INFLATION IN SOUTH AFRICA - DEFINITIONS, EXPLANATIONS AND EVIDENCE

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INTRODUCTION

The purpose of this paper is to consider the causes and effects of inflation in South Africa. Section I deals with problems in measuring inflation. It will be shown that such problems complicate the explanation of inflation. Section II presents evidence about the inflationary process in South Africa. The final Section III considers the effects of inflation in South Africa on the variability of prices and on output and employment. This section also considers what may be done about inflation.

S E C T I O N 1

INFLATION: A MEASUREMENT AND ANALYTICAL ISSUE

THE DEFINITION OF INFLATION

Consumer prices in South Africa increased some 5.25 times between 1970 and 1985. Annual increases in consumer prices over the period 1960-1985 are illustrated in Fig.1. According to the late Harry Johnson, 'Inflation is most conveniently (and neutrally) defined as a sustained trend in the general price level...' (Johnson, 1972, p.325). Inflation is clearly to be regarded as much more than a rise in the price level. An increase in the price level to a new higher level does not mean that prices will continue to rise thereafter, and that the process of rising prices will be sustained. The economics literature, while giving some attention to the definition of inflation, gives little guidance as to how inflation should best be measured. Parkin and Swoboda, in their survey of inflation, remark:

> '...that a useful starting point (for the analysis of inflation) is to recognise that inflation is the first difference of the logarithm of some price index. However, the breadth of the index and the length of time over which the change is considered are both matters upon which choice may be exercised. Hence, there is no unique measure of the rate of inflation and the precise definition chosen may reflect the particular problem at hand...'
> (Parkin and Swoboda, 1977, p.4)

There are important differences between once and for all increases in prices and what may cause them, and more or less continuous, persistent increases in prices and their causes. This section of the paper will attempt to show that the analytical and measurement

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This chapter owes much to my long-standing collaboration with Graham Barr

problems with inflation, that is separating the impact of once-and-for-all price rises from continuously rising prices, constitute the essence of the problem in measuring and explaining inflation, and that such difficulties and the different interpretations they give rise to, are inseparable and perhaps insoluble.

METHODS FOR MEASURING INFLATION

Any sharp discontinuities in the price index may be referred to as supply_side_shocks in that the increase in prices is similar to the increase in prices that would follow some natural disaster, that disrupted supplies, created shortages and pushed up prices.

When the index of prices before and after any shock is compared with prices in the same month of the previous year, higher rates of inflation will be indicated for 12 months, irrespective of any underlying trend in inflation, which may be rising or falling. After 12 months, the inflation rate measured in this way will seem much lower, as the impact of the price shock falls away. Again, lower inflation will be measured, irrespective of the underlying inflationary trends.

The issue may be illustrated by some hypothetical diagrams and examples. In Fig.2, an index of prices is measured on the vertical axis and time in months on the horizontal. A constant underlying trend in inflation of, say, 10% is assumed. In month 6, a large price shock is imposed that raises the index by 10%. Thereafter, the underlying trend of 10% p.a. inflation is resumed.

Inflation, measured as the year-on-year percentage changes over a 24 month period, is also illustrated. As may be seen, inflation doubles in month 6, and halves in month 18. Between month 6 and month 18, should inflation be regarded as 10% or 20%? This question indicates the the measurement problem. In practice, identifying the underlying trend in inflation is very difficult because the trend will not be a smooth one, as the incidence of demand and supply side shocks is irregular and not always easily separated and because prices do not, in fact, change continuously.

The change in an index of prices over any period of time - a day, week month or year - as indicated by Parkin and Swoboda, could be regarded as an appropriate measure of inflation. Clearly, the choice of the time period over which inflation is measured is crucial for the actual recorded rate of inflation. If the time period over which price changes are calculated is a short one, the measured rate of inflation will vary very sharply from one period to the next, as price changes are recorded. It should be recognised that the prices of the individual goods and services that make up the index of prices do not change continuously. Changes to such prices are made periodically, but changes will presumably be made more frequently, as the expected rate of inflation increases.

It has become standard practice to record price indices on an end of month basis. Nevertheless, the month-to-month changes in these price indices are not normally taken to be the rate of inflation. Month-to-month changes in inflation could be converted into annual equivalent rates of change in prices, and this annual equivalent rate could be regarded as the rate of inflation. As may be seen in Table 1, Column 2, such a measure of inflation can be a highly variable one. Using South African data for the period January 1983-January 1984, such a measure would indicate that inflation in South Africa was as high as 21,7% in February 1983 and as low as 5,2% in June of that year. Clearly, this is not an altogether satisfactory measure of inflation. It is, of course, possible to smooth month-to-month change by removing some of the variability in the index caused by regular seasonal influences on prices. However, as may be seen in Column 4, the de-seasonalised change in prices is also a highly variable measure of inflation.

It is, perhaps, for these reasons that the rate of inflation is conventionally regarded as the year-on-year rate of inflation. As may be seen in Column 3, this series is highly smoothed by comparison with the series in Columns 2 and 4. However, to repeat the observation made previously, it is so smoothed that a sharp change in the index in any one month, which may occur only for that month, will continue to be reflected in a higher year-on-year rate of inflation for 12 more months. After 12 months, the rate of inflation, measured by year-on-year changes, may then show a sharp decline, again irrespective of the underlying trend in inflation. (See Fig.3 where a comparison between the monthly rate of inflation converted into its annual equivalent rate and the year-on-year rate is made.)

A hypothetical example, indicating the inherent weakness of measuring inflation as the year-on-year percentage change in prices, is provided in Table 2. If the rate of growth of the index is measured by the year-on-year percentage change, the actual direction of growth would be incorrectly inferred every time. The movement from 240 up to 245 between June and January would be given as -5%. A movement from 245 down to 242 would be given as +2%, and a movement from 242 up to 245 as 0%.

As may be seen from this example, the year-on-year method is insensitive to short-term changes and simply gives the net movement over the year. Essentially, the problem is that the year-on-year formula applied to raw data gives a series that is smooth but biased in the short-term, while the month-to-month rates of growth give a result which, although not biased, is extremely variable, and one from which firm conclusions are not easily drawn.

In determining a rate of growth from an index, one will never be able to find a 'correct' figure and will always have to trade smoothness for bias. An approach that falls somewhere between these two extremes is to smooth the raw data and calculate month-to-month rates of growth of the smoothed values. Such a series is represented in Column 5 of the Table, where the rates of growth

TABLE 1:

RATES OF GROWTH PER ANNUM

Month	C.P.I. 1975=100	Month-to-Month growth in raw data (annualised)	Growth from one month to same month of prev.yr	Month-to-Month growth in deseason-alised figs.	Month-to-Month growth in trend
Jan 83	249,0	14,5	14,4	17,0	14,8
Feb 83	253,1	21,7	14,9	20,6	13,9
Mar 83	255,9	14,1	13,6	12,1	12,5
Apr 83	257,8	9,3	12,6	8,2	10,8
May 83	259,7	9,2	12,8	11,1	9,0
Jun 83	260,8	5,2	12,3	4,8	7,7
Jul 83	262,5	8,1	12,1	6,4	7,3
Aug 83	265,0	12,0	11,0	7,3	8,0
Sep 83	267,3	10,9	10,0	8,9	9,3
Oct 83	270,0	12,8	10,7	12,9	10,3
Nov 83	271,4	6,4	10,6	11,6	10,8
Dec 83	273,4	9,2	11,0	13,0	10,9
Jan 84	274,7	5,9	10,3	7,6	10,5

TABLE 2:

HYPOTHETICAL EXAMPLE

Month	Index	Year-on-Year rate of growth index
Jan	250	
Jun	240	
Jan	245	-5%
Jun	242	2%
Jan	245	0%

refer to the month-to-month movements in the 13th month, moving average of the raw data. Most importantly, it should be recognised that there is no absolutely correct way to calculate the rate of increase in prices. Nor is it clear that public concern about inflation would be any the less, if it were possible to separate statistically and analytically the impact of once-and-for-all price changes from continuous ones. Perhaps the public, after all, is concerned with levels of prices rather than their rates of change, however measured.

The inflationary problem, moreover, is not identified by economists, as Johnson remarked:

> '...the rate of price increase deemed to constitute an inflationary problem is not a scientific question but a political question determined by public opinion, and public opinion vacillates on the issue.'
> (Johnson, 1972, p.326)

THE CAUSES OF INFLATION: DEMAND AND SUPPLY

Clearly, the price of any good or service may rise either because demand has increased or supply has declined. Prices in general - as revealed in some price index - will have risen for one or the other reason, as has been indicated. Any higher level of prices could be the effects of a once-and-for-all increase in demand, or a once-and-for-all decrease in supply, and prices could stabilise at a new higher level. It is, however, impossible to isolate statistically the impact of what are supply-side forces acting on the index of prices from demand-side forces.

It is, nevertheless, difficult to conceive of a modern economy where the aggregate supply of goods could decline continuously over time, so putting continuous upward pressure on prices from the supply-side. It is all too easy to imagine an economy where aggregate money demands rise continuously to put continuous upward pressure on prices, entirely independently of supply conditions. The relationship between the supply of money and aggregate demand for goods and services is one of the best established empirical regularities in economics. This relationship also holds very well for South Africa, as is indicated below.

A supply-side shock that caused prices to rise could not cause a sustained rise in prices, unless it was accommodated by increases in the supply of money or reductions in the demand for money. Without these monetary effects, prices could not rise continuously because aggregate money demands could not support higher prices.

MONETARISTS AND KEYNESIANS ON INFLATION

There is little disagreement among economists about the monetary nature of inflation. However, there are major disagreements about whether the money supply growth associated with inflation, defined

as a sustained upward trend in the price level, should be regarded as the cause of inflation or as a consequence of other forces causing prices to rise. Monetarists and Keynesians offer different explanations for inflation and, therefore, different policy prescriptions.

For the 'monetarists', eliminating inflation requires that the Central Bank not accommodate any extra demands for money or more correctly, bank credit associated with higher prices. The Central Bank should not therefore increase the supply of Central Bank money as high-powered money to the banking system. Furthermore, the monetarists would argue that if such accommodation by the Central Bank were not provided, aggregate demand and supply would adapt consistently to non-inflationary expectations of money supply policies. Therefore, a Central Bank, acting as a monetarist institution, should set the supply of money independently of the price level or credit demands and the state of the economy.

'Monetarists', or perhaps more generally economists who assume that economic actors are rational and that therefore markets clear any excess supply, would be disinclined to accept the notion of persistent supply-side shocks to prices. They would argue that the prices sellers set, including the prices set for the hire of labour set by powerful trade unions, should not be regarded as an end of their economic actions, but as a means to the end. Thus prices, or wages, set by economic agents with price-setting powers would be expected income or utility maximising prices. In the absence of money supply growth, higher prices would, therefore, mean less rather than more utility. Therefore, prices established at any point in time, given a monetary view of the world, would be determinate and dependent upon expected demands, which in turn depend on expected money supply. Accordingly, monopoly power for the monetarist can explain high, not rising prices. Also, an increase in monopoly power may mean higher prices for some price setters, but not persistently higher prices. Furthermore, higher prices for some would mean lower prices for others, in the absence of any general increase in demand.

So-called Keynesian economists with an alternative non-clearing market view of the world, might regard persistent supply-side shocks as not only possible but likely. They would mostly look to the labour market and trade unions for the source of such supply-side shocks. They would be inclined to argue that economic actors with monopoly powers, e.g. trade unions, would exercise them to increase prices in the knowledge that higher prices would be accommodated by increases in the supply of money and in aggregate demand. The policy prescription that follows from such an interpretation is, naturally, very different from those recommended by monetarists. Keynesians would argue that monetary policies that accommodate supply-side shocks are unavoidable facts of economic life, and so, to eliminate inflation and the money supply growth associated with it, it is necessary to eliminate the originating factor in the inflationary process. Thus their arguments for price or wage or credit controls - or some

combination of these - are offered as the best means to the end of controlling inflation* and the supply of money. Furthermore, given their presumption that markets do not clear and that market outcomes are, therefore, not efficient, Keynesians are inclined to ignore or underplay the possibilities of efficiency losses associated with direct controls.

