monetary authorities adopted a more market-oriented exchange rate system. Figure 7.2 shows a relatively stable relation between the rate of change of import prices and the exchange rate from the mid 1980s, while this relation is less conspicuous over the period of a fixed exchange rate system. During the early 1970s, variations in import prices seem to be the result of external shocks, rather than exchange rate movements. Based on the descriptive evidence, the empirical part of this chapter will focus on three different sub-periods using quarterly data: 1973-1983, 1984-1998 and 1987-1998.

7.5 Empirical results

7.5.1 Price and wage equations

The price and wage equations are all estimated in annualised quarterly rates of change over the period 1973-1998. Distributed lag (DL) and Auto Regressive Distributed Lag (ARDL) models are first estimated for the price and wage equations respectively (equations 7.1 and 7.4), and the corresponding long-run solutions are reported in Table 7.1 and Table 7.2. The lag structures are determined by starting from general models with lag structures of up to order seven, and then eliminating insignificant lags to obtain the most parsimonious model. The price and wage equations pass all the diagnostic tests

in the different sub-periods at the 5% significance level.[11] In all the price equations only the lagged values of the wage rate yielded significant results, which imply that the model is recursive. The standard OLS method may therefore be applied to estimate the parameters of the wage-price models separately.

Table 7.1 reports the long-run results for the price equations over the different sub-periods. Equations (7.15) and (7.16) are almost identical except that the insignificant labour productivity variable is dropped from equation (7.16). Three noteworthy features stand out in the price equations over the period 1973-1983. First, the import price coefficient is very low, and second, the 'excess' demand variable is statistically significant with a high coefficient of 0.52. Third, as is shown in Figure 7.1, the wage rate has a relatively low coefficient. In contrast, price equation (7.17) over the period 1984-1996 yields a significant labour productivity coefficient and an insignificant 'excess' demand coefficient. More importantly, the import price coefficient is significant at the 1% level and much higher in magnitude compared to the period 1973-1983. Equation (7.18) excludes 'excess' demand and extends the sample period to 1998. The main difference between this equation and the preceding ones is the much higher magnitude of the wage coefficient. Finally, equation (7.19) estimates the price equation over the sub-period 1987-1998. As predicted by Figure 7.1, the wage and the import price coefficients are both high in magnitude compared to the sub-period 1973-1983.

The long-run wage equations are given in Table 7.2. Price expectations in equation (7.20) yield an extremely high coefficient of 1.52 over the period 1973-1983. However, it is important to note from Figure 7.1 that the wage rate outpaced price inflation, so that, effectively, the wage-price spiral derived from equation (7.6) is very low ($\lambda_1\delta_1$=0.23).

[11] Structural stability tests were based on the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) tests of the recursive residuals, which showed that all the models identified over the sub-periods display structural stability at the 5% significance level.

Table 7.1

Long-run Price Equations, 1973q1-1998q4

Variables	Eqn (7.15) 73q1-83q4	Eqn (7.16) 73q1-83q4	Eqn (7.17) 84q1-96q4	Eqn (7.18) 84q1-98q4	Eqn (7.19) 87q1-98q4
intercept	8.99***	8.75***	8.58***	6.25***	-1.65
	(6.76)	(6.60)	(3.65)	(3.14)	(-0.68)
$\dot{w}_t$	0.15*	0.15*	0.27*	0.41***	0.79***
	(1.91)	(1.91)	(1.83)	(3.23)	(5.47)
$\dot{e}D_t^{gap}$	0.50***	0.52***	0.17		
	(2.98)	(3.11)	(0.82)		
$\dot{q}_t$	-0.15		-0.93***	-0.91***	-0.37**
	(-1.23)		(-3.54)	(-4.26)	(-2.63)
$\dot{imp}_t$	0.07*	0.08**	0.20***	0.22***	0.35***
	(1.78)	(2.06)	(3.31)	(3.78)	(3.42)
Diagnostic tests					
R^2	0.34	0.31	0.50	0.55	0.66
LM-test	F(4,33) = 0.64	F(4,34) = 0.54	F(4,37) = 1.23	F(4,47) = 1.93	F(4,34) = 0.82
Ramsey's Reset	F(1,36) = 0.42	F(1,37) = 0.24	F(1,40) = 0.62	F(1,50) = 0.00	F(1,37) = 0.31
Normality	χ^2 (2) = 0.83	χ^2 (2) = 0.23	χ^2 (2) = 1.96	χ^2 (2) = 0.91	χ^2 (2) = 0.08
Heteroscedast	F(1,42) = 2.35	F(1,42) = 3.73	F(1,50) = 0.37	F(1,42) = 0.15	F(1,46) = 0.02

Notes:

1. t-statistics are in parentheses.
2. *** denotes significance at the 1% level, ** at the 5% level and * at the 10% level.

Table 7.2

Long-run Wage Equations, 1973q1-1998q4

Variables	Eqn (7.20) 73q1-83q4	Eqn (7.21) 84q1-98q4	Eqn (7.22) 87q1-98q4
intercept	-3.43	4.61	4.54
	(-0.93)	(1.42)	(1.45)
p_t^e	1.52***	0.69***	0.73***
	(5.19)	(2.79)	(2.94)
Diagnostic tests			
R^2	0.45	0.40	0.41
LM-test	F(4,32) = 1.39	F(4,48) = 0.46	F(4,38) = 0.92
Ramsey's Reset	F(1,35) = 0.22	F(1,51) = 0.30	F(1,41) = 0.35
Normality	χ^2 (2) = 0.25	χ^2 (2) = 1.39	χ^2 (2) = 0.66
Heteroscedast	F(1,42) = 3.45	F(1,58) = 0.11	F(1,46) = 0.02

Notes:

1. t-statistics are in parentheses.
2. *** denotes significance at the 1% level, ** at the 5% level and * at the 10% level.

Over the sub-periods 1984-1998 and 1987-1998 the price expectations coefficient in the wage equation is considerably lower and more in line with the impact of wages on prices. More specifically, the wage coefficient in equation (7.19) and the inflation expectations coefficient in equation (7.22) are almost identical in magnitude over the period 1987-1998, which implies that the wage-price spiral stabilised after the move towards a more market determined exchange rate. Effectively, the wage-price spiral derived from equation (7.6) of 0.58 is much higher over the period 1987-1998.

In sum, the evidence thus far suggests that the underlying causes of inflation have changed between the sub-periods 1973-1983 and 1984-1998. The analysis further suggests that the long-run inflationary effect of an exchange rate depreciation is particularly relevant over the period 1987-1998 when all the relevant variables seem to have stabilised.

7.5.2 Import price equations

To assess whether the long-run import price equations yield robust estimates of the import pass-through coefficient, equations in levels and rates of change will be considered. First, consider the import price equation in levels given by (7.9). Standard Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests statistics over the period 1984q1-1997q1 showed that all the variables in levels contain a unit root, but are stationary in first differences[12].

Table 7.3 reports cointegration tests and long-run estimates of equation (7.9) based on the maximum likelihood systems procedure developed by Johansen and Juselius (1990). Panel A shows that the null hypothesis of no cointegration can be rejected at the 5% significance level over the period 1984q1-1997q1. Panel A(i) gives the long-run elasticities and panel A(ii) imposes the cross coefficient restriction implied by equation (7.9). From panel A(ii) it can be seen that the cross coefficient restriction is marginally rejected at the 5% significance level. The result may suggest that a long-run analysis of import pass-through should focus on the period 1987q1-1997q1, when the exchange rate stabilised after the move towards a more market determined system.

Panel B tests for cointegration over the period 1987q1-1997q1 and shows that the null hypothesis of no cointegration can be rejected at the 5% significance level. Panel B(i) reports the long-run elasticities and panel B(ii) tests the cross coefficient restriction. In contrast to the sub-period 1984q1-1997q1, the null hypothesis cannot be rejected.

In addition, panel B(ii) tests whether the import pass-through coefficient is insignificantly different from unity, and shows that this restriction can be rejected at the 1% significance level. Panel B(iii) reports the long-run elasticities when the cross coefficient restriction is imposed. Based on the results in panel B(ii), the long-run elasticity of 0.82 in panel B(iii) is significantly different from one, i.e. import pass-through is incomplete in South Africa.

[12] The import price equations are only estimated until the first quarter of 1997. Data obtained from the OECD's statistical compendium for producer prices only cover this period.

Table 7.3

Import Pass-Through Estimates Based on the Johansen Procedure

Panel A: Tests for cointegration between *Limp*, *Lexr* and *Lppi*, 1984q1-1997q1		
H_0	λ max eigenvalue	λ trace
r = 0	24.07**	37.98**
r ≤ 1	10.33	13.90
r ≤ 2	3.57	3.57
Panel A(i): Long-run elasticities, 1984q1-1997q1		
Limp	*Lexr*	*Lppi*
-1	0.72	1.29
	(0.03)	(0.16)
Panel A(ii): Restriction based on the likelihood ratio test		
Restriction		Test statistic
$\alpha_1 = \alpha_2$		$\chi^2(1) = 3.85$**
Panel B: Tests for cointegration between *Limp*, *Lexr* and *Lppi*, 1987q1-1997q1		
H_0	λ max eigenvalue	λ trace
r = 0	21.37**	32.77**
r ≤ 1	11.27	11.39
r ≤ 2	0.11	0.11
Panel B(i): Long-run elasticities, 1987q1-1997q1		
Limp	*Lexr*	*Lppi*
-1	0.72	1.18
	(0.09)	(0.34)
Panel B(ii): Restrictions based on the likelihood ratio test		
Restriction		Test statistic
$\alpha_1 = \alpha_2$		$\chi^2(1) = 1.09$
$\alpha_1 = \alpha_2 = 1$		$\chi^2(2) = 11.64$***
Panel B(iii): Long-run elasticities with restriction ($\alpha_1 = \alpha_2$) imposed		
Limp	*Lexr*	*Lppi*
-1	0.82	0.82
	(0.01)	(0.01)

Notes:

1. *** denotes significance at the 1% level and ** at the 5% level.
2. The 5% critical values for the max eigenvalue and trace tests statistics are 21.12 and 31.54 respectively.
3. The figures in parentheses in panel A(i) , B(i) and B(iii) are asymptotic standard errors.
4. The order of the VAR model is six ($k = 6$).
5. The Akaike Information and Schwartz Bayesian selection criteria were used to determine the order of the VAR. In cases where the two selection criteria contradicted each other, a likelihood ratio test was performed to eliminate lags from a general to a more specific model.
6. The critical values computed by Osterwald-Lenum (1992) were used to determine the deterministic components in the underlying VAR model. In each case the constant was restricted to lie outside the cointegration space without a trend.

The long-run solution of an underlying ARDL model estimated in annualised quarterly rates of change over the period 1987q1-1997q1 is given by (t-statistics in parentheses)[13]:

$$\dot{imp} = -0.20 + 0.83\dot{exr} + 0.60\dot{ppi} \qquad (7.23)$$
$$(-0.12) \quad (5.21) \quad (3.74)$$

$R^2 = 0.83$
LM-test (serial correlation): F(4,24)=0.41
Functional form: F(1,27) = 0.05
Normality: χ^2 (2) = 0.08
Heteroscedasticity: F(1,39) = 0.10

Long-run test: F-test = 6.67
Wald test: χ^2 (1) = 0.86
(cross coefficient restriction)

Equation (7.23) is well determined and passes all the diagnostic tests with ease. The long-run F-test based on Pesaran *et. al's.* (1996) unrestricted error correction procedure for I(0) variables, shows that the null of no long-run relationship between import prices, the exchange rate and producer prices can be rejected at the 1% significance level; conditional on the exchange rate and producer prices as the long-run 'forcing' variables for import prices. The Wald test reported below equation (7.23) indicates that the cross coefficient restriction cannot be rejected. Equation (7.24) gives the long-run model when the cross coefficient restriction is imposed (t-statistics in parentheses):

$$\dot{imp} = 0.58 + 0.72\dot{exr} + 0.72\dot{ppi} \qquad (7.24)$$
$$(0.42) \quad (7.27) \quad (7.27)$$

In addition, to test the null hypothesis that the import pass-through coefficient of 0.72 is insignificantly different from unity, the Wald test of 7.79 indicates that this restriction can be rejected at the 1% significance level.

To summarise, both the levels and rates of change estimates are close in magnitude and further provide evidence that import pass-through is incomplete in South Africa. The results also support the prior belief that the long-run inflationary impact of an exchange

[13] The optimal lag length in the ARDL model was again determined by starting form a general model with a lag length of order seven, and then eliminating lags with insignificant parameter estimates.

rate change should be investigated over the period 1987q1-1998q4, when a more market determined exchange rate finally stabilised.

7.6 The long-run inflationary impact of an exchange rate depreciation

To investigate the long-run inflationary impact of an exchange rate depreciation and the subsequent wage-price spiral that it triggers over the period 1987-1998, the values from equations (7.19), (7.22) and (7.24) are substituted into equation (7.14).

$$\frac{\lambda_4}{(1-\lambda_1\delta_1)} \cdot K = \frac{0.35}{[1-(0.79)(0.73)]} \times 0.72 = 0.60 \qquad (7.25)$$

Equation (7.25) states that a one percent depreciation in the exchange rate over the period 1987-1998, will (on average) lead to a 0.60 percent increase in price inflation. To supplement the evidence in equation (7.25), the generalised impulse response analysis described by Pesaran and Shin (1998) can be employed to show the impact on price inflation (Infl), unit labour cost (Unit) and import prices (imp) following an exogenous shock to the exchange rate over the period 1987-1998[14]. Figure 7.3 displays the effect of a one standard error shock to the import weighted exchange rate over a time horizon of thirty quarters.

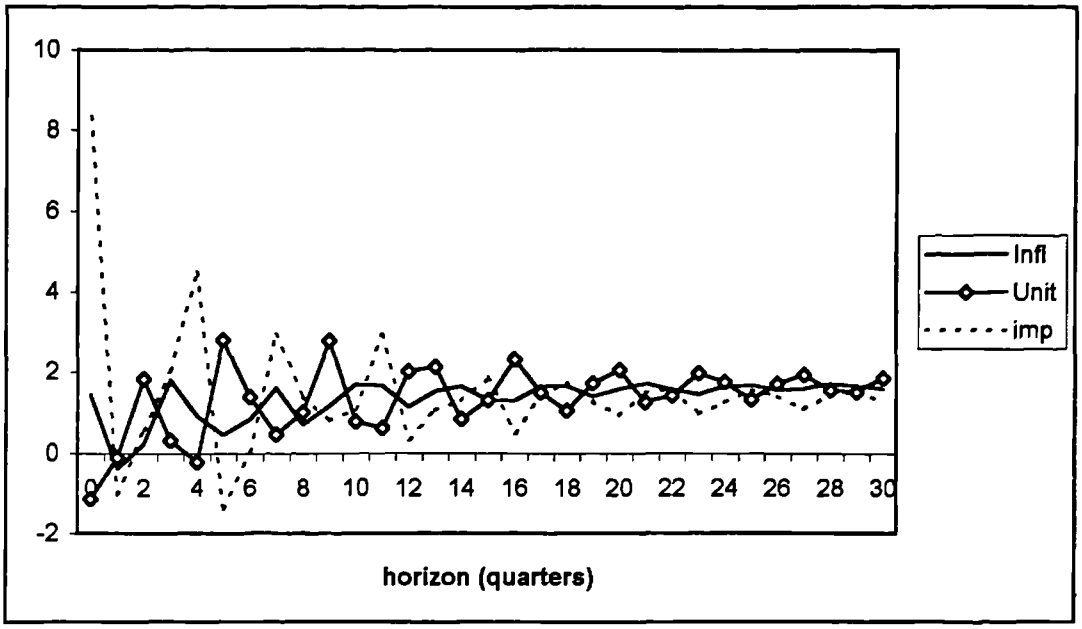
Figure 7.3 shows that price inflation, unit labour cost and import prices all show a high degree of persistence over a long period of thirty quarters. The analysis is particularly useful for policy purposes, since it reiterates that exchange rate depreciations over the period 1987-1998 provide a long-run explanation of price inflation in South Africa.

[14] The analysis is first based on estimating an unrestricted Vector Auto Regressive (VAR) model which includes price inflation, unit labour cost, the import weighted exchange rate and import prices. The generalised impulse response functions can then be estimated with respect to a one standard error shock to the exchange rate. Based on the Akaike and Schwartz Bayesian criteria an unrestricted VAR model of order five is estimated.

Figure 7.3

Generalised Impulse Response Analysis

(based on an unrestricted VAR model, 1987q1-1998q4)



Finally, to capture the significant changes in the underlying causes of inflation between the sub-periods 1973-1983 and 1987-1998, we substitute the values from equations (7.16), (7.19), (7.20) and (7.22) into equation (7.6)[15]. The most striking feature of the results in Table 7.4 is that the underlying causes of inflation in South Africa have changed from a demand-pull inflation over the period 1973-1983 to a cost-push cause of inflation over the period 1987-1998. The significant impact of labour productivity over the period 1987-1998, could be the direct result of escalating labour unrest during the 1980s and 1990s following the legalisation of Black trade unions in 1980 (Sadie, 1992). This is borne out by the wage-price spiral coefficient which increased from 0.23 over the period 1973-1983 to 0.58 over the period 1987-1998.

[15] A direct comparison between the sub-periods 1973-1983 and 1987-1998 is strictly speaking only valid based on a precondition. Since the 'excess' demand variable is constructed as a centred-moving average filter, equations in Table 7.1 which include this variable are only estimated until the fourth quarter of 1996. From a long-run perspective, the 'excess' demand variable is therefore excluded from equation (7.19) under the assumption that the insignificance of 'excess' demand since the mid-1980s is also relevant until the fourth quarter of 1998.

Table 7.4

Long-run Determinants of Price Inflation

Variables	1973q1-1983q4	1987q1-1998q4
$\dot{e}D_t^{gap}$	0.68	–
$\dot{q}_t$	–	-0.88
$\dot{imp}_t$	0.10	0.83

It is also important to note that the formation of different inflation expectations between the sub-periods 1973-1983 and 1987-1998, implies that the magnitude of the short-run and long-run coefficients reported in Chapter 6 (Tables 6.11 and 6.12) are inaccurate and only 'indicative'. In Chapter 6 it was assumed that inflation expectations remained constant over the period 1973-1996.

Even if it assumed that import pass-through is complete over the period 1973-1983, the low magnitude of the import price coefficient in Table 7.4 again underlines the fact that import prices do not provide a long-run explanation of price inflation over this period. During different times, a rise in import prices has been inflationary following exchange rate devaluations and a once-off adverse supply shock. However, capital inflows and a high gold price during this period allowed the monetary authorities to maintain a fixed exchange rate, which prevented continuous devaluations.

By contrast, the high magnitude of the import price coefficient over the period 1987-1998 in Table 7.4, not only reflects the move towards a market determined exchange rate system, but also the undiversified nature of South Africa's export sector[16]. Evidently, a structuralist theory of price inflation becomes relevant over the period 1987-1998. The general decline in the mining sector coupled with substantial capital outflows have led to a steady, but depreciating exchange rate, which have made the South African economy extremely vulnerable to imported inflation.

[16] Fallon and de Silva (1994) provide a thorough analysis of South Africa's export sector.

7.7 Conclusion

The main findings of this chapter have shown that the long-run causes of inflation in South Africa have changed from demand-pull inflation in 1973-1983, to a cost-push cause of inflation (import prices and wage rate changes) in 1987-1998. Cost-push inflation became more relevant in the South African economy after 1983, when substantial capital outflows, the general decline in the mining sector and an undiversified export sector exposed the country to imported inflation.

During the 1980s and 1990s, more restrictive monetary policy measures were in place to protect the country's balance of payments from adverse political and economic conditions (Botha, 1997; De Wet, 1995; Schmulow and Greyling, 1996). To maintain price stability, restrictive monetary policy measures were mainly based on reducing domestic aggregate demand. Although the successful democratic election in 1994 witnessed South Africa's reintegration into the global economy and the return of capital flows, macroeconomic policy up to the present is still based on restrictive measures (Weeks, 1999)[17]. To this end, the monetary authorities succeeded in bringing the inflation rate down gradually from double digit rates of around 13 percent per annum over the period 1973-1993, to single digit rates of around 7.7 percent per annum over the period 1994-1998.

The insignificant inflationary impact of 'excess' demand over the period 1984-1996 in this study may, to some extent, capture the impact of restrictive monetary policy measures. Although there are various microeconomic reasons to explain incomplete pass-through, low domestic demand seems to be particularly relevant to explain why the degree of import-pass through is incomplete in a small open economy like South Africa. The long-run pass-through estimates of 72% and 82% in rates of change and levels respectively also compare favourably with the pass-through estimates reported for other small open economies. For manufacturers import prices in Australia, Menon (1995b) reports an import pass-through estimate of 65%, while Moreno's (1989) import pass-through estimates range between 58% for Korea and 74% for Taiwan.

[17] Once the ANC government came into power in 1994, the proposed GEAR (Growth, Employment, and Redistribution programme) policy document stipulated an orthodox macroeconomic programme of tight fiscal and monetary policy, combined with trade liberalisation (Weeks, 1999).

The main policy implication of this study is that restrictive demand management policies may not necessarily promote high and sustainable economic growth, even though the monetary authorities managed to bring the inflation rate down to single digit rates[18]. The underlying cause of inflation is not demand-pull but cost-push. As long as the present structural features of the South African economy remain the same, there will always be a bias towards inflation. Against the background of an unemployment rate which has recently reached an unprecedented high of 40 percent, the time has come to consider whether the benefits reaped from lower unemployment outweigh the costs of higher inflation.

[18] The underlying motive for restrictive macroeconomic policy measures in the GEAR programme is to achieve the twin objectives of high growth and low inflation. According to Weeks (1999), however, growth has remained far below the target stipulated in GEAR.

PART 3

THE COSTS AND BENEFITS OF INFLATION

CHAPTER 8

GROWTH AND INFLATION IN SOUTH AFRICA: IS THERE AN INEVITABLE TRADE-OFF ?

8.1 Introduction

One of the most pervasive questions in macroeconomics is whether inflation, at any given level, is always bad for growth. There seems to be widespread consensus amongst Central Banks that zero inflation, or at least close to zero, is an important precondition for high and sustainable growth (Stanners, 1993). In a recent article published in the South African Reserve Bank's (SARB) Quarterly Bulletin, Smal (1998) provides theoretical and descriptive evidence that essentially emphasise the cost of inflation in South Africa. The main content of this analysis seems to be geared towards a justification for the rather conservative approach that has historically been adopted by the monetary authorities in bringing the inflation rate down to low levels.

Although it is easier to justify stringent deflationary policies when inflation is well in the double digit zone, it becomes more difficult when inflation is brought back to single digit rates. All too often Central Banks portray a one-sided view on the cost of inflation without taking into consideration the substantial costs associated with deflationary policies when inflation is already at low levels. More importantly, there are various theoretical reasons (Thirlwall, 1974) supported by recent empirical evidence (Sarel, 1996) to believe that mild inflation can actually be beneficial to growth.

Like many other countries, South Africa experienced high and accelerating inflation during the 1970s and 1980s. With inflation reaching an historically high level of 18% in 1986, the SARB had no choice but to implement a strict deflationary policy to bring inflation down to lower levels. Single digit rates were again reached after 1993 and in 1999 inflation of 5.2% was at its lowest level in thirty years. Without an official inflation target at the time of writing, the SARB's unofficial target ranges between 1%-5% which is roughly in line with the average of South Africa's major trading partners.

Against the background of an official unemployment rate which hovers around 40%, the relevant question is whether monetary policy should be geared towards attaining even lower inflation, or whether inflation should be allowed to vary within the single digit zone given the potential benefits of mild inflation.

The main purpose of this chapter is to provide a more balanced approach to the relation between inflation and growth in South Africa. The theoretical and empirical analysis will therefore not only focus on the costs of inflation, but also the potential benefits of mild inflation. An important and related issue to be investigated is whether the benefits of lower inflation are likely to outweigh the costs of disinflation policy in a developing country like South Africa.