The theoretical and practical difficulties in separating once-and-for-all increases in prices, caused by supply-side shocks, from continuous changes in prices, caused by continuous changes in aggregate demand, have been indicated. The 'causes' of price changes cannot be established from price statistics. Supply-side and demand-side shocks will impact to some degree interdependently on the price level. For this reason, it will remain impossible to refute different, competing theories of inflation from evidence of inflationary processes. Economists are likely to continue to differ on the issue of inflation and what should best be done about it, because of fundamental differences about the way the world works. Evidence of any actual process of inflation is unlikely to convince any economist, otherwise persuaded, that markets generally clear or do not clear. Agreement on such a fundamental issue has to precede agreement on the causes of inflation.

S E C T I O N II

INFLATION IN SOUTH AFRICA - SOME EVIDENCE

As indicated in Section I, observed increases in prices may be attributed to supply-side forces or demand-side forces. Moreover, the supply-side and demand-side forces affecting prices are unlikely to be completely independent because of the reactions to them by the economic authorities. Such interdependence has characterised South African economic policy responses to the state of the balance of payments and so have made money supply developments dependent on the balance of payments and on exchange rate changes.

Money supply growth can influence the level of demand and so prices, both directly and indirectly. The direct effects of increases in demand on prices are obvious enough. The indirect effects on prices occurs via the influence of extra demands for imports on the trade account of the balance of payments and so in turn the exchange rate. The interdependence of money supply growth, the balance of payments, the exchange rate and domestic prices will be explained below.

Of particular importance for the determination of prices in economies open to trade are the world prices (or costs of) imports and the prices of exports on world markets. Economies with a small share of world trade and open to world markets will not be able to influence greatly the prices expressed in foreign

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* Such arguments have been made, inter alia, by Moore (1984)

currencies of the goods or services they supply to or take from these world markets, i.e. they are price takers in world markets.

South Africa is quite heavily engaged in foreign trade, with imports and exports together comprising between 50 and 60% of GDP. The prices of the goods or services bought from or sold to world markets by South African firms cannot generally be regarded as under the control of South African firms with monopoly power. This applies also to the price of gold. South Africa, of course, does account for a significant proportion of the annual world output of gold. However, the accumulated stock of gold available from the output of earlier years is very large, relative to annual output. Moreover, the volume of transactions on the gold markets and the markets for gold for future delivery greatly exceed the value of annual output of gold.

The link between world prices and domestic prices is, for South African economic actors, the rate of exchange of domestic for foreign money. A relationship known as purchasing power parity is thought to represent a long-run equilibrium condition for economies open to trade. Purchasing power parity holds when the prices of similar goods sold in different countries are the same, when those prices are expressed in either the domestic or foreign currency. Deviations from purchasing power parity represent opportunities to trade profitably across international markets. That is, to buy where the goods are cheap and simultaneously sell where the same goods are more expensive, or to produce more internationally traded goods where production costs are low.

In the short run, substantial deviations from purchasing power parity can be oserved for South Africa. Exchange rate movements for the South African Rand have been proportionately much greater than differences in inflation rates between South Africa and its trading partners. Such deviations from purchasing power parity are regarded as representing movements in the real exchange rate.* Real exchange rate movements for the Rand against the US dollar are represented below in Fig.4.

The issue then arises as to the causes of exchange rate changes and in particular of real exchange rate changes. Clearly, differences in the rate of growth of money supply, relative to money demands between countries, can account for differences in their rates of inflation and, therefore, movements in nominal exchange rates in the direction of purchasing power parity.

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* Definition: Purchasing Power parity holds when $p = 1/e\ p^*$
where e is the foreign exchange value of a unit of domestic currency, e.g. the US dollar value of a Rand and p and p* are the index value of local and foreign prices.
The real exchange rate there is defined as $s = p^*/ep$
The convention may be to regard exchange rates as the domestic price of foreign currency in which case Purchasing Power Parity would be defined as $p = e'p^*$
and the real exchange rate as $s = e'p^*/p$.

However, the exchange rate may change for reasons quite independently of aggregate domestic demands. Such exchange rate changes may be regarded as a supply- side shock for the economy. After the depreciation in the real exchange rate, higher prices, in Rand terms, will be associated with every quantity of goods, including imports, supplied. Lower prices will follow a shock appreciation of the currency, that is, after an appreciation in the real exchange rate. (For a description of aggregate supply and demand curves, see Section IIIB below.)

Such supply-side shocks for the South African balance of payments can come in the form of changes in the dollar price of gold following changes in the growth and inflation in the US. Increases or decreases in the dollar price of gold quite clearly will affect the Rand/dollar exchange, quite independently of any forces acting simultaneously upon domestic demand and, in particular, on the growth in the money supply. Similarly, any shocks that affect perceptions about the political and economic future of South Africa will also independently affect capital flows to and from South Africa, the balance of payments and so the exchange rate. In 1979 and 1980, the foreign exchange value of the Rand appreciated in response to very large increases in the dollar price of gold and the real exchange rate appreciated. In 1985, the real exchange rate depreciated significantly, in response to political shocks. (In 1979 and 1980 world inflation was very high and in 1985 very low. In 1979, consumer prices in the US rose by 9,2% and in 1980 by a further 10,7%. In 1985, consumer prices in the US rose by 2,8%).

Nominal exchange rate changes have their causes. They also have their effects. Shocks to the exchange rate will cause the price of imports and exports to rise, so putting upward pressure on the prices of all goods and services supplied to South African consumers. Increases in the price of oil and so petrol, in response to movements in the Rand/dollar and other currency exchange rates, represent an obvious example of such an effect. Clearly, the prices of goods on world markets, expressed in US dollars, will be a further influence on South African prices. In 1980, world prices - and especially the dollar price - of oil had risen dramatically. In 1985, dollar and world inflation were much lower, and oil prices, expressed in dollars, fell dramatically towards the end of 1985. Figs.5 and 6 illustrate the relationship between import price inflation and consumer price inflation in South Africa.

Balance of payments pressure, in the form of a current account in deficit or capital outflows, not only puts pressure on the exchange rate, but also calls forth monetary policy responses which may be taken to protect the balance of payments and the exchange rate. Money supply growth rates have accordingly tended to slow down when the balance of payments was in deficit and the foreign exchange reserves of the Reserve Bank, net of foreign liabilities, were declining. Similarly, money supply growth rates in South Africa have accelerated when the balance of payments was in surplus and the net foreign exchange position of the Reserve

Bank was improving. Such surpluses are also associated with appreciations in the foreign exchange value of the Rand. Faster or slower money supply growth rates have been part of the balance of payments adjustment process. The evidence strongly suggests that much greater flexibility in the exchange rate after 1979 did not break the dependence of the South African money supply on the balance of payments, though money supply targets introduced in 1986 may do so. It should be understood that a fully flexible exchange rate will equalise demands for and supplies of foreign exchange without Central Bank intervention and therefore without changes in the domestic money supply.

As suggested, there are links between the exchange rate and consumer prices. The exchange rate via Central Bank intervention affects money supply growth rates and, in turn, money supply growth rates affect the balance of payments and so the exchange rate. Expectations of money supply growth rates and of exchange rate movements further complicate the process.

PREDICTING INFLATION

It is possible to predict inflation in South Africa, defined conventionally as the year-on-year percentage change in the monthly consumer prices, which successfully changes by using a model that combines the influence of import price inflation and money supply gorwth. The supply-side effects of world inflation and exchange rate changes in inflation are captured by import price inflation, while the domestic demand effects on inflation are assumed to be related to changes in the nominal money supply.

The model takes the following form:

$$\%_{12}\,CPI = \alpha + \sum_{k=0}^{P} \beta_k \,\%\Delta_{12}\, IMP_{t-k} + \sum_{k=0}^{P} \gamma_k \,\%\Delta_{12} M2_{t-k} \qquad I\ (1)$$

where CPI = consumer price index
imP = price of imports
M2 = money and near money
%12 = 12th order percentage change, i.e. year-on-year percentage change
P = the number of lags (usually 12)

The procedure adopted for estimating the lagged effects of the independent variables, money supply growth rates and import price inflation, was that of the widely used Almon Lag with end point constrained to zero. The predictive power of the model of inflation over the period January 1977 to November 1985, using a 12 month structure, is indicated below. As may be seen in Table 3, both money supply growth and import price inflation have highly significant effects on inflation. The closeness of fit for an equation embodying changes in rather than levels of prices must be regarded as highly satisfactory. It may also be noticed from Fig.5 that the monthly inflation rate itself varies from month to

month. Thus a model, which is able to explain 80% of the movements in the inflation rate over an extended period, should be regarded as very successful in predicting the underlying trend in inflation.*

TABLE 3: Estimates of Model Parameters in (3.1) over the period Jan.1977 to Nov. 1985 (P = 12)

Lag	IMPORT PRICES		MONEY SUPPLY	
	Coefficient	t-stat	Coefficient	t-stat
0	0,10741	(2,98255)	0,00160	(0,04867)
1	0,06011	(4,54543)	0,02961	(2,72668)
2	0,03056	(1,44821)	0,04514	(2,55383)
3	0,01251	(0,71694)	0,04847	(3,21337)
4	0,00115	(0,09327)	0,04098	(3,94692)
5	-0,00680	(-0,48203)	0,02519	(2,26322)
6	-0,01319	(-0,82981)	0,00473	(0,37079)
7	-0,01835	(-1,34321)	-0,01585	(-1,39694)
8	-0,02116	(-1,63866)	-0,03008	(-2,98452)
9	-0,01900	(-0,99604)	-0,03157	(-2,17767)
10	-0,00778	(-0,34879)	-0,01201	(-0,69406)
11	0,01806	(1,36073)	0,03783	(3,49858)
12	0,06558	(1,62815)	0,12828	(4,11433)
Sum	0,20911	(7,86819)	0,27254	(12,11000)

R-squared	0,80377
Adjusted R-squared	0,783337
S.E. of regression	0,923400
Durbin-Watson stat	0,784115
F-statistic	39,323910

Sample Monthly Data 1977-01 - 1985-11

Source: Standard Bank Data Base

What is of interest is that import price inflation and money supply growth rates are very poorly correlated and thus the two independent variables may be regarded as effectively independent of each other. The correlation between money supply growth rates

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* This model was first developed to isolate the impact of petrol price increases on the rate of inflation in South Africa. (See Barr & Kantor, 1986).

and import price inflation is a very weak one, being -0,0189 for the period 1977 to 1985. The Durbin Watson statistics may be regarded as unsatisfactory, in that first order autocorrelation is indicated. That is the forecast errors are not independent of each other. However, it should be noted that the dependent variable, the inflation rate, is the monthly year-on-year inflation rate. Thus any shifts in this rate of inflation, which may be the result of an exceptionally large or small increase in prices in any one month, for example, a sales tax increase, would continue to influence the measured rate of inflation for a full 12 months. Thus, unless one allows specifically for events such as a sales tax increase in a particular month, the model will tend to persistently underestimate or overestimate the inflation rate.

As indicated, import prices capture the combined effect of exchange rate changes and world inflation. The South African foreign exchange rates became flexible after 1980. The links between money supply changes (defined as M2 as in the model) and exchange rate changes, defined as the Rand/Dollar exchange rate (the dollars per Rand) are suggested by the following correlation matrix. (Table 4) The matrix presents correlations between monthly changes in money supply and the lagged and leading changes in the exchange rate. The evidence is that money supply growth responds with a lag to changes in the exchange rate, accelerating after the Rand has begun to appreciate against the dollar and decelerating after the Rand has begun to depreciate.