Section 8.2 presents a theoretical discussion and an overview of empirical studies which have analysed the costs and benefits of inflation. Section 8.3 describes the methodology to be employed in the empirical section together with descriptive evidence on the growth-inflation relationship in South Africa. The methodology described in this section will attempt take into account some of the various flaws of time series studies identified by Temple (1999) in a recent survey of inflation-growth studies. Section 8.4 presents the empirical results. The focus in section 8.5 is on the short-run costs of disinflation policy and whether restrictive monetary policy could have permanent negative effects on growth. Section 8.6 ends with conclusions and policy implications.

8.2 The costs and benefits of inflation: theory and empirical evidence

As a starting point it is useful to distinguish between the costs associated with anticipated and unanticipated inflation (Briault, 1995). Some of the most common costs associated with anticipated inflation are "shoe-leather" costs; "menu" costs from frequently changing price lists; "bracket creep" associated with a less than perfectly indexed tax system; and the loss of international competitiveness if a country is inflating at a higher rate than its major trading partners. According to Moosa (1997), the costs of anticipated inflation are presumably less serious than those associated with unanticipated inflation because anticipated inflation allows agents to adjust contracts, wages, nominal interest rates and the tax system. The loss of international

competitiveness potentially poses the most serious cost of anticipated inflation[1]. A positive inflation differential between a country and its major trading partners could lead to expectations about future exchange rate depreciations which may induce speculative capital outflows. Theoretically, if purchasing power parity holds in the long-run, the loss of international competitiveness could be fully offset by exchange rate depreciations, but it is also important to acknowledge that international competitiveness is not only determined by prices, but a wide range of factors that includes product attributes such as quality, reliability and design (Moosa, 1997: 652).

The most damaging costs are arguably those associated with unanticipated inflation. Unanticipated inflation may cause confusion between relative and aggregate price changes which subsequently leads to the misallocation of scarce resources and lower growth. Moreover, uncertainty about future price levels could force investors to delay investment decisions since investment is a sunk cost and largely irreversible (Pindyck, 1991). Lastly, high and variable prices also imply uncertainty about the real interest rate. If savers and investors form different expectations about the real interest rate, funds will be allocated inefficiently. Empirical studies that have found the distortionary effect of inflation to impact negatively on economic growth include those conducted by Barro (1996); De Gregorio (1992, 1993); Fischer (1993); Grimes (1991); Kormendi and Meguire (1985); and Smyth (1992).

To avoid a one-sided view that primarily emphasises the cost-effects of inflation on growth, it is also important to highlight some of the potential benefits of inflation[2]. The main essence of the Keynesian view is that inflationary finance can mobilise resources for capital accumulation. The redistribution of wealth from money into physical assets may proceed through two main channels, one of which originates from the Keynesian approach and the other from the Quantity Theory approach. First, if real wages are slow to adjust to inflation, the Keynesian view asserts that inflation will redistribute income from workers with low saving propensities to entrepreneurs with higher saving propensities. Second, according to the Quantity Theory approach, inflation acts as a tax

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[1]Moosa (1997), for example, cites Dawson (1992) who showed that inflation needs to be 20 percent before "menu" costs amount to 0.1 of a percentage point. Moreover, it could also be argued that technological advancements have made "shoe leather" and "menu" costs almost negligible.

[2] For a comprehensive theoretical discussion on the potential benefits of mild inflation, see Thirlwall (1974).

on real money holdings which redistributes wealth from the holders of money balances to the government who invests the proceeds on behalf of society[3]. The Keynesian view also stresses other important means through which inflationary finance could stimulate saving and investment such as a lower real interest rate and a rise in the nominal rate of return on investment.

An important implication of the Keynesian view is that forced saving that results from inflationary finance generates higher real saving for investment purposes. Higher investment levels lead to higher income growth, and if saving is a positive function of income, a self-perpetuating process evolves when investment also generates its own saving. Thus, although inflationary finance of investment may cause prices to rise in the short-run, this need not necessarily be the case over a longer period.

Turning to a structuralist view of inflation, the argument is held that up until a certain critical inflation rate, there is a positive relation between inflation and growth which is not necessarily the outcome of inflationary finance, but rather an inevitable by-product of growth in developing countries. According to structuralists, the build-up of inflationary pressure that results from structural factors is the natural outcome of higher growth. The inevitable trade-off between growth and inflation implied by the structuralist view suggests that higher growth and lower unemployment can only be achieved at the cost of some inflation, which should be accommodated by the monetary authorities if lower unemployment is a priority or, indeed, if output losses are to be avoided through premature restrictive measures.

The growth-inflation process described by structuralists is typically based on two main arguments (Johnson, 1966; Johnson, 1984; Yeldan, 1993). First, due to factor immobility and downward rigidity of factor prices, structural imbalances that arise from

[3] The positive effect of an inflation tax on investment and growth will be subject to an important precondition (Johnson, 1984; Thirlwall, 1974). Because inflationary finance reduces the real value of normal taxes, the net contribution of inflationary finance may be ambiguous. Thus, an important precondition for higher growth is that the government uses the additional revenue from the inflationary tax for investment in high yielding projects to complement, rather than crowd-out, private investment.

expanding and declining sectors are inflationary. However, upward movements in wages and prices are necessary to reallocate scarce resources in the most efficient way. It is interesting to note that the relationship between inflation and growth described here by structuralists is bi-directional, which is a departure from most empirical studies which investigate uni-directional causality from inflation to growth (Paul *et. al.*, 1997). Second, because the demand for traditional exports is inelastic in developing countries, foreign exchange earnings are generally not enough to finance imported capital and intermediate goods which play an essential role in the development process. To avoid balance of payments problems arising from high import propensities of domestic industries, a trade policy of import substitution is required and/or currency depreciations in the case of a flexible exchange rate system, which in turn may both create inflationary pressure.

Empirical studies conducted during the 1950s and 1960s, generally found that mild inflation either exerted a positive impact on growth (Dorrance, 1966; Thirlwall and Barton, 1971), or that there was no discernible relationship (see Bruno and Easterly's (1996) overview). It is important to note, however, that adherents of a Keynesian or structural view of inflation have always gone to great lengths to stress that the benefits of inflation will not be forthcoming when inflation is extremely high or exceeds a critical rate of around 10% (Johnson, 1966; Thirlwall, 1974). It is therefore not surprising that on the surface there is some ambiguity between studies conducted during the 1950s and 1960s when inflation was low and well within the single digit range, compared to studies during the 1970s and 1980s when most countries experienced high and accelerating inflation.

In one of the few papers that has attempted to test empirically the costs and benefits of inflation, Sarel (1996) conducted a panel study for 87 countries during the period 1970-1990. The empirical results show that there is a non-linear relation between growth and inflation and that the structural break occurs when inflation is 8 percent. Above the structural break inflation exerts a powerful negative impact on growth, but below the break the impact of inflation tends to be slightly positive. The results also show that if the structural break is excluded from the estimates, the negative impact of inflation on growth is underestimated by a factor of three. The panel study by Ghosh and Phillips (1998) also finds a structural break, but the positive impact of inflation on growth only

occurs at inflation rates between 2-3 percent, otherwise inflation and growth are negatively related. Barro (1996) concludes from his panel study that although there is a small but negative relation between inflation and growth, the effect largely comes from high inflation countries[4]. Finally, Bruno and Easterly (1996) present empirical evidence which shows that the negative impact of inflation on growth is only relevant above a threshold of 40 percent.

8.3 Data, methodology and descriptive evidence

The theoretical and empirical overviews in the previous section suggest that empirical studies of growth-inflation relationships may not generate unbiased results without an extensive analysis of the time series properties. Without taking into account that the particular growth-inflation relationship under study contains a structural break, or possibly more than one break, it may understate the negative impact of inflation on growth. If the data are dominated by high inflation periods, the results may not be unbiased because it precludes the potential benefits of mild inflation. For policy purposes, it therefore seems crucial to explicitly take into account various structural breaks that may exist between inflation and growth.

The empirical analysis in this chapter departs from previous time series case studies in one important aspect. To capture the potential costs and benefits of inflation, South Africa's inflationary experience over a long and extended period is divided into five inflationary episodes. Table 8.1 presents the five inflationary episodes in South Africa together with the corresponding mean and median real gross domestic product (GDP) growth rates. The data are seasonally adjusted and in annualised quarterly rates of change over the period 1960q2-1999q2.

[4] Stanners (1996) on the other hand, criticises Barro's (1996) main findings and argues that the results are basically consistent with his own findings in 1993, which showed that lower inflation does not lead to improved growth rates.

Table 8.1

Inflation and GDP Growth Statistics in South Africa, (1960q2-1999q2)

Inflation	**60q2-99q2**	**60q2-70q4**	**71q1-93q4**	**71q1-85q4**	**86q1-93q4**	**94q1-99q2**
Description of inflation period		Zero inflation	Double Digit inflation	Accelerating Inflation	Deflationary Period	Single Digit inflation
Mean	9.41	3.02	12.77	12.20	13.83	7.87
Median	9.51	0	12.72	12.45	14.36	7.77
Standard dev	6.22	4.21	4.68	4.77	4.37	4.68
GDP Growth	**60q2-99q2**	**60q2-70q4**	**71q1-93q4**	**71q1-85q4**	**86q1-93q4**	**94q1-99q2**
Mean	3.18	6.02	2.08	2.67	0.96	2.26
Median	2.94	5.94	2.50	3.51	1.16	1.66
Standard dev	5.42	7.25	4.43	4.95	3.01	2.40

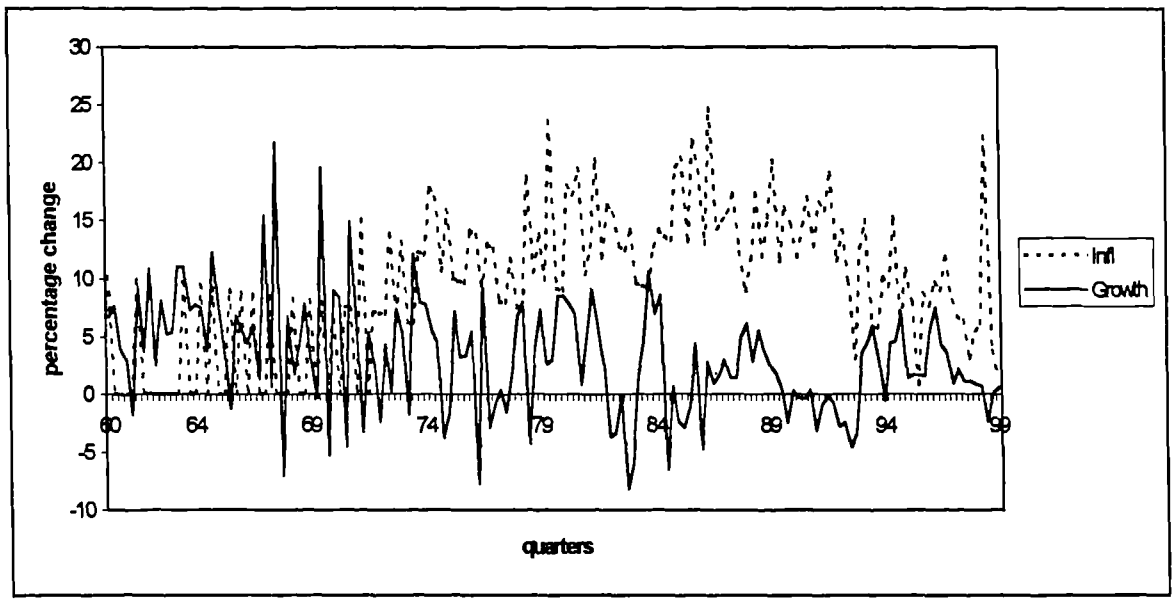
Table 8.1 indicates that South Africa's mean and median inflation rates of 9.41 and 9.51 percent over the whole period 1960q2-1990q2 are not high compared to the median of 6.1 percent for developed countries and 11.3 percent for developing countries[5]. The underlying reason for sub-dividing South Africa's inflationary experience into five episodes is based on two main considerations. First, an analysis of the inflation-growth relationships in the zero and single digit periods may capture the benefits of mild inflation. Second, the double digit, accelerating and deflationary episodes may represent periods which are particularly useful to study the costs of inflation. The distinguishing feature between the five inflationary episodes is not only based on periods of high and low inflation, but also includes a period of stabilisation (the deflationary period), where inflation decelerated from an historically high level of 18 percent in 1986. Easterly (1996) has shown that periods of stabilisation are generally characterised by an expansion in short-run output, which makes such an analysis particularly useful to study the growth benefits of lower inflation. Again, such a relation may not automatically present itself without isolating it from other inflationary episodes.