TABLE 4: Sample 1980-01 - 1985.11 71 observations

COR{GM,GE*-i)}	COR{GM,GE(+i)}	i	lag	lead
***	***	0	-0,2923	-0,2923
**	****	1	-0,2066	-0,3889
*	*****	2	-0,1225	-0,4713
	*****	3	-0,0412	-0,5478
*	******	4	0,0596	-0,0587
**	******	5	0,1795	-0,6057
***	******	6	0,2624	-0,6157
***	******	7	0,3221	-0,6093
****	******	8	0,3875	-0,5965
****	******	9	0,4154	-0,5603
****	*****	10	0,4268	-0,5075
****	****	11	0,4129	-0,4399
****	****	12	0,4110	-0,3572

If this relation were to be graphed, it would look something like the illustration in Fig.7.

INSERT FIGURE 7.

The money supply process in South Africa, including the influence of exchange rate changes and exchange rate expectations, is fully discussed in Chapter . It should perhaps be emphasized here that the links between the balance of payments and money supply growth rates should not be regarded as inevitable but as the consequence of particular policies. Alternative policies, those of market-determined exchange and interest rates combined with money supply targeting, could break the link between the balance of payments and the money supply. In this way, given close control over the money supply, prices could not increase persistently because of excess demand. This, of course, is a monetarist prescription.

However, even with non-inflationary control of the money supply, the price level may still increase in response to supply-side shocks, in particular to other forces that influence the exchange rate. The appropriate policy responses to such supply-side shocks are considered in Section III.

The exchange rate is, of course, not the only source of supply-side shocks for the economy. Sharp changes in administered prices, especially food prices, would have in the nature of a supply-side shock - as would changes in indirect taxation, for example an increase or decrease in the rate of sales tax.

S E C T I O N III

THE EFFECTS OF INFLATION

IIIA. ON THE VARIABILITY OF PRICES

The problem with inflation is not simply that prices rise. The problem is that different prices may rise at very different rates. When relative prices change, that is the prices of goods or services, expressed in terms of the equivalent quantity given or asked in exchange for other goods and services (e.g. the number of apples exchanged for every orange), are subject to change, real prices become more difficult to predict and economic decision-makers become subject to greater uncertainties. These uncertainties about prices would make the economic system less well co-ordinated, less efficient and would increase the natural rate of unemployment. (see Friedman, 1977)

Measure of Relative Prices

A number of tests have provided support for the hypothesis that higher inflation is associated with more variable prices. Among the better known is the study by Parks (1978).

Following the work of Theil (1967), Parks computed the following measure of the variability (VP_t) of a set of n relative prices for price data for the Netherlands and the USA:

$$VP_t = \sum_{i=1}^{n} w^*_{it} (DP_{it} - DP_t)^2 \qquad \text{IIIA (1)}$$

where : w^*_{it} is the average expenditure share on the ith commodity over the period under observation (the weight of the ith good in a price index) consisting of n sub-categories

DP_{it} is the annual rate of change of the prices (log form) of the ith good and DP_t is the rate of change of the general price index

i.e.

$$DP_t = \sum_{i=1}^{n} s^*_{it} DP_{it} \qquad \text{IIIA (2)}$$

The factor $DP_{it} - DP_t$ is thus the rate of change in the ith relative price and hence VP_t represents a joint measure of relative price variability at some point in time.*

The existence of a relationship between the variability of relative prices and changes in absolute prices can be tested by regression analysis. It has been found that there are statistically significant, though rather weak, relationships between VP_t and DP_t in the predicted direction.

Relative Prices in the Republic of South Africa

A similar approach to the measurement of relative price variability was applied to South African data for the period 1961 to 1984. The reclassification of commodities and services included in the consumer price index limited the study to the prices of the only five categories of goods and services for which data was available for the entire period. These items include, however, some of the more important items in the CPI, viz. housing, food, furniture and equipment, clothing and footwear and motor vehicles. In Table 4, we list the price changes in log form at an annual rate for the five categories and for all prices (DP_t) and the measure of relative price variability (VP_t) over the period studied at six monthly

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* See, for applications of this method, Parks's study for the US and the Netherlands (Parks, 1978) and that of Blejer for Argentina (Blejer, 1981,1983). See also the recent survey by Cukierman of the theoretical and applied literature on the relationship between prices and prices in general. (Cukierman, 1983).

intervals. (See Eqns. (1) and (2) above.) Fig.8 gives time series plots for DP_t and VP_t for South Africa which are also listed in Table 4.

In order to maintain comparability with the other studies of relative price variability, VP_t is multiplied by 10_4.

The degree of relative price variability for South Africa reported in Table 4 and presented in Fig.8 is broadly similar to the results obtained for other countries. It would appear that the averave relative price variability increased in the more recent period of higher inflation, though there were also periods of high relative price variability between 1961 and 1971, as may be seen from the observation for July 1964 and January 1970.- The most striking observation is for the six months ending January 1981, when the index of relative price variability registered as much as 55,52. This value owed a great deal to a large and exceptional increase in the real price of food over this period.

In order to consider the relationship of VP_t with general inflation, a regression of VP_t on DP_t was performed. It yielded the following relationship:*

$$VP_t = \underset{(0,3196)}{0,8567} + \underset{(3,808)}{0,6526}\ DP_t \qquad \text{IIIA (3)}$$

$$\bar{R}_2 = 0,2269$$
$$D.W. = 1,8215$$

The value of the coefficient for DP_t is statistically significant and does support the general observation that higher rates of inflation are associated with more variable relative prices.

As discussed below, the value for VP_t for January 1981 of 55,528 is rather extreme, and in fact will be very influential in the regression results. When this point was excluded, the following result was obtained:

$$VP_t = \underset{(1,934)}{2,0815} + \underset{(4,496)}{0,5444}\ DP_t \qquad \text{IIIA (4)}$$

$$\bar{R}^2 = 0,2992$$
$$D.W. = 1,6326$$

This result is somewhat better, although the linear fit would still be considered to be rather weak.

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* (t statistics in parentheses)

TABLE 4: Price Changes: VP_t and DP_t for South Africa - 1961-1984

Year	Housing (1)	Food (2)	Clothing /Footwear (3)	Furniture /Equipmt. (4)	Motor Vehicles (5)	DP_t	VP_t
Jan'61	3,24	1,43	,93	-,30	,43	1,67	1,46
Jul'61	2,42	1,92	1,34	-,10	3,63	2,17	,98
Jan'62	3,45	-,41	1,23	,20	2,97	1,64	3,06
Jul'62	3,48	-,50	,71	-,30	1,15	1,22	3,01
Jan'63	2,03	3,01	,91	-,79	2,58	1,72	1,65
Jul'63	1,00	,40	1,51	-1,00	3,77	,90	1,32
Jan'64	2,29	-,89	1,10	-,60	2,51	,90	2,36
Jul'64	3,62	5,18	1,88	,50	,30	2,56	4,06
Jan'65	4,05	8,78	3,42	1,00	,49	4,18	10,85
Jul'65	3,49	6,73	3,09	1,58	1,87	3,82	4,38
Jan'66	5,69	3,68	2,09	1,28	1,57	3,74	2,61
Jul'66	5,32	1,42	1,70	,59	1,84	3,14	3,79
Jan'67	3,51	2,78	1,68	,88	4,74	3,52	1,59
Jul'67	4,30	5,80	1,67	,10	6,68	4,18	4,39
Jan'68	5,13	1,87	,65	,10	4,35	2,19	3,82
Jul'68	5,41	,91	-1,48	1,74	-,09	1,98	5,42
Jan'69	4,56	3,63	,00	1,54	-,53	2,82	3,08
Jul'69	5,81	-,58	5,88	,29	4,82	2,95	9,33
Jan'70	6,29	,73	6,50	,38	5,64	3,40	7,82
Jul'70	4,70	5,78	3,11	1,61	1,61	4,06	2,68
Jan'71	5,16	5,94	2,89	2,07	2,00	4,23	2,61
Jul'71	6,33	4,80	5,07	2,14	7,54	6,03	2,93
Jan'72	6,35	5,03	6,33	3,21	8,32	6,72	3,04
Jul'72	6,21	6,55	5,05	5,46	6,14	5,47	,67
Jan'73	7,79	10,86	6,22	6,38	2,70	7,97	4,06
Jul'73	8,32	14,20	6,77	7,32	5,32	9,37	11,48
Jan'74	6,10	12,66	6,63	9,84	2,70	8,50	11,91
Jul'74	7,91	15,77	10,65	13,87	5,32	11,32	15,18
Jan'75	11,53	18,95	14,07	14,96	9,39	14,15	13,03
Jul'75	12,89	12,98	9,85	10,17	12,48	13,73	2,72
Jan'76	11,79	6,48	7,81	7,92	15,34	11,11	12,42
Jul'76	9,99	6,35	10,45	9,78	19,13	10,74	13,86
Jan'77	9,63	8,72	10,61	9,54	15,78	10,86	4,54
Jul'77	8,26	9,67	11,65	7,75	11,87	10,75	3,70
Jan'78	7,04	11,32	9,13	8,26	10,58	10,10	3,95
Jul'78	7,48	13,29	11,01	12,13	13,48	10,72	2,72
Jan'79	8,50	12,58	9,71	10,19	11,53	10,50	3,03
Jul'79	10,26	13,75	3,25	5,77	7,92	11,82	15,14
Jan'80	11,83	13,34	5,70	6,03	8,51	12,96	13,44
Jul'80	9,30	14,52	9,55	8,65	10,11	11,54	5,13
Jan'81	9,10	25,00	13,41	9,60	13,78	14,36	55,53
Jul'81	13,18	20,80	14,19	10,71	12,89	14,48	18,19
Jan'82	16,03	10,66	12,80	14,70	14,04	13,11	5,31
Jul'82	12,65	11,67	14,39	14,38	15,02	13,51	1,91
Jan'83	15,87	10,45	14,15	12,01	10,48	13,46	6,36
Jul'83	16.90	10,38	10,33	8,93	8,71	11,63	10,76
Jan'84	16,23	9,95	7,76	7,65	10,69	9,84	13,29

Source: SA Reserve Bank Quarterly Bulletin & supplements

INSERT FIGURE

III.B. INFLATION, INTEREST RATES AND EXCHANGE RATES

Among the other important relative prices are real exchange rates and real interest rates. As defined above, the real exchange rate appreciates or depreciates as nominal exchange rates change proportionately less or more than differences in inflation rates between countries. Changes in real exchange rates affect the profitability of exporting or importing. When the real exchange rate appreciates, exports become less profitable and imports less profitable to produce or exchange and vice versa when the real exchange depreciates. Therefore fluctuations in the real exchange rate imply considerable risk for importers and exporters.

Real interest rates are defined as the difference between nominal interest rates and expected inflation. As such, real interest rates are unobservable because inflationary expectations are unobservable. All that can be observed are differences between actual rates of interest and actual rates of inflation. A description of actual after-the-event real short-term and long-term interest rates for South Africa is provided in Figs.9, 10 and 11.

Expected inflation will be incorporated into financial contracts. Obviously, lenders will wish to offset the impact of inflation on the real returns obtained for their savings. Similarly, borrowers will be prepared to offer compensation in the form of higher nominal returns or interest rates when more inflation is expected. It should not be presumed that either lenders or borrowers, as a class, will be better informed about inflation or that lenders always lose and borrowers always gain from inflation. As mentioned earlier, unexpectedly high inflation will benefit borrowers and harm lenders. Unexpectedly low inflation will benefit lenders at the expense of borrowers. (The taxation or tax expensing of nominal interest will further complicate the relationship. These points are considered in Chapter).

The relationship between inflation and (expected) real interest rates (or returns) is not an simple one. This relationship would depend, in part, upon the impact of inflation on real savings and real investment decisions. If the volume of real savings were to decline in response to expected inflation and inflation did not affect real investment decisions, then real interest rates would be expected to rise in response to the excess demands for real savings during inflationary periods. If, alternatively, real savings were to increase in response to greater inflation-associated uncertainties, real interest rates would tend to fall.