[5] The median inflation rates for developed and developing countries over the period 1979-1993 are taken from Thirlwall (1997).

Figure 8.1 plots the growth and inflation data over the period 1960q2-1999q2, and clearly shows how the different inflationary episodes have evolved over time, especially the accelerating and deflationary episodes which cannot be distinguished by the mean and median inflation rates in Table 8.1.

Figure 8.1

Inflation (Infl) and Growth, 1962q2-1999q2



The general picture presented by Table 8.1 and Figure 8.1 is that high average growth rates coincide with low average inflation rates. Conclusions drawn from simple contemporaneous correlations between growth and inflation, however, says little if anything about the direction of causality, or whether the inflation-growth correlations truly represent the costs and benefits outlined in the previous section. In an extensive survey of inflation-growth studies, Temple (1999) identifies the absence of good cyclical adjustments as one of the major flaws of time series case studies. Inflation and growth may both be endogenous to restrictive or expansionary government policy, or be the joint outcome of shocks such as those experienced to oil and commodity prices in the 1970s. Contemporaneous correlations between growth and inflation may therefore be spurious without capturing the "true" costs and benefits of inflation. Studies conducted by Freeman and Yerger (1997); Karras (1993); Rudebusch and Wilcox (1994); and Sbordone and Kuttner (1994), have all shown the importance of good cyclical adjustments. More specifically, these studies show that the relation between

inflation and growth without cyclical adjustments is usually strong and negative, but when adjustments are made for cyclical factors the relationship is much weaker or the relationship simply disappears[6].

A casual overview of South Africa's growth and inflation experience over the period 1960q2-1999q2, suggests that commodity and oil price shocks in the 1970s, severe balance of payments difficulties in the 1980s and early 1990s following the immediate repayment of foreign debt and political shocks, and restrictive monetary policy measures to maintain price stability after 1986, are all factors which may lead to a spurious relationship between inflation and growth. However, the sub-division of South Africa's growth and inflation experience into five episodes presents distinct advantages compared to standard time series case studies and even cross country and panel studies[7]. First, it is easier to assess whether the inflation-growth relationship in a specific inflationary period is robust or whether the results are mainly driven by shocks and/or cyclical factors which are particularly relevant to the sub-period under analysis. Second, knowledge of country specific features such as the conduct of monetary policy and the relative importance of shocks across different inflationary periods, may partly avoid selecting instruments to capture cyclical and other factors purely on an arbitrary basis.

The econometric methodology employed in this chapter is mainly based on long-run and short-run causality tests within the identified inflationary episodes. The long-run causality tests are based on Pesaran *et al's.* (1996) unrestricted error correction procedure for I(0) and I(1) variables and are given by:

$$\Delta \dot{g} = a_0 + \sum_{i=1}^{r} b_i \Delta \dot{g}_{t-i} + \sum_{i=1}^{r} c_i \Delta \dot{p}_{t-i} + \delta_1 g_{t-1} + \delta_2 \dot{p}_{t-1} + \varepsilon_t, \qquad (8.1)$$

[6] Freeman and Yerger (1997) and Karras (1993) have shown that the strong negative impact of inflation on growth shown by Smyth (1995) and Grimes (1991), respectively, is invalid once cyclical factors are taken into account.

[7] Some of the main criticisms that have been levelled against cross country studies, are the sensitivity of growth-inflation results to the country sample and time period under analysis (Clark, 1997; Levine and Zervos, 1993). In addition, Temple (1999) argues that panel studies can be subjected to exactly the same criticisms as those levelled against time series case studies.

where a_0 is an intercept term; $\dot{g}$ is the annualised quarterly rate of change of real gross domestic product; and $\dot{p}$ is the annualised quarterly rate of change of consumer price inflation. The unrestricted error correction model consists of two parts. The variables in first differences represent the short-run part and the lagged level variables, which also include the error correction term ($\dot{g}_{t-1}$), the long-run part of the model. Also note that the short-run part of the model excludes the current value of inflation since there is no *a priori* way to know whether inflation is the long-run exogenous variable. To test the null hypothesis that the lagged levels of the variables (i.e. the long-run part of the model) are not jointly significant (H_0: $\delta_1 = \delta_2 = 0$), the statistic is the standard F-test. Since this statistic has a non-standard distribution the critical value bounds in Pesaran and Pesaran (1997:484) are used for I(0) and I(1) variables, depending on the order of integration of the variables under analysis. If the F-statistic rejects the H_0, we can conclude that there exists a long-run relationship between growth and inflation, with inflation as the "long-run forcing" variable. By treating inflation as the endogenous variable the procedure can be repeated to draw some inferences on the conditions necessary for efficient estimation.

Alternatively, to explicitly take into account the impact of cyclical and other factors in the relation between inflation and growth, consider the following Vector Auto Regressive (VAR) representation:

$$\dot{g}_t = \beta_0 + \sum_{i=1}^{m} \beta_{\dot{g}i} \dot{g}_{t-i} + \sum_{i=1}^{m} \beta_{\dot{t}o\dot{t}i} \dot{t}o\dot{t}_{t-i} + \sum_{i=1}^{m} \beta_{\dot{p}i} \dot{p}_{t-i} + \sum_{i=1}^{m} \beta_{\dot{m}3i} \dot{m}3_{t-i} + \sum_{i=1}^{m} \beta_{\dot{r}i} \dot{r}_{t-i} + \xi_t, \qquad (8.2)$$

where β_0 is an intercept term; $\dot{t}o\dot{t}$ is the terms of trade (including the price of gold) that reflects supply shocks; and $\dot{m}3$ and $\dot{r}$ are the M3 money stock and nominal lending rate respectively, to capture the impact of cyclical factors such as government policy and other demand factors. All the variables are in annualised quarterly rate of change. The null hypothesis that inflation does not cause growth can be represented by $H_0 : \beta_{\dot{p}i} = 0 \supset i$, based on a standard F-test. The same procedure applies to all the other variables on the right-hand side. Reverse causality, with inflation as the left-hand side variable, can be tested along similar lines.

The underlying motive for conducting long-run and short-run causality test are primarily based on the order of integration of the variables under analysis. With the exception of inflation, Standard Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) test statistics over the period 1960q2-1999q2 showed that all the variables are stationary at the 5 percent significance level. In addition, Perron (1989, 1990) has shown that standard DF and ADF tests may be biased by not rejecting the null hypothesis of a unit root if the time series contains a structural break. By including suitable dummy variables in the ADF regression to capture the oil price shock in 1973 and the breakdown of the Bretton Woods system in 1971, the unit root hypothesis for inflation could now be rejected based on the 5% critical values in Perron (1990)[8].

Since all the variables are I(0), standard cointegration techniques cannot be used to detect long-run relationships between the relevant variables. The Pesaran *et al.* (1996) procedure in equation (8.1) provides a useful alternative, because long-run relationships can also be determined even when all the variables are stationary. The main drawback of this procedure is that an analysis between inflation and growth only becomes meaningful when there is uni-directional long-run causality either running from inflation or from growth. Because all the variables are by construction I(0), bi-directional causality between inflation and growth, although plausible from a theoretical viewpoint, may merely pick up a third effect through the error correction terms[9].

If there is indeed bi-directional causality between inflation and growth based on the unrestricted error correction procedure in equation (8.1), then the VAR model that allows for shocks and cyclical factors in equation (8.2) is the next best alternative. The procedure will then be based on a short to medium-run analysis without saying anything

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[8] A similar result is obtained by splitting the sample period into two sub-periods. The corresponding ADF tests are –5.38 with a 5 percent critical value of –2.94 in the period 1960q2-1970q4, and –2.91 with a 5 percent critical value of –2.88 in the period 1971q1-1999q2. Also note that the descriptive analysis in Table 8.1 and Figure 8.1 assumes that there are five breaks in the inflation series. The severest break, however, occurred after 1970, where inflation jumped from an average of around 3 percent to double digit rates, thus causing some bias in the ADF tests.

[9] The intuition behind this reasoning is as follows. When two non-stationary variables cointegrate to form a stationary time series, then causality through the stationary error correction term in an error correction model serves as a test for weak exogeneity. Even in cases where there is bi-directional causality between two variables the result still has a meaningful interpretation, where each variable is weakly exogenous to the other (Engle and Granger, 1987). However, in cases where two variables are stationary, there is no *a priori* way to know whether bi-directional causality through the error correction term is indicative of weak exogeneity, or whether there are simultaneity problems between the two variables.

about permanent long-run effects. It is, of course, more likely that short to medium-run results that explicitly allow for cyclical factors and shocks could have permanent effects, or, at least, that the results represent the "true" short to medium-run costs and benefits of inflation. However, it is important to acknowledge that an analysis which is based on five inflationary episodes immediately implies that a permanent long-run relation between inflation and growth is highly improbable.

8.4 Empirical results

Long-run causality results based on the unrestricted error correction procedure in equation (8.1) are reported in Table 8.2.

Table 8.2

Long-Run Causality Tests

Equation	Right-hand side variables		Final results
	$\dot{g}$	$\dot{p}$	
1960q2-1999q2			
$\dot{g}$		30.52***	$\dot{g} \Leftrightarrow \dot{p}$
$\dot{p}$	7.76***		
1960q2-1970q4 (zero inflation period)			
$\dot{g}$		23.56***	$\dot{g} \Leftrightarrow \dot{p}$
$\dot{p}$	18.46***		
1971q1-1993q4 (double digit inflation period)			
$\dot{g}$		14.29***	$\dot{g} \Leftrightarrow \dot{p}$
$\dot{p}$	10.99***		
1971q1-1985q4 (accelerating inflation)			
$\dot{g}$		10.87***	$\dot{g} \Leftrightarrow \dot{p}$
$\dot{p}$	8.73***		
1986q1-1999q2 (deflationary and single digit inflation period)			
$\dot{g}$		4.61	no causality at 5% significance
$\dot{p}$	4.89		

Notes:
1. *** denotes significance at the 1% level based on the critical value bounds for I(0) variables in Pesaran and Pesaran (1997).
2. The results are for lag lengths of order one in the short-run part of the model, although the results are also consistent for lag lengths up to order three.

The results show that there is bi-directional causality between inflation and growth over the whole period 1960q2-1999q2, the zero inflation period, the double digit inflation period and the accelerating inflation period. Although bi-directional causality is plausible from a structuralist viewpoint of inflation, the error correction terms may merely pick up effects such as government policy and shocks, which make such an analysis uninformative about the "true" relation between inflation and growth. This contention is borne out by the absence of any casual relation (at the 5% significance level) over the deflationary and single digit inflation periods (1986q1-1999q2). It will be shown more formally in the next section that during this period actual growth in South Africa was very close to its productive potential. The bi-directional causality results should therefore be treated with a great deal of circumspection given the contrasting results in periods when cyclical and other factors were present, compared to periods when these factors were negligible.

The VAR model in equation (8.2) presents a useful alternative, where all the variables are effectively endogenised and the effects of cyclical and other factors are taken into account. Due to data unavailability in the zero inflation period (1960q2-1970q4), the money supply and interest rate are represented by the M1 money supply and the nominal discount rate respectively, and taken from International Financial Statistics (various issues). For all the other inflationary episodes the variables are defined as before[10].

The empirical results for the zero inflation period (1960q2-1970q4) are reported in Table 8.3. Although the null hypothesis of a casual relation from inflation to growth in the growth equation cannot be rejected, the most noteworthy feature is that the sum of the inflation coefficients is positive. Causality from growth to inflation and the negative sum of the growth coefficients may reflect the impact of supply shocks such as droughts, which are not adequately captured by the other insignificant variables.

[10] The data for all the other inflationary episodes are obtained from the SARB's historical data set published on the internet (http://www.resbank.co.za/Economics/econ.html). The exception is the nominal lending rate which is taken from International Financial Statistics (various issues).

Table 8.3

Granger Causality Tests in a Five Variable VAR Model

Equation	k	R^2	LM-test	Right-hand side variables				
				$\dot{tot}$	$\dot{g}$	$\dot{p}$	$\dot{m}3$	$\dot{r}$
1960q2-1970q4 (zero inflation period)								
$\dot{g}$	2	0.39	(0.47)					
F-test				0.62		1.79	0.43	0.21
Sum of coefficients				-0.09		0.83	0.07	0.003
$\dot{p}$	2	0.38	(0.08)					
F-test:				0.24	2.82*		1.99	1.01
Sum of coefficients:				0.01	-0.34		-0.009	0.01
Causality result:					$\dot{g} \Rightarrow \dot{p}$			
1971q1-1993q4 (double digit inflation period)								
$\dot{g}$	4	0.43	(0.45)					
F-test:				0.52		2.66**	2.81**	3.70***
Sum of coefficients:				0.02		-0.31	0.27	-0.05
Causality results:						$\dot{p} \Rightarrow \dot{g}$	$\dot{m}3 \Rightarrow \dot{g}$	$\dot{r} \Rightarrow \dot{g}$
$\dot{p}$	4	0.38	(0.36)					
F-test				0.50	0.58		1.75	0.21
Sum of coefficients				0.01	0.29		0.09	-0.005
1971q1-1985q4 (accelerating inflation)								
$\dot{g}$	1	0.09	(0.36)					
F-test:				0.09		0.02	2.82*	0.23
Sum of coefficients:				-0.002		-0.02	0.14	0.008
Causality result:							$\dot{m}3 \Rightarrow \dot{g}$	
$\dot{p}$	1	0.07	(0.01)					
F-test:				0.04	0.46		0.89	0.91
Sum of coefficients:				-0.005	0.08		0.07	0.01

Table 8.3 (Continues)

Equation	k	R^2	LM-test	Right-hand side variables				
				$\dot{tot}$	$\dot{g}$	$\dot{p}$	$\dot{m}3$	$\dot{r}$
1986q1-1993q4 (deflationary period)								
$\dot{g}$ (excluding $\dot{r}$)	3	0.65	(0.96)					
F-test:				0.45		0.92	3.50**	
Sum of coefficients:				-0.02		-0.30	-0.20	
$\dot{g}$ (including $\dot{r}$)	3	0.79	(0.17)					
F-test:				1.78		3.71**	5.18**	3.73**
Sum of coefficients:				0.02		-0.70	-0.06	-0.08
Causality results:						$\dot{p} \Rightarrow \dot{g}$	$\dot{m}3 \Rightarrow \dot{g}$	$\dot{r} \Rightarrow \dot{g}$
$\dot{p}$	3	0.71	(0.10)					
F-test:				2.23	1.08		2.53	1.51
Sum of coefficients:				-0.14	0.32		-0.09	0.01
1994q1-1999q1 (single digit inflation period)								
$\dot{g}$ (excluding $\dot{r}$)	1	0.37	(0.51)					
F-test:				0.91		2.52	0.90	
Sum of coefficients:				0.08		0.17	-0.05	
$\dot{g}$ (including $\dot{r}$)	1	0.45	(0.33)					
F-test:				0.58		5.25**	0.54	2.85
Sum of coefficients:				0.05		0.35	-0.04	-0.03
Causality result:						$\dot{p} \Rightarrow \dot{g}$		
$\dot{p}$	1	0.09	(0.37)					
F-test:				0.11	1.15		0.02	0.008
Sum of coefficients:				-0.06	0.53		-0.02	0.004

Notes:

1. *** denotes significance at the 1% level, ** at the 5% level and * at the 10% level.
2. k denotes the order of the VAR models.
3. The Akaike Information and Schwartz Bayesian selection criteria were used to determine the order of the VAR models. In cases were the two selection criteria contradicted each other, a likelihood ratio test was performed to eliminate lags from a general to a more specific model.
4. The VAR models, with one notable exception, pass diagnostic tests such as the Lagrange Multiplier (LM) test for serial correlation, heteroscedasticity, normality and functional form specification at the 5% significance level.
5. The figures in parentheses ( ) are probability values. Values which fall below 0.05 indicate that the probability of no serial correlation is less than 5%.

The results in the double digit inflation period (1971q1-1993q4) present an entirely different picture. In contrast to the zero inflation period, there is now uni-directional negative causality from inflation to growth, while the other variables are also highly significant with uni-directional causality from the M3 money supply and the nominal lending rate to growth. The negative sum of the inflation coefficients in the growth equation further accentuates the cost-effect of inflation on growth.

When the double digit inflation period is sub-divided into two different sub-periods; the accelerating and deflationary periods, it can be seen that the results in the double digit period are entirely driven by the deflationary period. Only the M3 money supply is significant in the accelerating period (1971q1-1985q4), with uni-directional causality from the M3 money supply to growth and a positive sum of coefficients in the growth equation[11]. To provide a more rigorous analysis of the accelerating phase, causality tests are also conducted over the period 1973q1-1983q4 (not reported here). Figure 8.1 shows that accelerating inflation seems to be steadier over this period, especially when periods such as 1984 and 1985 are excluded when South Africa's exchange rate system changed towards a more market determined one. The results over this period, however, remained the same compared to the period 1971q1-1985q4.

The analysis thus far clearly emphasises the importance of sub-dividing South Africa's inflationary experience into different inflationary episodes. Not only does such an analysis provide a more balanced approach to the costs and benefits of inflation, it also avoids drawing conclusions on the costs of inflation in the wrong time period. Similar to Easterly's (1996) study, the analysis can now focus on a more rigorous assessment of the growth-inflation relation in the deflationary period.

In the deflationary period (1986q1-1993q4) restrictive monetary policy was primarily based on the cost of borrowing from the discount window[12]. The impact of restrictive

[11] A VAR model of order one is reported for the accelerating inflation period, even though the inflation equation suffers from serial correlation (see the LM-test in Table 8.3). The results did not change for VAR models up to order six, but in these cases both the growth and inflation equations displayed serial correlation.

[12] Recall that over this period South Africa's inflation rate decelerated from an historically high level of 18% in 1986. After 1986 the SARB adopted a stringent deflationary policy to protect the balance of payments from net capital outflows of around 5 billion rand per annum following political instability and the immediate repayment of foreign debt.

monetary policy measures can be captured by the nominal lending rate, assuming that banks base their lending rate as some mark-up over the cost of borrowing from the discount window. The nominal lending rate therefore represents the actions of government policy and can be used to assess whether inflation exerts an independent influence on growth, or whether the inflation-growth relation is mainly the outcome of government policy. Consider the following two hypotheses to test the robustness of the inflation-growth relation. First, if inflation is significant when the lending rate is excluded from the regression but turns insignificant when the lending rate is included, then the result clearly shows that the inflation growth-relation is dictated by monetary policy, and that the inflation-growth relation is spurious. On the other hand, if inflation and the lending rate are both significant in the growth equation, then it shows that inflation and the lending rate both exert an independent effect on growth.

Returning to the results in Table 8.3 for the deflationary period, it can be seen that inflation is insignificant in the growth equation which excludes the lending rate. However, the growth equation which includes the lending rate shows that inflation, the M3 money supply and the lending rate are all highly significant and negative. The inflation-growth relation is therefore robust and indicates that inflation and the lending rate both exert an independent negative impact on growth. The results largely support Easterly's (1996) contention that periods of stabilisation are particularly useful to study the cost-effects of inflation outlined in section 8.2.

The single digit inflation period (1994q1-199q1) in Table 8.3 again shows that causality from inflation to growth is insignificant when the lending rate is excluded, but turns highly significant when the lending rate is included. Although the lending rate itself is insignificant with a value that falls just below the 10% significance level, the result confirms the independent impact of inflation on growth. Moreover, the negative sum of the lending rate coefficients suggest that monetary policy over this period was probably less restrictive than the deflationary period, but nevertheless conservative[13]. The most

[13] The return of short-term capital flows and South Africa's reintegration into the global economy following the democratic election in 1994, allowed monetary policy to be less restrictive during this period. According to Weeks (1999), however, the policy document (GEAR) of the newly elected ANC government still stipulates an orthodox macroeconomic programme based on restrictive monetary and fiscal policy.

striking result is the positive sum of the inflation coefficients in the growth equation, emphasising the growth benefits of mild inflation.

To assess the robustness of the growth-inflation results during the deflationary and single digit inflation periods in a different way, Table 8.4 reports the results when the real interest rate ($\dot{r}i = \dot{r} - \dot{p}$) is included in the VAR models. The results in both periods are almost identical compared to those obtained in Table 8.3 when the nominal interest rate was included. Moreover, in both periods there is no apparent effect running from inflation to the real interest rate, which again confirms the independent effect of both inflation and the interest rate on growth.

Table 8.4

Granger Causality Tests Including the Real Interest Rate

Equation	k	R^2	LM-test	Right-hand side variables				
				$\dot{t}ot$	$\dot{g}$	$\dot{p}$	$\dot{m}3$	$\dot{r}i$
1986q1-1993q4 (deflationary period)								
$\dot{g}$	3	0.79	(0.17)					
F-test:				1.78		4.12**	5.18**	3.73**
Sum of coefficients:				0.02		-0.78	-0.06	-0.08
Causality results:						$\dot{p} \Rightarrow \dot{g}$	$\dot{m}3 \Rightarrow \dot{g}$	$\dot{r} \Rightarrow \dot{g}$
$\dot{r}i$	3	0.72	(0.15)					
F-test:				1.03	0.39	1.68	1.89	
Sum of coefficients:				0.74	1.94	-3.79	2.20	
1994q1-1999q1 (single digit inflation period)								
$\dot{g}$	1	0.47	(0.36)					
F-test:				1.02		5.47**	0.57	2.70
Sum of coefficients:				0.08		0.32	-0.04	-0.02
Causality result:						$\dot{p} \Rightarrow \dot{g}$		
$\dot{r}i$	1	0.21	(0.26)					
F-test:				2.30	0.06	0.15	1.87	
Sum of coefficients:				-2.27	-0.90	-0.97	1.45	

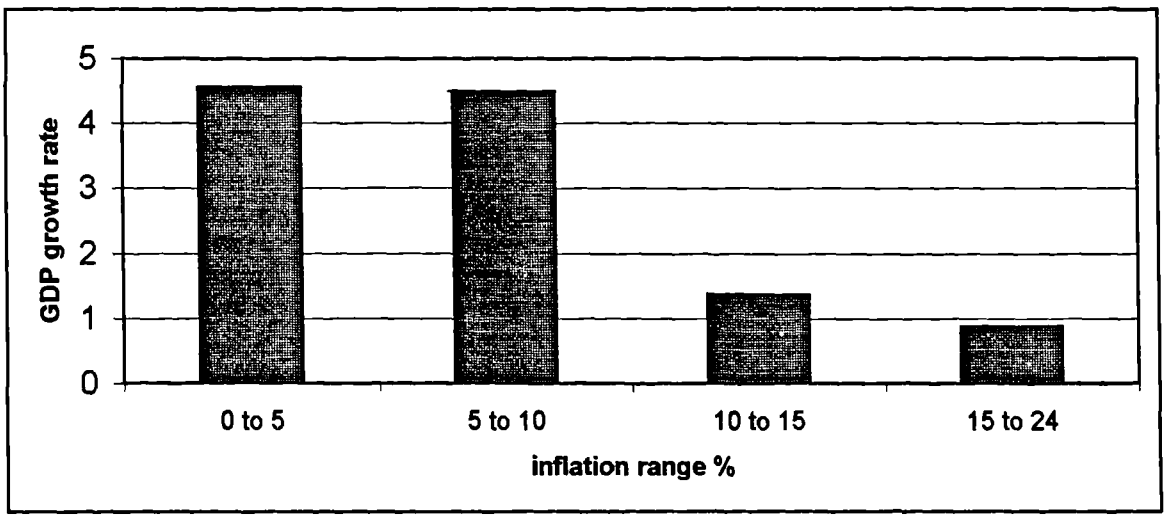
Note: Notes are the same as Table 8.3.