However, the assumption that real investment would be unaffected by inflation is a difficult one to defend. If inflation is associated with greater real price variability, then it is the investor in specific capital equipment who are most vulnerable to unexpected changes in relative prices. For example, if the price

of food rises more slowly than the wages of food workers, then food manufacturing becomes less profitable and investment in food manufacturing equipment less successful. Therefore it is perhaps more realistic to assume that inflation-associated uncertainties may well bring less real investment and less real demand for finance and so lower real interest rates, other things including real savings remaining the same. Uncertainties associated with inflation may also encourage more real savings. It should also recognised that savers unlike investors are not locked in. They can adjust their future spending decisions to realised changes in relative prices.

Nominal interest rates and so real interest rates will also be affected by changes in demands for money. Given inflationary expectations, any switch from non- or low interest-bearing into interest-bearing financial securities, including currency or bank deposits in response to higher expected rates of inflation, would imply lower nominal interest rates.

The discussion of the links between inflation and real interest rates or returns was conducted as if the chain of causation runs from inflation and inflationary expectations to nominal and real returns. This, however, may not always be the case: The causation may be the reverse one in that lower expected or actual returns may cause higher inflation. If, for example, returns to investors declined because of slow economic growth, the authorities may attempt to counter the slower growth with faster rates of monetary expansion. This would then lead to higher inflation. If so, higher inflation would be associated with slower growth and lower returns. (See Geske and Roll, 1983).

In South Africa, slower growth and higher inflation can be the effect of a supply-side shock in the form of either a gold price reduction or capital withdrawals. The supply-side shock will cause the exchange rate to depreciate and prices will rise. In this way, higher inflation may well be associated with slower rather than faster growth and with poorer, rather than better, real returns. Similarly a helpful supply side shock in the form of a higher gold price or a recovery of political confidence will lead to faster growth, a higher value for the Rand, lower inflation and lower interest rates.

Thus what further complicates the determination of interest rates and the link between inflation and interest rates are expectations of exchange rate changes when exchange rate movements and expectations of them are to a degree dependent on supply-side rather than demand-side forces. Or, in other words, when the real exchange rate changes and is expected to change.

In this way, or because of official policy responses, changes in exchange rate expectations will lead to changes in interest rates. An improvement in the gold price or in political confidence will cause the Rand to appreciate and interest rates to fall. If so, the exchange rate will appreciate and interest rates decline ahead of a fall in the inflation rate. Should the exchange rate be

expected to depreciate, interest rates and inflation will accelerate after the exchange rate has fallen and interest rates risen.

The equilibrium condition for financial markets open to capital flows is interest parity. That is the costs of borrowing or rewards from lending in both the domestic and foreign financial markets must be expected to be the same. Or, in other words, differences in interest rates between two financial markes, for equivalently risky assets, will be equal to expected movements in the rate of exchange, as revealed by differences between the spot and forward rate of exchange of domestic for foreign currency. Thus interest and exchange rates are interdependently determined.

The interest parity equation may be expressed as follows:

$$i_{SA} - i_{US} = \frac{SR - SR^{e}}{SR}\% \qquad \text{IIIB (1)}$$

or $i_{SA} = \hat{T}_{US} + \hat{e}$ where $\hat{e}$ is the expected movement in the exchange rate, i.e. $\hat{e} = \frac{SR - SR^{e}}{SR}\%$

Such a relationship can be maintained by arbitrage. If there are well developed markets in foreign exchange for forward delivery, any deviations from interest parity then provides a riskless opportunity to profit by buying one currency and selling the other, to earn a higher rate of return. The risk of exchange rate changes over the period of the loan can be insured against by simultaneously selling the currency, in which interest is being earned for forward delivery in exchange for another currency. If the cost of such forward cover, as represented by the percentage difference in the spot and forward rates of exchange, is less than the difference in interest rates, when calculated on the same annualized basis, then a riskless profit can be earned. Thus, given interest parity, there are no advantages to be had from either borrowing in the domestic currency or a foreign currency, without assuming the risk of exchange rate changes.

In the absence of a well-developed market in foreign exchange and where, as in South Africa, the Central Bank controls both the spot and forward markets in foreign exchange, officially quoted forward exchange rates may not reflect the expectations of participants in the market place. If so, open positions may be assumed in the foreign exchange market in expectation of a profit through borrowing or lending or repaying foreign currencies. These open positions will mean foreign exchange flowing in or out of the domestic economic so putting downward or upward pressure on money supply growth on short term interest rates.

A further complication is that the exchange rates and exchange rate expectations of importance for profits and interest rates in South Africa may be the financial, rather than the commercial Rand.

The behaviour of nominal and real interest rates in South Africa confirms the importance of both demand and supply forces influencing interest rates. What is of obvious importance at times, are the supply-side influences on exchange rates and exchange rate expectations and therefore on inflation.

As may be seen in Fig.9 and 10, ex post real interest rates, defined as the difference between monthly interest rates and inflation, have mostly been negative over the period 1975 to 1986. The only extended period of consistently positive real interest rates was between early 1983 and 1985. This was a period when increases in consumption demands from households and government sustained a strong recovery in the economy, even while the gold price was falling.

The previous recovery of the economy from 1977 to 1981 had everything to do with the strength of the gold price and the recovery of political confidence associated with it. The expectation of exchange rate appreciation and the rapid monetary growth that occurred in 1979 and 1980 led to lower nominal and real interest rates. Interest rates then rose in 1981 as the recovery gathered momentum and served to reduce trade account surpluses. These smaller surpluses then reversed the direction of the exchange rate in 1981 and expectations of depreciation gradually replaced those of appreciation.

The links between interest rates and the business cycle are revealed in Figs. 12 and 13. Nominal interest rates are largely procyclical - real interest rates less so. The procyclical behaviour of nominal interest rates has much to do, as indicated, with the balance of payments and exchange rate expectations, which are related to the state of the economy. The early stages of a business cycle recovery are associated with higher balance of payments surpluses and lower nominal interest rates. The later stages of a recovery with reduced surpluses and higher interest rates. Changes in inflation lag behind movements in the exchange rate, and this explains the looser links between real interest rates and the business cycle.

The correlation statistic measuring the strength of the relationship between inflation and nominal interest rates reveals a generally positive, though weak, relationship. Inflation, as measured by year-on-year change in the monthly CPI, explains 0,34% of the changes in long term interest rates. The R^2 for the associated inflation and short term interest rates much weaker, being 0,075 for the same period January 1977 to October 1985.

The attempt was made to measure the combined impact on nominal and real interest rates of inflation and unexpected inflation, where unexpected inflation was defined as movements in the inflation rate away from its long term cycle. That is to say, an inflation cycle was fitted to the actual inflation rate over the whole period under observation and this cycle was assumed to reflect expected inflation (see Fig.14). Whether such a measure is an accurate proxy for inflationary expectations throughout the

period under observation is, of course, highly doubtful. As mentioned previously, inflationary expectations cannot be observed and proxies for expected inflation have to be sought for purposes of empirical analysis.

The results of a regression equation that relates nominal interest rates, short- and long-term, to inflation and unexpected inflation are as follows:

Dependent Variable is RINT72
Smpl 1976.01 - 1986.12

Variable	Coefficient	Std. Error	T-Stat	1-Tail Sig.
C	2,8213848	1,0695688	2,6378713	0,008
INFL2	0,7238017	0,0779894	9,2807699	0,000
INFU	-0,7357993	0,2066823	-3,5600495	0,000

R-squared	0,401081	Mean of dependent var	12,61098
Adjusted R-squared	0,391796	S.D. of dependent var	2,627319
S.E.of regression	2,048979	Sum of squared resid	541,5827
Durbin-Watson stat	0,056452	F-Statistic	43,19404
Log likelihood	-280,4717		

IIIB (1)

As may be seen the coefficient on inflation and inflationary expectations indicates statistically significant influences in the direction predicted by economic theory. However, the D.W. statistic is highly unsatisfactory, indicating autocorrelation and therefore biased results. The interest rate series is highly autoregressive, being highly dependent on the previous month's value.

The regression equation for short-term interest rates shows a much weaker link to inflation. The pattern of short-term interest rates is also highly autoregressive, as may be seen in the regression result for (2).

Dependent Variable is RINT53
Smpl 1977.01 - 1985.10

Variable	Coefficient	Std.Error	T-Stat	2-Tail Sig
C	3,9557583	4,0418586	0,9786978	0,330
INFL2	0,6151350	0,3034218	2,0273263	0,046
INFU	-0,8241153	0,6211040	-1,3268556	0,188

R-squared	0,039846	Mean of dependent var	12,09009
Adjusted R-squared	0,021202	S.D. of dependent var	5,407642
S.E. of regression	5,350008	Sum of squared resid	2948,126
Durbin-Watson stat	0,028319	F-Statistic	2,137223
Log likelihood	-326,6582		

IIIB (2)

As may be seen in regression equation (3), the link between real long-term interest rates , inflation and inflationary expectations is statistically significant, though again biased by autoregression.

Dependent Variable is RIN2
Smpl 1977.01 - 1985.10

Variable	Coefficient	Std. Error	T-Stat	2-Tail Sig.
C	4,5309146	1,6546200	2,7383416	0,008
INFL2	-0,4094783	0,1242121	-3,2966052	0,001
INFU	-0,7090379	0,2542620	-2,7886113	0,007

R-squared	0,256956	Mean of dependent var	-0,836800
Adjusted R-squared	0,242528	S.D. of dependent var	2,516449
S.E. of regression	2,190139	Sum of squared resid	494,0608
Durbin-Watson stat	0,049979	F-Statistic	17,80946
Log likelihood	-231,9861		

IIIB (3)

The link between the short-term real interest rates, inflation and inflationary expectations is a much weaker one, as may be seen in (4).

Dependent Variable is RINI
Smpl 1977.01 - 1985.10

Variable	Coefficient	Std. Error	T-Stat	2-Tail Sig
C	6,5266060	3,5601320	1,8332483	0,070
INFL2	-0,5776757	0,2673340	-2,1608761	0,033

R-squared	0,042969	Mean of dependent var	-1,083404
Adjusted R-squared	0,033767	S.D. of dependent var	5,462552
S.E. of regression	5,369535	Sum of squared resid	2998,518
Durbin-Watson stat	0,033171	F-Statistic	4,669386
Log likelihood	-327,5565		

IIIB (4)

Exchange Rates and Exchange Rate Policy

Flexible exchange rates are the logical corollary of differences in inflation rates across countries. If exchange rates are fixed and expected to remain fixed between two countries or between two regions of a common currency area, then inflation rates in these two regions will be approximately the same. In other words, fixed exchange rates maintain the stability of real exchange rates. Fixed exchange rates therefore deny countries the opportunity to conduct monetary policies that are independent of the balance of payments. In order to maintain fixed exchange

rates must accelerate when the balance of payments is in surplus. Similarly, under a fixed exchange rate regime when the balance of payments is in deficit, money supply growth rates must slow down to reduce expenditure growth rates and so demands for imports, in order to conserve foreign exchange necessary to maintain fixed exchange rates. If the expectation is that exchange rates will remain fixed, an increase in domestic interest rates relative to foreign interest rates then becomes equivalent to increased real returns for foreign lenders and increased costs for domestic borrowers. Increases in interest rates which were engineered by monetary authorities were used to protect the foreign exchange values of their currency. Higher interest rates discouraged foreign capital outflows and encouraged foreign capital inflows which protected the reserves. However, unless the capital inflows were used to finance investment and contribute to a growth in output and incomes, the borrowing country would sooner or later run out of credit with which to finance the consumption of imports. Thus, either fixed exchange rates had to be abandoned or the standard of living reduced by application of monetary policy and perhaps fiscal policy restraint. It was largely in this way that South Africa maintained a fixed rate of exchange with the US dollar between 1949 and 1971. Accordingly, South African inflation and US inflation occurred at approximately the same rate and the real exchange rate between the US and South Africa remained highly stable.

All this changed after 1971 when fixed exchange rate links between the major trading countries were abandoned though there were periods when the dollar value of the Rand was temporarily fixed. After 1971, the rate of inflation in South Africa differed from that of the US and the real exchange rate fluctuated. Such fluctuations clearly added to economic risks.