The empirical analysis in this section has shown that the costs and benefits of inflation are both relevant in South Africa. It should also be clear from the analysis that such a distinction would not have been possible without dividing South Africa's inflationary experience into five different episodes. The benefits of inflation are clearly visible in the single digit inflationary period and to a lesser extent in the zero inflation period. The costs of inflation are particularly relevant in the double digit range, but only when the deflationary period is isolated from the others. If the mean and median inflation rates of 7.87 and 7.77 in the single digit period are used as a basic threshold, then the policy implication of this study is very similar to Sarel (1996). Policy makers should avoid inflation above a threshold of 8 percent, but at the same time allow inflation to vary below 8 percent given the growth benefits of mild inflation.

To supplement the empirical evidence in this section, Figure 8.2 divides the inflation rate into different sub-samples together with the corresponding average growth rates. By using the SARB's unofficial 1-5 percent inflation target as a benchmark, the results show that there is hardly any difference between the average growth rate of 4.55 percent in the inflation range of 0-5 percent, compared to the average growth rate of 4.48 percent in the inflation range of 5-10 percent, thus making a good case for the growth benefits of mild inflation.

Figure 8.2

Growth and Inflation Correlations in Different Sub-samples



However, the low average growth rates of 1.37 and 0.87 percent in the 10-15 percent and 15-24 percent range respectively, clearly support the contention that double digit inflation should be avoided. Although the descriptive evidence in Figure 8.2 suggests a threshold inflation of as high as 10 percent, inflation which is kept below 8 percent is presumably a more sensible approach. Inflation above 8 percent is likely to fuel inflation expectations and a resulting accelerating inflationary process which, for some time, may be beyond the control of the monetary authorities.

8.5 The short-run costs of disinflation policy

8.5.1 Theoretical issues

The empirical analysis in the previous section has shown that there are definite growth benefits to be gained from bringing inflation down to single digit rates. Deflationary policy, however, is not a costless procedure and can involve huge output losses which may swamp the initial benefits gained from lower inflation. The cost of disinflation policy may be particularly severe when there are nominal rigidities in the labour market and in debt contracts, especially if inflation is unanticipated so that it takes time for economic agents to adjust their contracts (Briault, 1995). For example, in the case of nominal wage rigidity disinflation policy leads to increasing real wages with a subsequent fall in company profits, lower investment and a rise in unemployment.

Following Clark *et al.* (1996); Debelle and Laxton (1997); Laxton *et al.* (1995); and Filardo (1998), the output cost of disinflation policy is studied in a Phillips curve model which relates inflation to an output gap. To derive an expectations-augmented Phillips curve, consider the following price and wage equations respectively (Blanchard and Katz, 1997):

$$\dot{p}_t = \alpha_p + \dot{w}_t + \varepsilon_{pt}, \tag{8.3}$$

$$\dot{w}_t = \alpha_w + \delta \dot{p}_t^e + \beta(\dot{e}D^{gap}) + \varepsilon_{wt}, \tag{8.4}$$

where $\dot{p}$ is consumer price inflation; $\dot{w}$ is wage inflation; p^e is inflation expectations which follow an Auto Regressive (AR) process and is based on inflation in the past; and

the output gap ($e\dot{D}^{gap}$) is defined as the actual real output growth rate ($\dot{y}$) minus the potential real output growth rate ($\bar{\dot{y}}$). The potential output gap is derived in exactly the same way as described in Chapter 7.

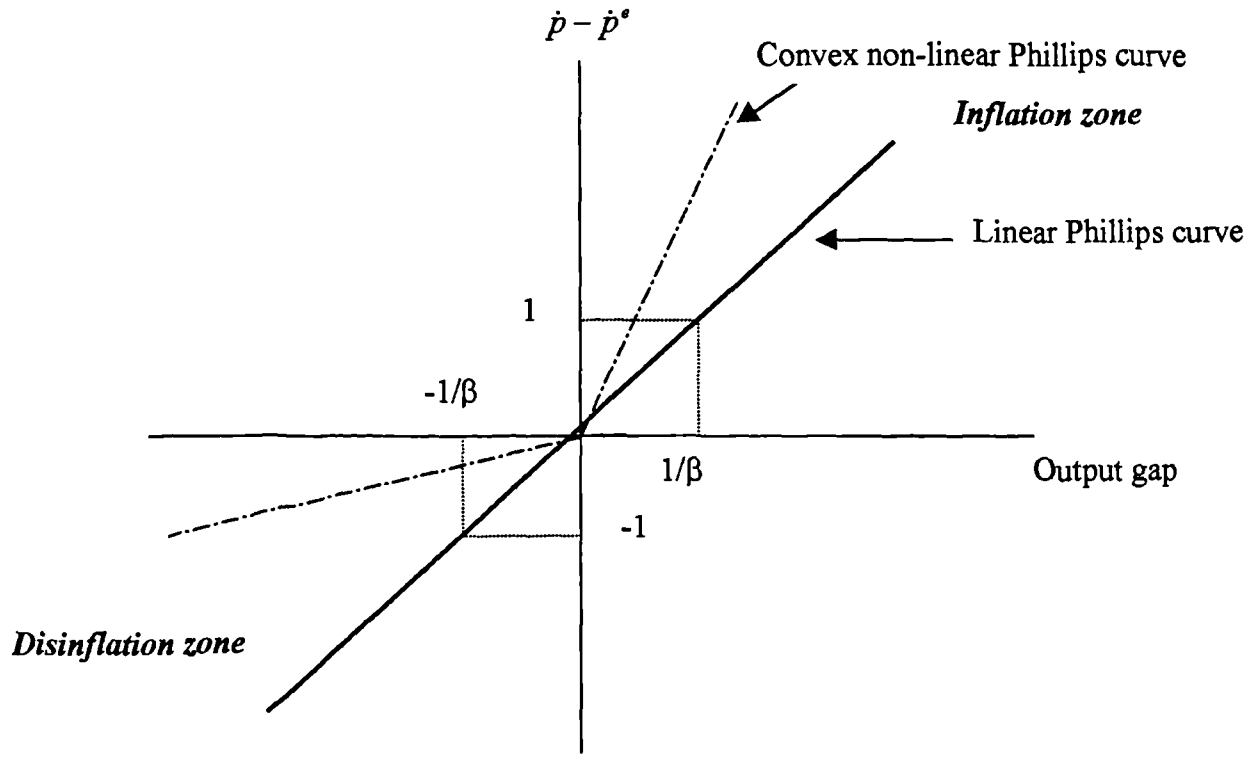
Substitute equation (8.4) into equation (8.3) to obtain the following reduced-form expectations-augmented Phillips curve:

$$\dot{p}_t = \alpha + \delta \dot{p}_t^e + \beta(\dot{eD}^{gap}) + \varepsilon_t; \ \beta > 0 \tag{8.5}$$

where $\alpha = \alpha_p + \alpha_w$ and $\varepsilon_t = \varepsilon_{pt} + \varepsilon_{wt}$. Equation (8.5) depicts a linear Phillips curve relation which assumes that the inflationary impact of an upswing in the business cycle is equally offset by the deflationary impact of a downswing in the business cycle. Figure 8.3 plots a linear Phillips curve to visualise the associated output costs implied by a linear relation.

Figure 8.3

Different Shapes of Phillips Curve Relations



For simplicity, also note that the linear curve is drawn to run through the origin, which according to the long-run analysis of Friedman (1968) and Phelps (1968) implies that $\dot{p} = \dot{p}^e$, i.e. inflation is non-accelerating in the long-run. Based on the linear curve, the output cost of reducing inflation by one percentage point ($1/\beta$) is the same irrespective of whether we are in the overheated (inflation zone) or weak (disinflation zone) economy stage. It is therefore not necessary for monetary authorities to take drastic steps during any stage of the business cycle, because inflation is easily wrung out of the system during recessionary conditions.

In addition to a linear Phillips curve, Figure 8.3 also plots a convex curve. According to Filardo (1998), a convex curve is consistent with an economy subject to capacity constraints and downward rigidities in prices and wages. The convex curve predicts that inflation will become increasingly sensitive to output changes as the economy move from the weak stage to the overheated stage. For stabilisation policy a distinction between the two curves becomes important to assess the cost of disinflation policy. For example, the convex Phillips curve implies that it is easier and more effective to implement a deflationary policy during an upswing in the business cycle. In contrast to the linear curve which shows that the output cost is the same irrespective of the business cycle, the convex curve predicts that the output cost will be lower compared to the weak economy. Moreover, the convex curve further implies that restrictive monetary policy should specifically focus on the overheated stage, because inflation is not equally offset during the weak economy stage.

To capture non-linearities in a Phillips curve relation we can rewrite equation (8.5) as

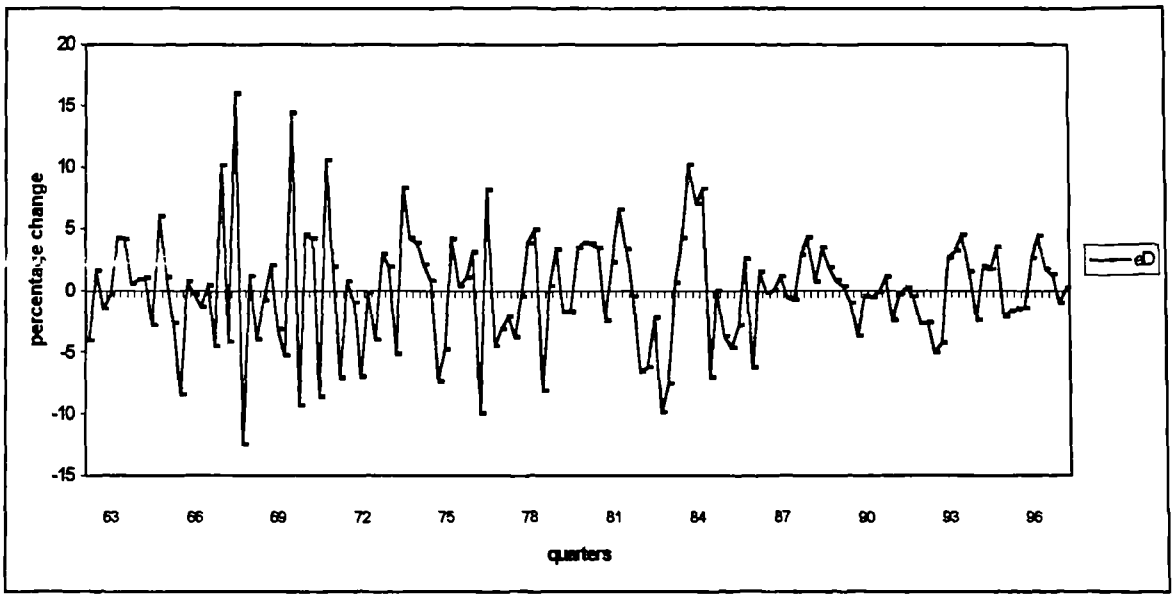
$$\dot{p}_t = \alpha + \delta \dot{p}_t^e + \beta_1 (e\dot{D}_{overh}^{gap}) + \beta_2 (e\dot{D}_{weak}^{gap}) + \varepsilon_t; \;\; \beta_1, \beta_2 > 0, \qquad (8.6)$$

where $e\dot{D}_{overh}^{gap}$ takes the value of zero when the output gap is negative and its positive value otherwise, and $e\dot{D}_{weak}^{gap}$ takes the value of zero when the gap is positive and its negative value otherwise. Inferences on the shape of the Phillips curve can be drawn by inspecting the magnitude of the slope coefficients.