Whatever the exchange rate regime, be it flexible or fixed, South Africans are not able to avoid the real effects of political instability as manifested in withdrawals of foreign capital. If capital is withdrawn, South Africans will be obliged to reduce their standard of living and their levels of consumption in order to generate the export surpluses required to meet demands for foreign capital. Under fixed exchange rates this adjustment to living standards would be affected in part by much slower rates of growth in the money supply. Under flexible exchange rates, the adjustment process takes the form of higher prices associated with exchange rate falls. These higher money prices relative to money income have the effect of reducing the real money supply, real disposable incomes and spending. Thus the price increases that follow a devaluation have the same deflationary force as would an increase in taxes.

The question as to whether an adjustment process realised via reductions in money supply growth rather than exchange rate depreciastion and so more stability in prices would be less disruptive of real economic activity than one where money supply growth is more stable and exchange rates and prices less so, is not easily answered. We return to this question below.

IIIC. THE RELATIONSHIP BETWEEN INFLATION AND ECONOMIC ACTIVITY IN SOUTH AFRICA: THEORY

The interpretations by economicsts of the relationship between inflation and economic growth have naturally responded to changes in the evidence of this relationship. The concerns of economists in the immediate post Second World War period were much with the problems of recession. Their experience of the depressed economic conditions and deflation in the 1930's led them to believe, following John Maynard Keynes (Keynes 1936), that the economic problem was not so much one of inadequate supplies but of insufficient demand. They thought that fiscal policy injections, by way of government taxing less and spending more, were necessary to maintain aggregate demand coincident with full employment of resources and especially labour. They were concerned with closing what they regarded as inevitable deflationary gaps. For them, inflation would only occur with excess demand and full employment. For the early Keynesian economists, inflation and unemployment were mutually exclusive economic conditions. Economists in the 1960's, influenced by the experience of creeping inflation and less than full employment and the analysis and measurements of A W Phillips (Phillips, 1958) thought there were trade-offs between inflation and employment. That is, they came to believe that more inflation could be traded off for less unemployment. However, economic developments in the late 1960's and 1970's did not support this hypothesis at all. Higher inflation came to be associated with more rather than less unemployment and with slower rather than faster economic growth.

It was Milton Friedman who developed the notion of the natural rate of unemployment. He argued that the natural rate of unemployment was independent of inflation and one to which the economy would gravitate. Friedman argued that unemployment would be determined by real forces and that firms or workers would not suffer any permanent money illusion. That is, they would not confuse nominal prices or inflation with the real prices that were of importance to them. Friedman, moreover, made the important distinction between anticipated and unanticipated inflation. Anticipated inflation, he argued, would not have real effects because economic actors affected by and expecting inflation would adjust their plans accordingly. For example, prices or wages or interest rates would rise in anticipation of higher levels of demand and so higher realised levels of demand would not have real effects, i.e., would not influence output or employment. (Friedman, 1977)

These ideas were later refined by the Rational Expectations School. Only unanticipated inflation could, by temporarily misleading economic actors, promote higher levels of activity. Friedman regarded deviations in the growth of money supply from its trend as causing temporary increases in the level of employment or output beyond its natural level. Given rational expectations, output or employment could be greater or less than their natural levels. If actual demands turned out to be greater

or less than was expected because inflation turned out to be higher or lower than expected. Expected levels of demand would be calculated rationally. That is rational expectations of inflation would be the expectations generated by the best economic model of inflation. Economic actors, it was argued, could be confused by unexpectedly high prices or wages. They would attribute such higher prices to an increase in the real demands for the goods or services they supplied. They would therefore wish to supply more goods or more services in response to what they falsely believed was a real increase in demand. If inflation turned out to be unexpectedly low, they would respond as if the real forces of demand had turned against them. Firms would believe themselves less profitable and respond by producing less and hiring fewer workers. The emphasis of this analysis was therefore very much on the demand side. Output and employment would respond to unexpectedly high or low levels of demand and therefore prices. The potential real supply of labour and goods was assumed to be given.

In summary, therefore, if prices rise faster than expected because of unexpected increases in demand, output and employment are likely to increase. However, if prices rise unexpectedly because of unexpected reductions in supply, employment and output are likely to decline. Thus favourable demand-side shocks and the inflation associated with it, shocks by definition being unexpected, are likely to encourage favourable output and employment effects, whereas unfavourable supply-side shocks, less supplied at every price, would increase prices but be associated with lower output. (For my own fuller interpretation of the history of these ideas, see Kantor, 1979).

A Rational Expectations Analysis of Output and Inflation

In Fig.15, aggregate domestic output is measured on the horizontal axis and the aggregate price level on the vertical axis. The natural or full employment level of output is equivalent to Q. The aggregate real demand curve is negatively sloped. That is to say, other things equal, the lower the level of prices, the higher the level of real demand. Among the other things equal that would influence demand would be the expected level of prices. The higher the expected level of prices, the higher the level of demand. Other factors influencing demand could be money supply and government expenditure.

The investment and consumption demands of firms and households, which are the major components of aggregate domestic demand, will depend upon expected income. Clearly it is expected rather than actual income that drives the investment expenditure decisions of firms. Actual income, in an uncertain world, may limit the capacity of the firm or households to borrow to finance expenditure. Much of the expenditure of households, which is defined as consumption, represents an investment decision. Households invest in household capital, furniture, electrical appliances, even clothes that provide consumption services over

time. Households also often borrow to finance such expenditure, that is they mortgage future income to the purpose. Therefore, expectations of income will be a very important influence on the willingness of households to spend.

Expected income is sometimes, again after Milton Friedman, known as permanent income. (Friedman,). Obviously, permanent income or alternatively, wealth, will not be independent of current income. Nor will the borrowing capacity of the household, as for the firm, be independent of current income.

In a certain world there would also be no material difference between the cost of borrowing and rewards for lending. Naturally, calculations of expected income are clouded with uncertainty about the future. However, the permanent income or wealth of the household could be calculated formally in the same way as the value of any investment. It is the present value of the expected cash flows, after expected taxes, that determines the value of an investment. Such cash flows have to be appropriately discounted by the relevant interest rate, which reflects the opportunity cost of making a particular investment. Such present value calculations depend critically on the length of time for which income is expected. The longer the time horizon, the greater the present value of permanent income or more generally, the perceived wealth of the firm or household and their willingness to spend. Also the higher the rate of discount, the less will be the value of future income. Changes in the degree of confidence in future income prospects are equivalent to lengthening or shortening the relevant time horizon.

Thus, the aggregate domestic demand (AD) function of the economy could be described, in a very general way, as

$$AD = f\left(y^{*}_{(+)},\ P_{(-)},\ P^{e}_{(+)},\ g_{(+)},\ m_{(+)}\ \ldots\right)$$

where y^{*} represents permanent income, P and P^{e} actual and expected prices respectively, g government expenditure, and m money supply. The influence of the different variables, positive or negative, on aggregate demand is indicated by the positive or negative signs above the variables.

Aggregate supply will also naturally depend, other things equal, on the level of prices. The higher the level of prices, the more profitable will be the firms, and the greater their willingess to supply, as illustrated. Again, among the other things held equal, would be inflationary expectations. For any given level of prices received, an increase in expected inflation would imply reduced profitability and so reduced supplies made available to the market.

The aggregate supply of goods and services to the economy will be influenced by the availability of resources - land, labour and

capital. Willingness to supply labour will be influenced by tastes for leisure and rewards for work. It may be assumed that the greater the rewards, the higher the cost of not working and the greater the supply of labour. Again, for given wages, an increase in either prices or expected prices will reduce the supply of labour made available to firms and so the smaller the output of goods. Potential supply will naturally increase with the availability of physical capital, plant and machinery. The savings that facilitate capital creation can come from domestic or foreign savings.

An increase in the expected level of prices would, therefore, shift the aggregate supply curve of Fig.15 to the left. The aggregate supply (AS) function illustrated in Fig.15 may be generally described as

$$AS = h\left(P^{(+)}, P^{e(-)}, L^{(+)}, N^{(+)}, K^{(+)}, T^{(+)}\right)$$

where L,N,K, and T stand for supplies of labour, land or natural resources, capital and improved technology respectively. The direction of the effects of the variables influencing supply are again as indicated.

The actual price level established in any period will be the price level that equalises aggregate supply and demand. Ideally, this equality would be established with full employment. That is, where AD_1 and AS_1 intersect at P_1 in Fig.15 corresponding to the natural or full employment level of output Q. Such a result would occur, following national income or utility maximising behaviour, when events, including inflation, turned out as expected. If all the variables influencing aggregate supply and demand behaved as expected, then actual demand and supply would behave as expected, the prices would turn out as expected and actual output and employment would be equal to the potential or natural levels.

If realised aggregate demand was greater than expected, that is took position AD_2 in Fig.15, actual prices would be higher than expected and output levels would be temporarily higher than their natural levels, as firms and workers responded according to aggregate supply function (As_1). Output levels Q_2 could not, however, be sustained. Given rational behaviour and given tastes for leisure, expectations of higher prices or inflation would be adjusted upward and less supplied as it was realised that prices in general had increased, rather than only the particular prices of advantage to particular firms or workers. Thus, if aggregate demand were expected to be maintained at the higher levels, suppliers would wish to supply less at each price. Their responses would be represented by an aggregate supply curve shifting inwards from AS_1 to AS_2. A higher equilibrium level of prices P_3 would be established.

It should be noted that these results do not depend upon prices rising faster than wages. The higher expected profits can be generated by a more intensive use of fixed capital or natural resources.

A supply-side shock can be illustrated by a shift upwards of the aggregate supply function. That is, indicating that less would be supplied at every price, e.g. a movement from AS_1 to AS_2. If aggregate demand remained unchanged at level AD_1, this movement would mean higher prices and lower output levels.

The discussion of this model has so far proceeded as if the economy were closed off to world trade. Such a presumption would not be helpful in understanding the behaviour of the South African economy. Independent changes in import supply and export demand conditions can be illustrated by shifts in the aggregate domestic demand or supply functions. Changes in the nominal and real exchange rate would cause such shifts.

An appreciation in the real exchange rate would effectively increase available supplies and decrease aggregate demand for every given domestic price. A depreciation in the real exchange rate would have opposite effects. That is the effects of a depreciation of the real exchange rate would be captured in Fig.15 by an upward shift of the aggregate supply curve and a rightward shift of the demand curve. The net effect of a shock to the real exchange rate on output levels is therefore indeterminate. it would depend on the relative movements of aggregate supply and demand.

The potential demand from world markets for the output of a small economy is very large. Therefore, given access to world markets, the problem of a small economy is not one of permanently deficient demand for the goods and services capable of being produced there. If the price is right, much more could always be sold. The limiting factor is surely the profitability of exporting at world market related prices, rather than any lack of potential demand.

Profits from exporting have to compete with profits to be earned from satisying domestic demands. However, if domestic demands decline unexpectedly, putting downward pressure on the prices of and rewards for supplying goods to the domestic market, resources will be shifted towards these sectors of the economy that export or compete directly with imports. Such shifts will, of course, occur with changes in the real exchange rate. Unexpected fluctuations in the real exchange rate or unexpected changes in domestic demand will affect the relative profitability of satisfying domestic or foreign demands and will lead to changes in the composition of domestic output. However, the adaptation of the pattern of production to changed circumstances cannot take place instantaneously. Therefore, the level of output or employment will not always be sustained at its full employment level during any adjustment process.

IIID. Output, Employment and Inflation in South Africa: The Evidence

The theoretical discussion above would not lead any observer to expect any consistent, reliable links to exist between output, employment , real returns and inflation in South Africa. Theory suggests that the effects might be in one direction or the other. Higher prices might be associated with less output and lower returns, if the cause of higher prices were a supply-side shock. If the supply-side shock was caused by an unexpected depreciation in the real exchange rate, output and returns might at first decline and then increase, as export demands and supplies were encouraged. However, if the increase in prices were the result of an unexpected increase in domestic demand, prices, output and returns might be expected to rise together.