Valid inferences on the cost of disinflation policy can only be drawn once it has been established that the Phillips curve relations described above are stable. Figure 8.4 plots the output gap over the period 1964q2-1997q2. Note that potential output is measured as an eight-sided filter, so that the period 1960q2-1999q2 effectively stretches from 1962q2 to1997q2. The Figure shows that the upswings and downswings in the output gap are fairly stable until the mid-1980s, but thereafter seems to fade away considerably following adverse economic and political conditions and the resulting deflationary policy measures to protect the country's balance of payments from capital outflows.

Figure 8.4

'Excess' Demand (eD), 1962q2-1997q2



Following Alogoskoufis and Smith (1991), the stability of inflation expectations is tested by modelling inflation as an AR process of order four (not reported here). An inspection of the recursively estimated lagged coefficients revealed that inflation expectations may have shifted during the mid-1980s, which is consistent with the descriptive evidence presented earlier and the analysis in Chapter 7[14]. Thus, Phillips curve relations over two sub-period will be considered: 1973q1-1983q4 when inflation

[14] Recall that in Chapter 6 we estimated inflation expectations recursively over the period 1962-1997, and showed that inflation expectations shifted upward during the mid-1970s, but remained constant thereafter. In this chapter inflation expectations are estimated recursively for two different sub-period: 1960q2-1999q2 and 1973q1-1999q2. The results for the sub-period 1960q2-1999q2 showed an upward shift in the early 1970s, while the results for the sub-period 1973q1-1999q2 clearly showed an upward shift in inflation expectations during the mid-1980s.

was accelerating and the output gap yielded stable cyclical fluctuations, and 1986q1-1997q2 when inflation decelerated and the South African economy experienced a general recession.

8.5.2 Empirical results

Table 8.5 reports the results for the linear and non-linear Phillips curve relations over the two sub-periods. The models in the different sub-periods pass all the diagnostic tests at the 5% significance level. The output gap in the linear model over the period 1973q1-1983q4 is highly significant at the 1% level. The model also includes the quarterly rate of change of import prices ($\dot{imp}$) to control for the effect on inflation, even though the magnitude of the parameter estimates remained the same when import prices were excluded. The only difference is that the inflation expectations coefficient becomes more significant when import prices are included.

The non-linear model over the period 1973q1-1983q4 shows that the output gap in the linear model is entirely dictated by the observations in the overheated economy stage (inflation zone). This contention is supported by the insignificance of the output gap coefficient in the weak economy stage. Although the output gap in the overheated economy stage loses significance in the non-linear model, the output gap coefficients of 0.50 and 0.49 in the linear and non-linear models respectively, are almost identical. The highly significant output gap coefficient in the linear model may indicate that some of the observations in the weak economy stage actually belong to the overheated stage, even though these observation are negative. Filardo (1998) has shown that the threshold for the output gap observations should not necessarily only be based on positive and negative values as was assumed in equation (8.6). An economy, for example, can only be regarded as being in the weak economy stage when the negative output gaps fall below a certain threshold. However, such an exercise was not performed here due to the relatively small sample size.

Table 8.5

Testing for Linear and Non-Linear Phillips Curve Relations

Accelerating inflation: 1973q1-1983q4		
Variables	Linear curve (3; 2-3; 2)	Non-linear curve (3; 2; 2; 2)
intercept	8.06*** [4.30]	7.69*** [3.28]
$\dot{p}^e$	0.28** [2.08]	0.23 [1.66]
$\dot{e}D^{gap}_{overh}$	0.50*** [3.15]	0.49 [1.62]
$\dot{e}D^{gap}_{weak}$		0.08 [0.36]
$\dot{imp}$	0.05** [2.07]	0.05 [2.10]
Diagnostic tests		
R^2	0.30	0.21
LM-test	F(4,35) = 0.55	F(4,35) = 0.51
Ramsey's Reset	F(1,38) = 0.23	F(1,38) = 0.12
Normality	χ^2 (2) = 1.45	χ^2 (2) = 2.39
Heteroscedasticity	F(1,42) = 1.22	F(1,42) = 0.35
Deflationary period: 1986q1-1997q2		
Variables	Linear curve (1-4; 1-2)	Non-linear curve (2-3; 1; 1)
intercept	2.46 [1.10]	5.79** [2.65]
$\dot{p}^e$	0.76*** [4.55]	0.62*** [4.37]
$\dot{e}D^{gap}_{overh}$	0.14 [0.44]	-0.53 [-1.16]
$\dot{e}D^{gap}_{weak}$		1.10** [2.55]
Diagnostic tests		
R^2	0.40	0.41
LM-test	F(4,35) = 0.33	F(4,37) = 1.39
Ramsey's Reset	F(1,38) = 0.10	F(1,40) = 0.79
Normality	χ^2 (2) = 0.61	χ^2 (2) = 1.45
Heteroscedasticity	F(1,44) = 0.02	F(1,44) = 0.21

Notes:

1. *** denotes significance at the 1% level and ** at the 5% level.
2. The figures in parentheses ( ) are the chosen lag lengths and those in brackets [ ] are t-statistics.
3. To avoid simultaneity problems between the output gap and inflation, the output gaps in the different models are all endogenised by excluding the level variables.

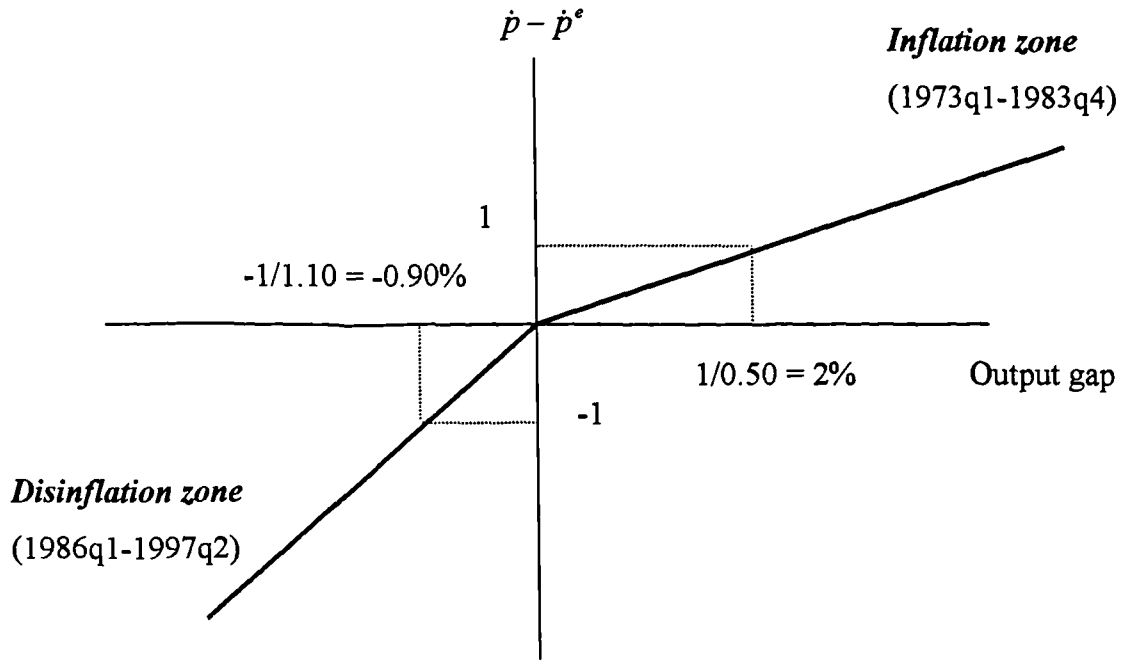
Turning to the Phillips curve relations over the period 1986q1-1997q2, Table 8.5 indicates that the output gap in the linear model is insignificantly different from zero. The non-linear model provides the most interesting result. Although negative, the output

gap in the overheated economy stage (inflation zone) is insignificant, but statistically significant in the weak economy stage (disinflation zone). This result reflects the general recessionary conditions that prevailed during this period and further shows that the cost of restrictive monetary policy should be investigated in the disinflation zone.

Figure 8.5 traces the Phillips curve relations over the two sub-periods together with the associated costs of disinflation policy implied by the relations.

Figure 8.5

Phillips Curves, 1973q1-1983q4 and 1986q1-1997q2



For illustrative purposes the curves are drawn from a zero origin, although, strictly speaking, this is not correct because inflation expectations in both sub-periods are less than unity[15]. During the sub-period 1973q1-1983q4, a Phillips curve relation is only relevant in the overheated economy stage (inflation zone). A one percentage point reduction in inflation, translates into a 2 percent fall in the actual real GDP growth rate.

[15] A unitary inflation expectations coefficient implies that there is no long-run trade-off between the output gap and inflation. The Phillips curve then becomes a vertical line with inflation equal to inflation expectations.

The accelerating inflationary trend over this period may also be explained by the insignificance of the output gap in the weak economy stage (disinflation zone), because inflation in the overheated stage was not offset by disinflation in the weak economy stage.

In contrast to the period 1973q1-1983q4, a Phillips curve relation over the period 1986q1-1997q1 is only relevant in the weak economy stage (disinflation zone). A one percentage point reduction in inflation results in an output cost of 0.90 percent of actual real GDP growth. The decelerating inflationary trend experienced over this period may now be explained by the insignificance of a Phillips curve relation in the inflationary zone – deflationary policy was not offset by expansionary policy in the inflationary zone, hence the downward trend in inflation. Also note that the slope of the Phillips curve is steeper in the period 1986q1-1997q2 compared to the period 1973q1-1983q4. Evidently, the cost of disinflation policy is less severe in the disinflation zone when South Africa experienced a general recession, compared to the inflationary zone when economic conditions were more favourable.

Finally, before we assess whether there were any net gains from the SARB's deflationary policy over the period 1986q1-1993q4, an important qualification needs to be made. The cost of disinflation policy yielded almost identical results irrespective of whether the sample period covered 1986q1-1993q4 or 1986q1-1997q2. Although South Africa experienced more favourable economic conditions following the elections in 1994, the low average and median growth rates of 2.26 and 1.66 respectively over the period 1994q1-1999q2 in Table 8.1, clearly show that there has not been a marked improvement in the growth performance compared to the period 1986q1-1993q4. Overall, South Africa has been in the disinflation zone since 1986 up until the present.

From Table 8.4 it can be seen that the short-run growth benefits gained from a one percentage point reduction in inflation over the period 1986q1-1993q4 amount to 0.78 percent of actual real GDP growth. The corresponding cost of disinflation policy is 0.90 percent of actual real GDP growth which shows that there were no net gains from the SARB's deflationary over the period 1986q1-1993q4, but instead net losses in terms of output foregone to reduce inflation. To place these numbers in perspective, Table 8.1

indicates that South Africa recorded an historically low average and median growth rate of 0.96 and 1.16 percent respectively over this period.

8.6 Conclusion

The methodology employed in this chapter has departed from standard time series case studies in one important aspect. To provide a more balanced approach on the costs and benefits of inflation, South Africa's inflationary experience over a long and extended period was divided into five inflationary episodes. These episodes included periods of low inflation which were particularly useful to study the benefits of mild inflation, and double digit inflation periods to analyse the cost of inflation.

The empirical results have shown that mild inflation exerts a positive impact on growth while periods of double digit inflation during the deflationary period are negatively related to growth. Moreover, both the costs and benefits of inflation were found to be robust, by exerting an impact on growth which acted independently from government policy and other cyclical factors.

For policy purposes the empirical results suggest a threshold inflation of 8 percent, which is similar to the study conducted by Sarel (1996). The message to policy makers is plain: avoid inflation above 8 percent, but at the same time allow inflation to vary below 8 percent given the benefits of mild inflation. A threshold inflation of 8 percent also proves that the familiar outcries by Central Banks and politicians that very low, or zero, inflation should be an ultimate objective, is devoid of any empirical support in this study.

The empirical study suggests two important policy implications. First, with an inflation rate which is at present well within the single digit zone, the monetary authorities should refrain themselves from any attempts to lower inflation even further. If mild inflation exerts a positive impact on growth there are obviously no net gains from implementing deflationary policy measures. Instead, the results have shown that deflationary policy is not a costless procedure. Even during periods when more

restrictive monetary policy was desirable the cost of disinflation policy outweighed the benefits of lower inflation.

Second, the analysis in this study has essentially investigated the short to medium-run relation between growth and inflation. Whether there are any permanent effects running from growth to inflation is highly questionable. The mere fact that South Africa's inflationary experience is characterised by five inflationary episodes refutes the widely held belief that there could be permanent effects running from inflation to growth. It is more likely that the cost of disinflation policy could have permanent effects because inflation in South Africa is not demand-pull but cost-push. Restrictive demand management policies may have the desired effect in reducing the inflation rate to very low levels, but at a permanent cost. Cost-push inflation resulting from exchange rate depreciations and wage rate changes will always create an economic environment which is biased towards inflation. To control these causes of inflation, demand management policies will have to be restrictive on a permanent basis, but at the cost of permanent output and employment losses.

CHAPTER 9

CONCLUSION

The main objective of the thesis was to determine whether the nature and conduct of monetary policy is conducive to high and sustainable real economic growth rates without inflation. An analysis of this nature is particularly relevant in a South African context, given the growing importance that the South African Reserve Bank (SARB) has attached to restrictive monetary policy in stabilising and reducing inflation.

The thesis consists of three main parts. Part 1 (Chapters 3, 4 and 5) presented an extensive monetary analysis of the South African economy to determine the exogenous/endogenous nature of the money supply. Part 2 (Chapters 6 and 7) investigated the underlying causes of inflation in South Africa. In addition to net 'excess' demand, the underlying causes of inflation also included cost-push and structural forces which may not necessarily have been the outcome of excessive monetary expansion by the SARB. Part 3 (Chapter 8) analysed the relation between growth and inflation in South Africa and whether disinflation policy may have permanent negative effects. The main findings of the chapters can be summarised as follow.

Chapter 2 provided a theoretical and descriptive analysis to assess South Africa's growth and inflation experience over the period 1965-1996. The analyses suggest that significant structural changes in the South African economy over the period 1965-1996 may have induced a change in the underlying causes of inflation between the sub-periods 1965-1981 and 1982-1996.

The main findings of Chapter 3 have shown that there exists a stable long-run money demand function for M3 in South Africa, while the demand for M1 and M2 display parameter instability following the financial reforms since 1980. The extensive analysis of the different money demand definitions further showed that money demand becomes more stable as we move from a narrow to a broader definition, which may provide an explanation why previous studies have made contradictory claims about the stability of

money demand. Hurn and Muscatelli (1992) find evidence of a stable M3 money demand relation which is based on the broadest definition of money, while Moll (1999) finds no evidence of a stable money demand function for narrower definitions of money.

The empirical results in Chapter 4 have shown that money and 'excess' money are endogenous to broad and narrow measures of inflation. Although there exists a stable long-run money demand function for South Africa and thus a predictable link between money and money income, the endogenous nature of money over the period 1966-1997 refutes a monetarist belief that excessive monetary expansion is the underlying cause of inflation in South Africa. The results further show that the exogenous nature of 'excess' money to consumer price inflation need not necessarily be indicative of direct control by the monetary authorities, but could be the result of a process where 'excess' money may come into existence even under an endogenously determined money supply.

Chapter 5 acts as a supplement and extension of the main findings in Chapter 4, by describing South Africa's money supply process along several competing, but not mutually exclusive, theoretical paradigms over the period 1966-1997. To capture the effects of the significant changes in South Africa's monetary system, the period 1966-1997 was sub-divided into two sub-periods: 1966-1979 when monetary policy was based on direct control measures and 1980-1997 when monetary policy was based on a more market-oriented approach. From a long-run perspective, the most important conclusion to be drawn from the empirical results is that irrespective of the monetary system at the time, the money supply in South Africa is endogenously determined over the period 1966-1997. The endogenous nature of the money supply supports the empirical analysis in Chapter 4 which showed that the money supply has been passive in the inflationary process. From a monetarist perspective, the inflationary impact of excessive monetary expansion by the monetary authorities is only relevant over the period of direct control measures. Whether excessive monetary expansion can be regarded as one of the underlying causes of inflation during the period 1966-1979 is debatable, because the money supply is also endogenous over this period. Disintermediation, together with an ineffective liquid asset reserve system, were some of the underlying reasons why the money supply was mainly credit driven and beyond the direct control of the SARB. The empirical results in Chapter 5 further showed that

even under an endogenously determined money supply, 'excess' money may come into existence because agents do not automatically absorb any amount of deposits created by the flow of new bank lending.

The most important policy implication of the results in Chapter 5, is that a thorough long-run analysis of inflation in South Africa will have to search beyond the realms of the SARB alone, and focus on the potential inflationary impact of cost-push and/or structural forces in the South African economy.

Chapter 6 examined the inflationary impact of net 'excess' demand, the dispersion of demand between sub-markets and 'excess' demand for agricultural products over the period 1962-1997. Structuralists argue that the dispersion of demand between sub-markets and 'excess' demand for agricultural products are more persistent and likely to occur under an endogenously determined money supply. The analysis showed that a Phillips curve relation in South Africa has been subject to various sources of instability over the period 1962-1996. The period 1962-1983 witnessed a leftward shift in my specification of the Phillips curve following an upward revision of inflation expectations in 1973. The leftward shift in the Phillips curve may potentially be explained by cost-push forces of inflation which induced inflation expectations, and not necessarily structural forces of inflation. It was shown that 'excess' demand for agricultural products is only inflationary in the short-run, while supply fully adjusts in the long-run to meet demand. Moreover, although the dispersion of demand provides a long-run explanation of inflation in South Africa, the low magnitude of the short-run and long-run coefficients indicate that it cannot be regarded as one of the major causes of price inflation. The empirical results further indicated that a unique Phillips curve relation seems to have little relevance over the period 1984-1996. The balance of payments constraint experienced during this period implies that demand-pull and cost-push inflation increased their interdependence, so that a clear distinction becomes increasingly difficult.

Chapter 7 examined the inflationary impact of exchange rate depreciation in South Africa over the period 1984-1998 when the monetary authorities adopted a more market oriented exchange rate system. Although the empirical part of the chapter focused extensively on this period, the analysis also concentrated on the period 1973-1983 to

determine whether the underlying causes of inflation have changed following significant structural, political and institutional changes. From a macroeconomic perspective, the empirical results showed that the long-run causes of inflation have changed from a demand-pull inflation over the period 1973-1983, to a cost-push cause (import prices and wage rate changes) of inflation since 1987 when a market determined exchange rate finally stabilised.

The methodology employed in Chapter 8 has departed from standard time series case studies in one important aspect. In an attempt to provide a more balanced approach to the costs and benefits of inflation, South Africa's inflationary experience over a long and extended period was divided into five inflationary episodes. These episodes included periods of low inflation which were particularly useful to study the benefits of mild inflation, and double digit inflation periods to analyse the cost of inflation. The empirical results showed that mild inflation exerts a positive impact on growth while periods of double digit inflation during the deflationary period are negatively related to growth. Moreover, both the costs and benefits of inflation were found to be robust, by exerting an impact on growth which acted independently from government policy and other cyclical factors. Finally, the empirical results suggest that deflationary policy is not a costless procedure. Even during periods when restrictive monetary policy was desirable the cost of disinflation policy outweighed the benefits of lower inflation.

General conclusions and policy implications

In this thesis we have presented an extensive theoretical, descriptive and econometric analysis of South Africa's money supply process, the causes of inflation, the growth-inflation relationship and the cost of disinflation policy.

We have argued that cost-push inflation resulting from exchange rate devaluations in the early 1970s and the oil price shock in 1973, caused an upward revision of inflation expectations. It was shown in Chapter 7 that even though cost-push inflation during the early 1970s may have induced inflation expectations, the long-run cause of inflation during the period 1973-1983 can still be regarded as demand-pull. During different times, a rise in import prices has been inflationary following exchange rate devaluations and a once-off adverse supply shock. However, capital inflows and a high gold price

during this period allowed the monetary authorities to maintain a fixed exchange rate, which prevented continuous devaluations.

The change in the underlying cause of inflation from a conventional Phillips curve relation in the 1950s and 1960s to an expectations augmented relation, led to a steady, but accelerating inflationary trend since the early 1970s. During this period, direct monetary control measures were largely ineffective to reduce and stabilise the inflation rate. Although excessive monetary expansion may have caused inflationary pressure during different times, the empirical results in Chapter 5 showed that any attempt by the monetary authorities to control the money supply directly, was equally offset by credit extensions outside the banking system.

The theoretical and empirical analysis in Chapter 7 illustrated that the underlying causes of inflation have changed from a demand-pull inflation in 1973-1983 to a cost-push cause (import prices and wage rate changes) of inflation in 1987-1998. The argument was held that the general decline in the mining sector coupled with substantial capital outflows have led to a steady, but depreciating exchange rate, which have made the South African economy extremely vulnerable to imported inflation. The change in the cause of inflation also coincided with a change in the monetary system towards a more market-oriented one in 1980. In Chapter 5 it was argued that after the adoption of more market-oriented monetary policy measures in 1980, the monetary authorities controlled the money supply indirectly through a slowdown in economic activity. Even though the underlying cause of inflation was essentially cost-push, the monetary authorities used demand management policies to reduce and stabilise inflation. Three questions with important policy implications automatically present themselves. First, whether the adoption of a more market-oriented monetary system in 1980 was successful in reversing the accelerating inflationary trend since the early 1970s. Second, whether there are substantial benefits to be gained from lower inflation. Third, whether the cost of disinflation policy may have permanent negative effects if the diagnosis of inflation is incorrect.

With regards to the first question we can return to Figures 8.1 and 8.5 in Chapter 8. Figure 8.1 shows that the accelerating trend of inflation since the early 1970s was reversed during the mid-1980s when inflation followed a decelerating trend. Figure 8.5

depicts Phillips curve relations and indicates that South Africa has been in the disinflation zone since the mid-1980s. Based on the evidence it is clear that after the adoption of more market-oriented monetary policy measures the monetary authorities managed to reduce and stabilise the inflation rate, despite the fact that inflation is essentially a cost-push phenomenon. It should also be noted that the decelerating inflationary trend experienced since the mid-1980s was probably not only the result of restrictive monetary policy measures, but also the general recessionary conditions that prevailed at the time.

Second, for policy purposes the empirical results in Chapter 8 suggest a threshold inflation of 8 percent. The message to policy makers is plain: avoid inflation above 8 percent, but at the same time allow inflation to vary below 8 percent given the benefits of mild inflation. A threshold inflation of 8 percent also shows that the SARB's unofficial inflation target of 1-5 percent may be too conservative. The fact that South Africa has been in the disinflation zone since the mid-1980s coupled with the newly elected ANC government's policy document that still stipulates tight monetary policy measures, give clear indications that the government's conservative stance towards inflation will not change in the near future. With an inflation rate which is at present well within the single digit zone, the monetary authorities should refrain themselves from any attempts to lower inflation even further. If mild inflation exerts a positive impact on growth there are obviously no net gains from implementing deflationary policy.

Third, since inflation is essentially a cost-push phenomenon, demand management policies may have the desired effect in reducing inflation to zero or very low levels, but at a permanent cost. Cost-push inflation resulting from exchange rate depreciations and wage rate changes will always create an economic environment which is biased towards inflation. To control these causes of inflation demand management policies will have to be restrictive on a permanent basis, but at the cost of permanent output and employment losses.

As a concluding remark, it must be stressed that growth and inflation studies are typically subject to a great deal of controversy for the various reasons outlined in Chapter 8. An important area for future research is to explore (empirically) the exact

channels through which mild inflation and double digit inflation can be beneficial and harmful to growth respectively. Formal models developed by Tobin (1965), Mckinnon (1973) and Shaw (1973), will provide a useful starting point to study the relationship between inflation, money and growth[1].

[1] For an excellent discussion of these models, see Ghatak (1995). Also see Ghatak and Deadman (1989).

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