There is, in fact, no evidence of any consistently positive or stable relationship between higher prices and economic growth or economic activity, more generally, defined in South Africa. As much is evident from the relationship over time between real GDP growth and inflation, defined as year-on-year changes in the CPI (see Fig.16 using quarterly data). The lack of any consistent pattern is, perhaps, better illustrated by a scatter diagram for quarterly changes in real GDP and the GDP deflator (see Fig.17). The correlation statistic for this relationship is in fact a negative ,03.

Real GDP growth may not, with reason, be regarded as providing a good measure of economic activity (see Chapter). Indeed, the relationship between real GDP growth and the business cycle index, i.e. the index of so-called coinciding indicators of the business cycle, is statistically very weak. The simple correlation coefficient for quarterly changes in real GDP and the business cycle over the period, 1st quarter 1976-1st quarter 1985, is in fact a negative ,085.

The business cycle index may be regarded as indicating the growth path of the economy over time. As may be see in Fig.18, the index itself does not reveal a growth trend and moves about its 1975 value of 100. Expansion or upswing phases of the business cycle are of course indicated when the index rises and contraction or downswing phases occur when the index declines. The relationship between the expansionary and contractionary phases of the business cycle and inflation are indicated in Fig.18. The inflation rate indicated here has been smoothed. As may be seen, and as might have been predicted from the theoretical discussion, there are periods when inflation rates and economic activity accelerate together and other periods when growth and inflation rates move in opposite directions. In general, the statistical relationship between changes in prices and the business cycle yields a correlation coefficient R^2 of 0,35, for monthly data for the period 1 January 1976 to 31 December 1986, where the business cycle is measured by the new coinciding indicators published by the Standard Bank.

There would therefore appear to be no well defined Phillips curves for South Africa. Growth and inflation are not closely linked in general. There have been periods of accelerating growth, with higher inflation, as well as periods when growth has declined as inflation accelerated. Similarly, there are periods when faster growth is associated with lower rates of inflation. as may be seen in Figs. 16-18.

A regression equation relating the business cycle (NC Ind) to inflation (IMFL) and unexpected inflation yields the following results. Both inflation and unexpected inflation yield results consistent with the theory. Again, however, the DW statistic indicates autoregression in the residuals of the equation. Given that inflation is measured here as year-on-year changes in the consumer price index, such an indication is perhaps understandable. Any unexpected movement in the inflation rate will affect the index and its rate of change for 12 months.

Dependent Variable is NCIND
Smple 1976.01 - 1986.12

Variable	Coefficient	Std. Error	T-Stat	1-Tail Sig
C	64,067769	4,9428122	12,961805	0,000
INFL	2,2614783	0,3604134	6,2746781	0,000
INFU	-4,6827281	0,9551437	-4,9026426	0,000

R-squared	0,259726	Mean of dependent var	94,59849
Adjusted R-squared	0,248249	S.D. of dependent var	10,92109
S.E. of regression	9,468974	Sum of squared resid	11566,33
Durbin-Watson stat	0,136374	F-Statistic	22,62995
Log likelihood	-482,5213		

IIID (1)

V. Policy Responses and Conclusions

The supply-side shocks associated with political instability are clearly beyond the control of the fiscal and monetary policy authorities. Such supply-side shocks may, nevertheless, justify a policy response. If prices are rising because of a supply-side shock, any attempt to offset higher prices with reductions in aggregate demand would, at least temporarily, result in further declines in output. That is, both the aggregate supply and demand curves would be shifting to the left.

A more appropriate policy response to a real exchange rate shock might be to counteract supply-side shocks with higher rather than lower levels of aggregate demand. Such a response would imply higher rather than lower levels of both prices and output. In Fig. , the AD curve would be made to shift to the right, indicating that increases in aggregate demand were being

encouraged to offset the impact of the supply-side shock in output at the expense of a higher level of prices. However, to bring our discussion full circle, if the increase in aggregate demand did occur to offset the supply-side shock, prices would stabilise themselves at the new higher level, and the inflation rate, measured as the year-on-year price increase, would fall again when twelve months had elapsed.

There would, however, be no guarantee that the government would be able to encourage just the right amount of extra demand through monetary and fiscal policy actions. Consumption or investment spending by the private sector would have to be accurately predicted for any fine tuning of the economy to succeed.

Rational expectations vitiates the case for discretionary fiscal and monetary policy. In general, rationality implies that markets will clear rationally of their own accord. Rational use of information, including information about the policy actions of the fiscal and monetary authorities, implies that such actions will be anticipated and therefore will not have real effects. Only unexpected actions can have real effects. However, if the system has an automatic tendency to full employment, unexpected actions by government may only serve to make the economic system less certain and less efficient than it might be, if government behaved predictably.

An argument for rules that would bind the authorities to act predictably follow from any acceptance of rationality and rational expectations. Older Keynesians argued that any tendency to full employment simply would take too long. Prices and wages, they argued, were too inflexible and therefore discretion for the authorities to reinforce any rational movements towards full employment was required. Older Keynesians did not take account of the possibility of evasive action by economic agents in the form of higher prices, interest rates, imports or exports, estgablished in advance of the intended stimulation. Modern Keynesians tend to accept the logic of rational expectations. However, they base their case for discretion in the assumption of lagged responses to policy reactions. These lags, that is the inability of prices and wages to adjust quickly enough to the predicted impact of monetary or fiscal policy, have become a large part of the argument for discretion in fiscal and monetary management.

Rules can take the form of a money supply rule that would automatically match the expected growth in demand for money with increases in supply. If extra supply simply matched extra demand, there could be no excess supplies of money and no demand-led inflation.

For this purpose, the demand for money would have to be predicted accurately. Demand for money to hold would depend upon growth in income and changes in tastes for different financial assets and also changes in the technology of effecting transactions. Any discretionary money supply policies would also have to predict demands for money, in order to estimate the impact of a change in

the supply of money. The stability of the demand for money, i.e. its predictability, is essential to justify either rules for or discretion over money supply growth rates. On the assumption that the demand for money is predictable, the successful application of a money supply growth rate would eliminate any inflation that emanates from excess surplus of money.

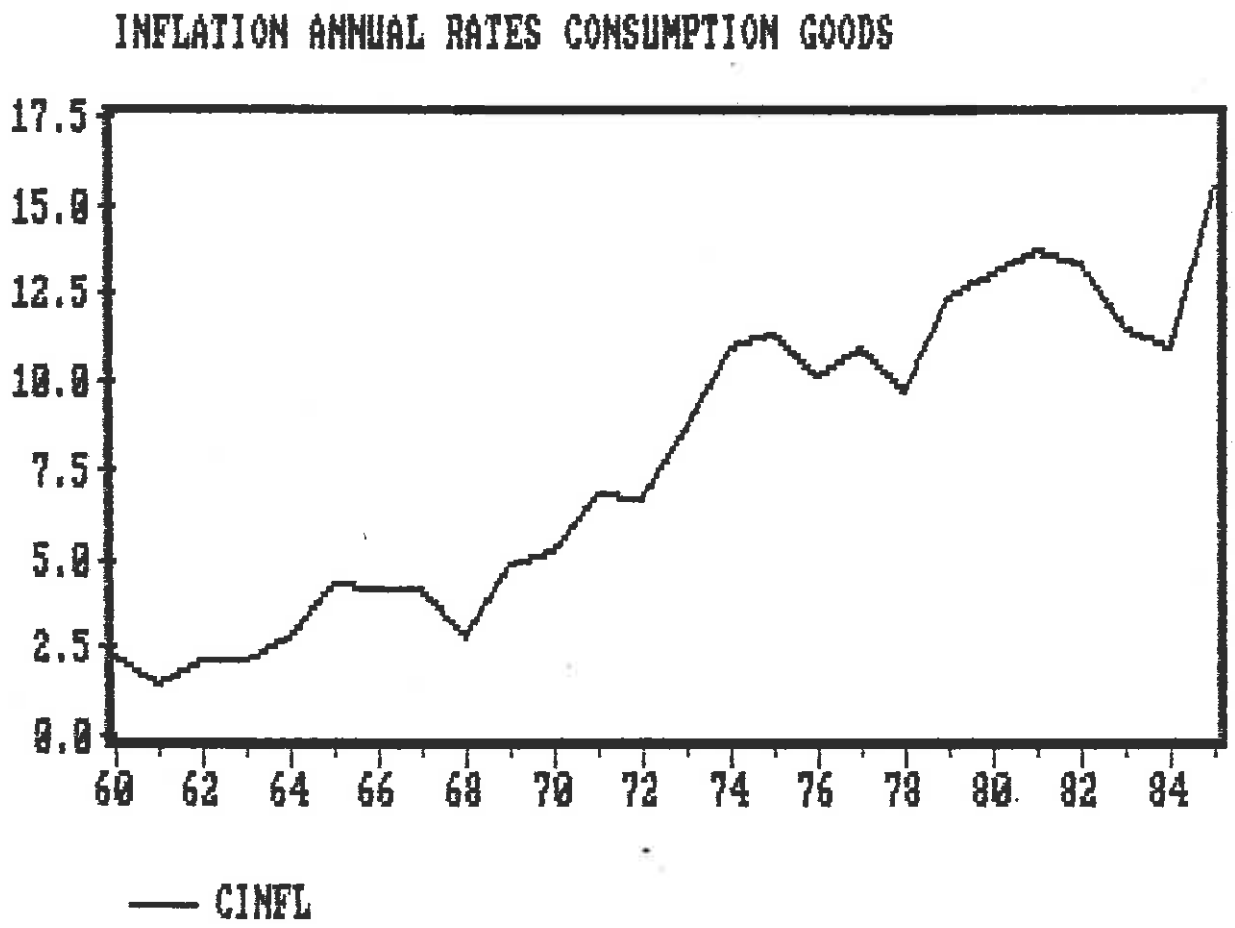
Another rule that might be applied would be rules for government spending and revenue collecting. It would be possible to rule that government spending did not exceed a predetermined proportion of expected gross domestic product (GDP). In order to avoid such a government expenditure rule becoming pro-cyclical, the expected level of GDP which established the limit to government spending could be a full employment GDP. Similarly, tax revenues and tax rates could be estimated according to full employment levels of activity. In this way, government spending and tax rates would be set independently of the state of the economy and the government's extra borrowing requirements would automatically rise and fall counter-cyclically. The government might plan to balance its budget with revenues over the business cycle or plan on average to borrow more each year. The equivalent of, say, a certain percentage, e.g. 3% of GDP.

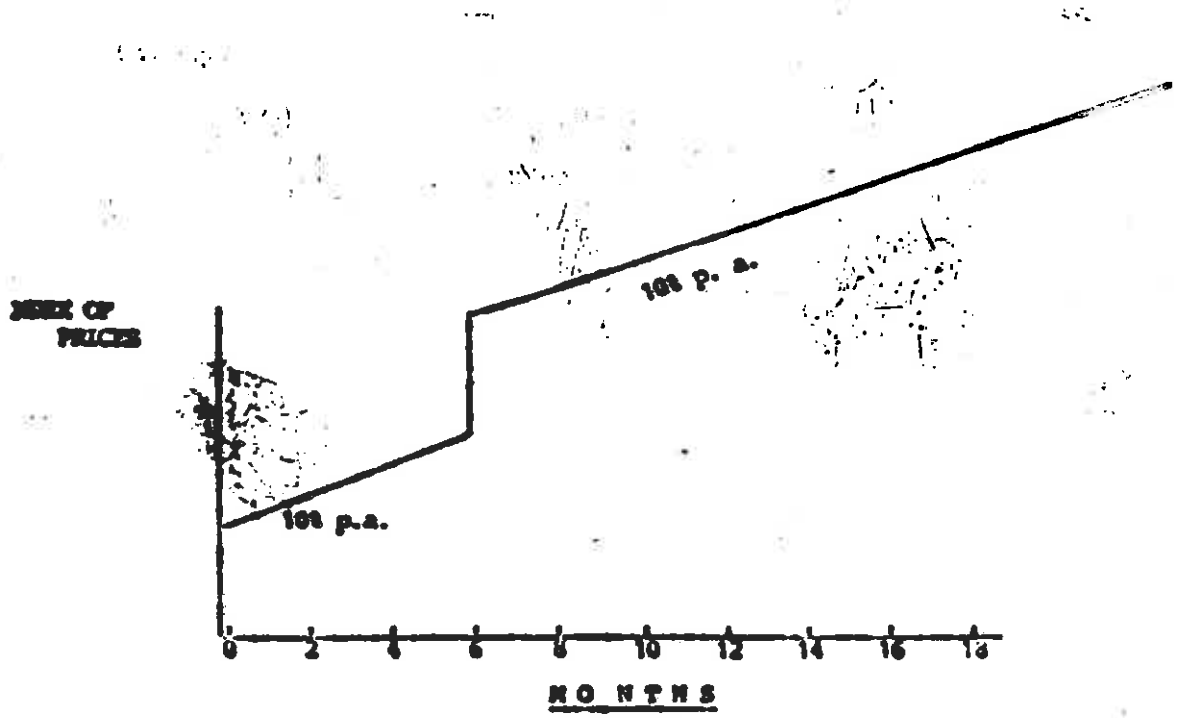
In the absence of supply-side shocks, such rules might produce a high level of output and price stability. Supply-side shocks, however, would still disturb economic tranquillity. If supply-side shocks of the kind indicated previously were to drive up prices, there would clearly be no justification for a more restrictive monetary and fiscal policy stance. This would have the effect of adding a negative demand-side shock to a supply-side shock. Using Fig. such effects would be illustrated by a leftward shift in both the aggregate supply and demand curves. If the decrease in demand were unexpected, coupled with an unexpected decline in supply, output and prices would be temporarily lower.

The case for increasing demand in response to a supply-side shock is perhaps a stronger one than the general case for discretionary policy. If the magnitude of the shock on prices could be accurately estimated, there would be a strong case for attempting to stabilise output levels by accommodating the higher supply-side induced prices with higher than expected levels of demand. In this way, both inflation and output would be temporarily higher. However, the practical difficulties of knowing precisely the magnitude of the shock and estimating private levels of demand, given monetary and fiscal policy stimulation, do not encourage any more confidence in successful fine-tuning when the economy has been subject to a supply-side shock, than in more normal circumstances.

Figures 1-18

FIGURE 1:


INFLATION ANNUAL RATES CONSUMPTION GOODS
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
60
62
64
66
68
70
72
74
76
78
80
82
84
CINFL


INDEX OF PRICES
10% p.a.
10% p. a.
0
2
4
6
8
10
12
14
16
18
MONTHS

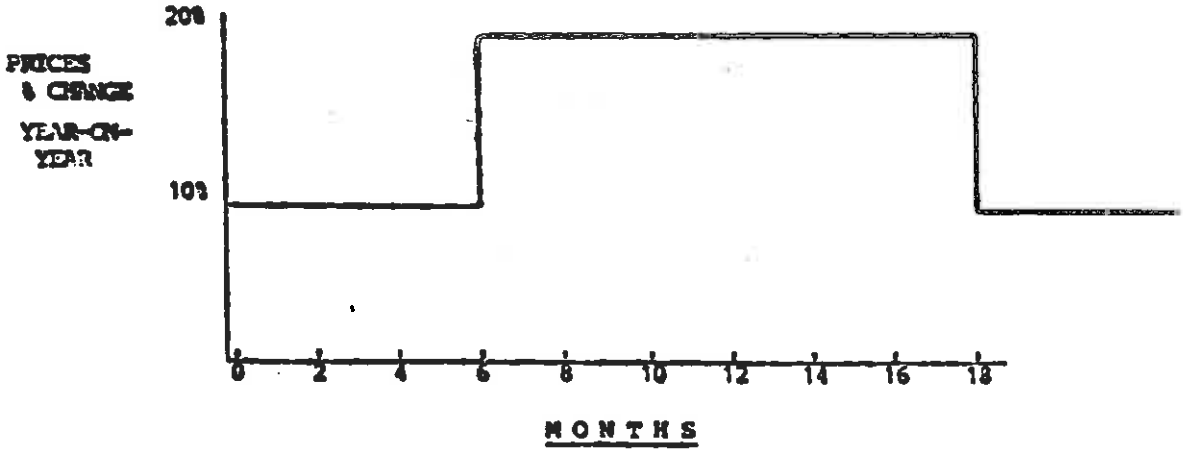
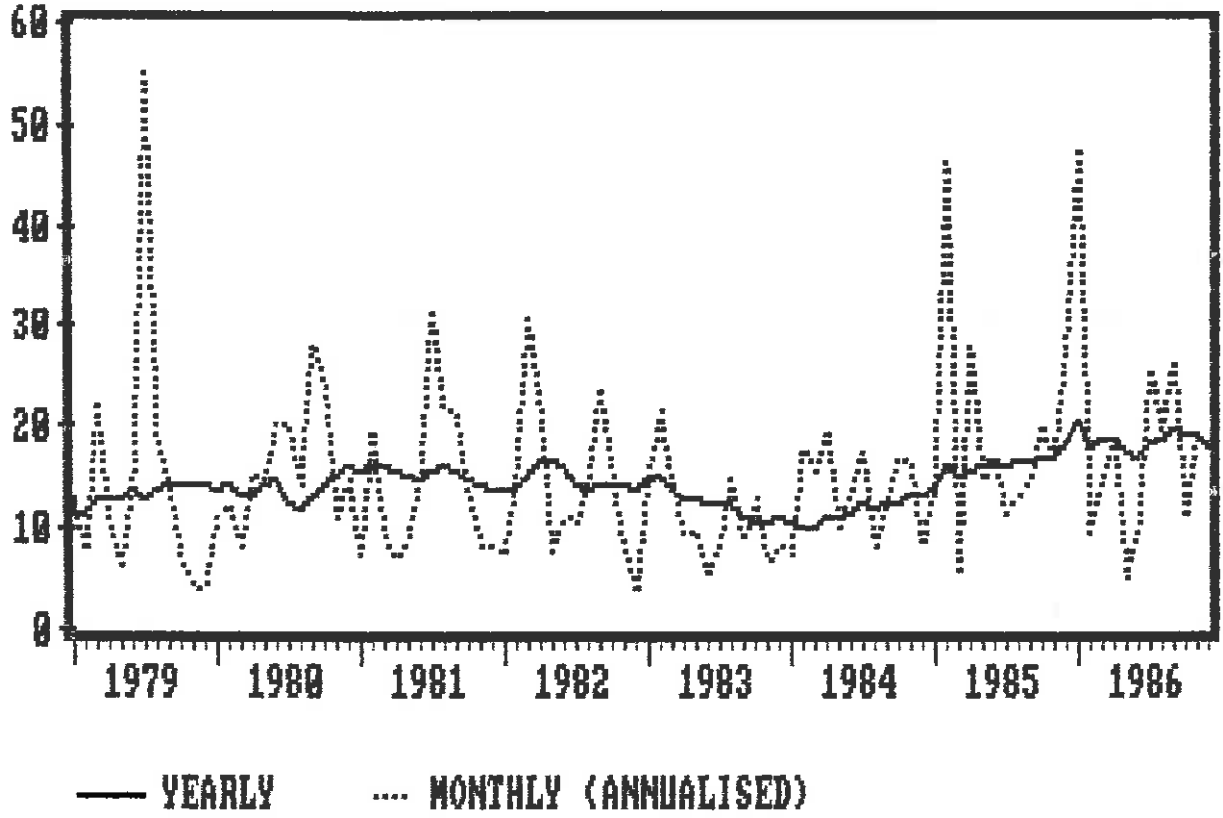
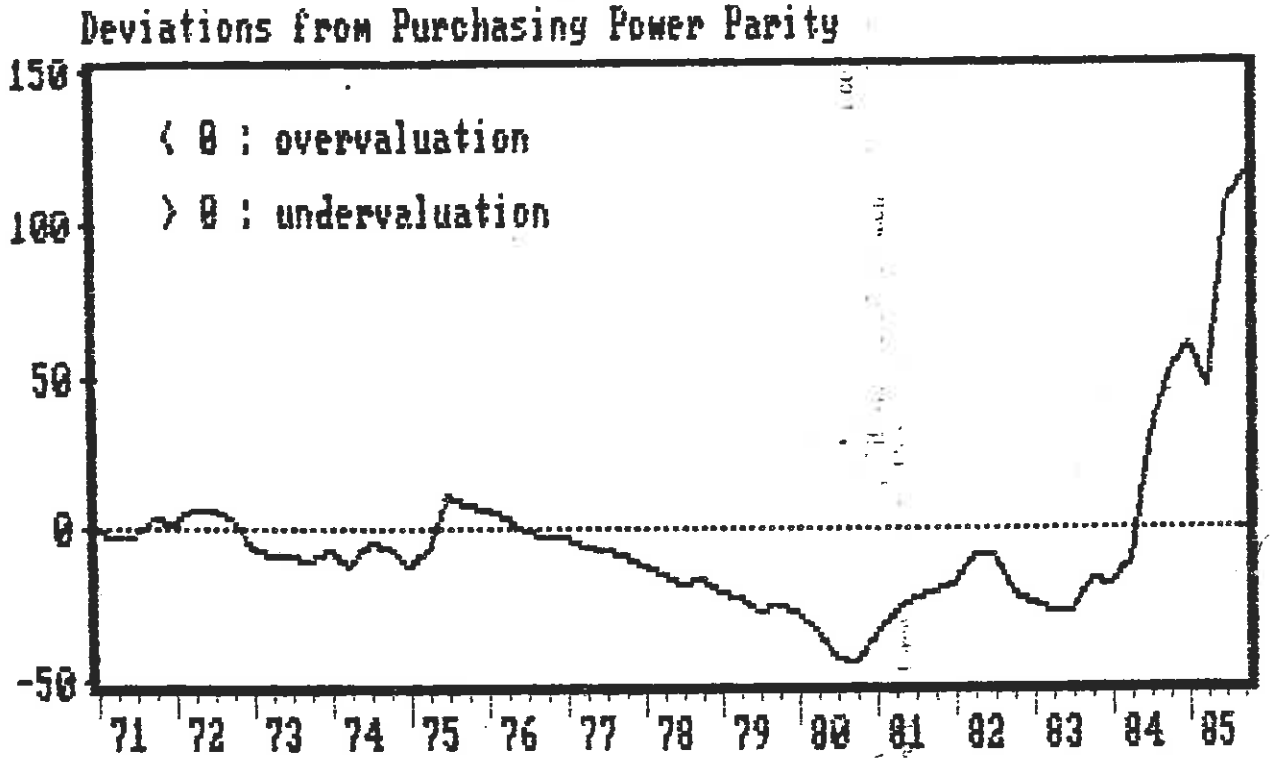

PRICES % CHANGE YEAR-ON-YEAR
20%
10%
0
2
4
6
8
10
12
14
16
18
MONTHS

FIGURE 2:

FIGURE 3: INFLATION RATES



MOVEMENTS IN THE RAND/US DOLLAR REAL EXCHANGE RATE (1975 = 100)*



*Using wholesale prices

FIGURE 4:

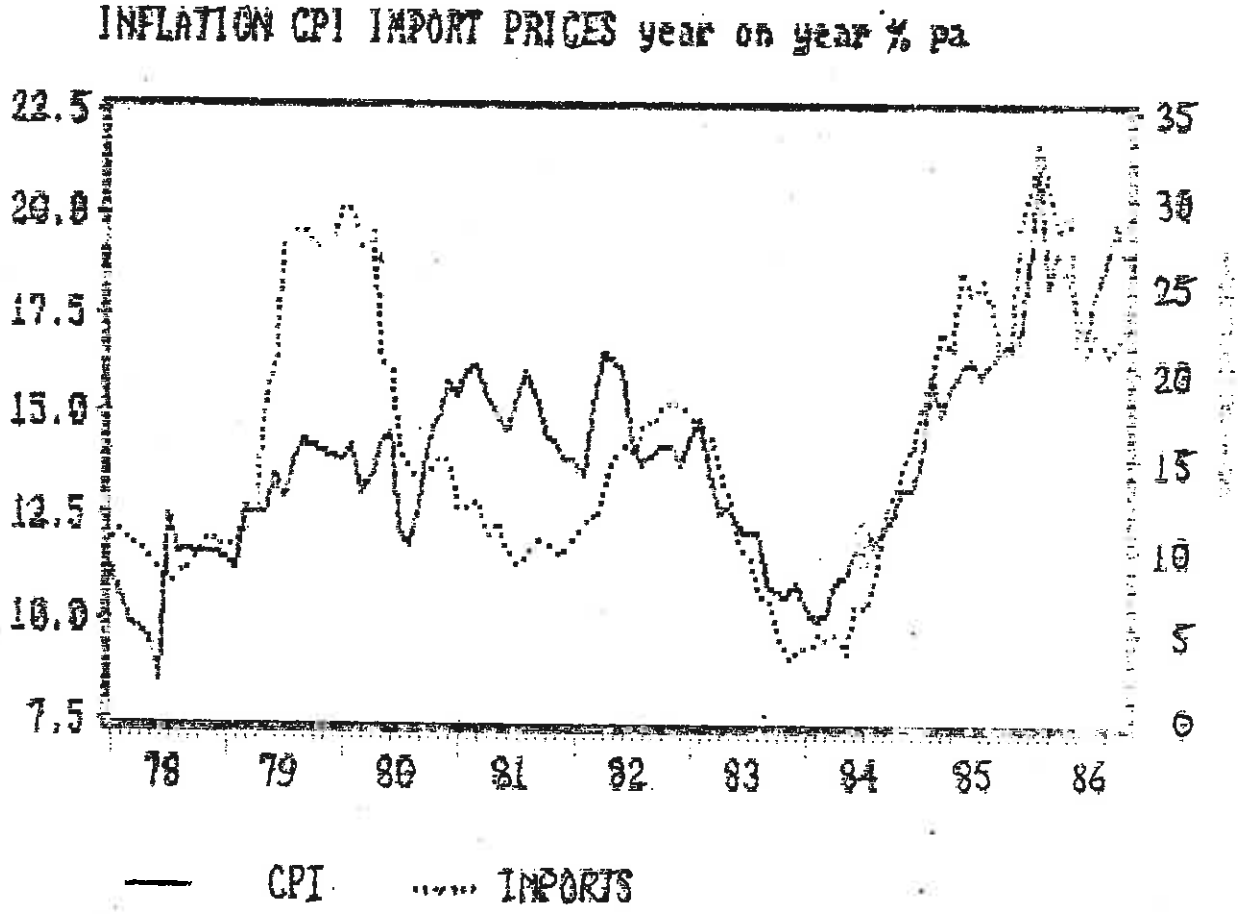

INFLATION CPI IMPORT PRICES year on year % pa
22.5
20.0
17.5
15.0
12.5
10.0
7.5
35
30
25
20
15
10
5
0
78
79
80
81
82
83
84
85
86
CPI
IMPORTS

FIGURE 5:

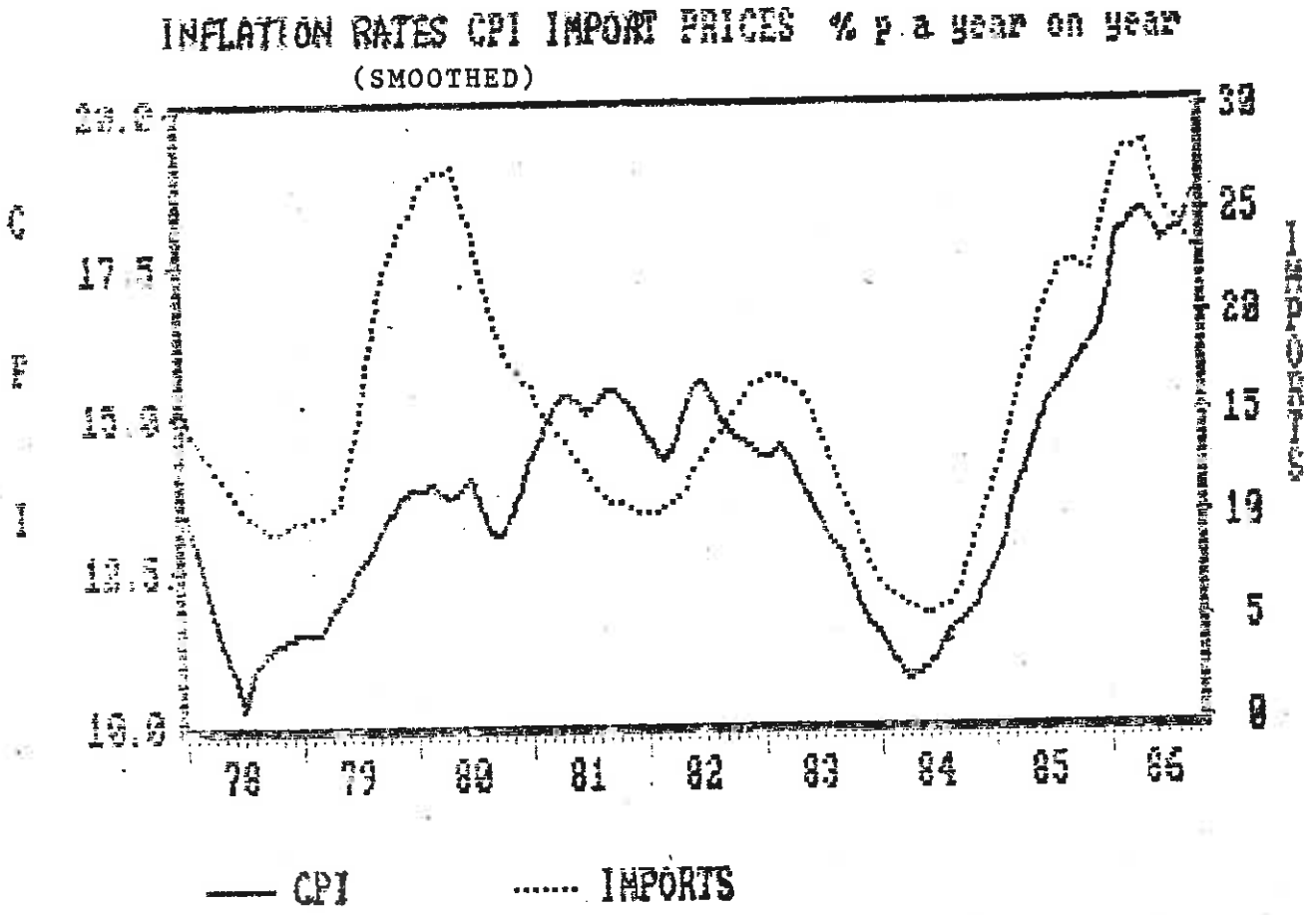
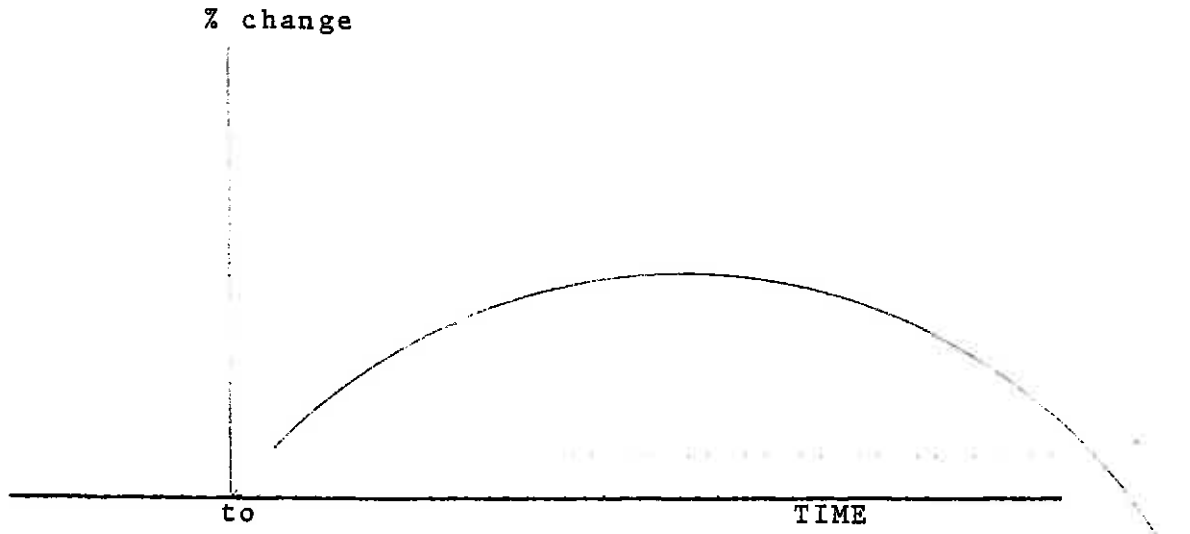

INFLATION RATES CPI IMPORT PRICES % p.a year on year
(SMOOTHED)
30
25
20
15
10
5
0
78
79
80
81
82
83
84
85
86
CPI
IMPORTS

FIGURE 6:

RAND / DOLLAR EXCHANGE RATE



MONEY SUPPLY GROWTH: % CHANGE YEAR-ON-YEAR

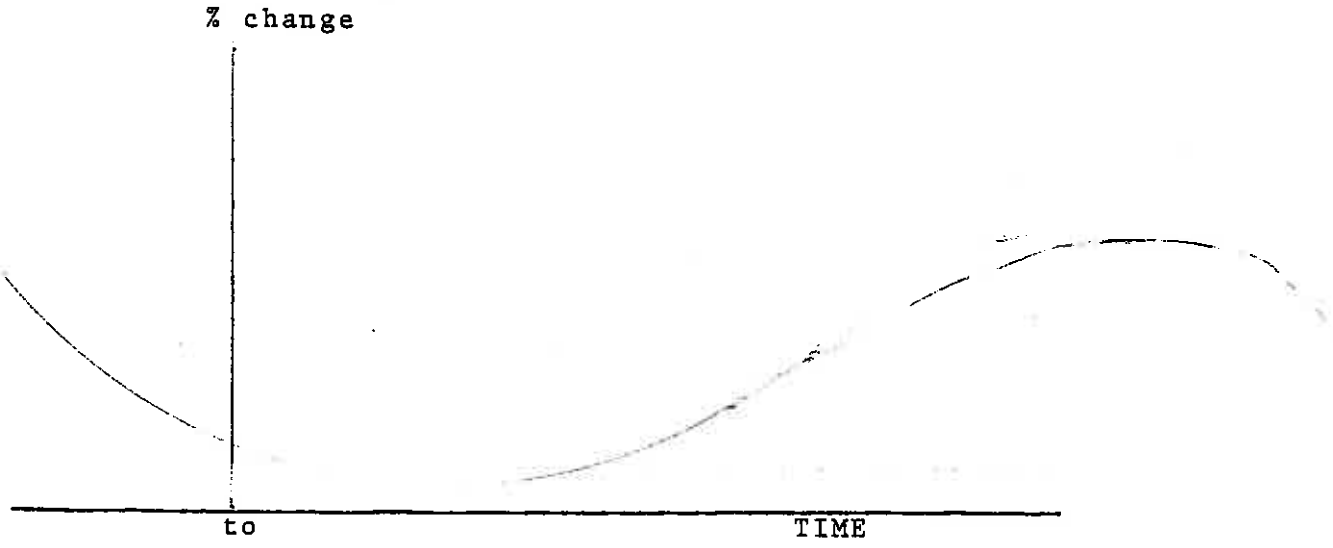


FIGURE 7:

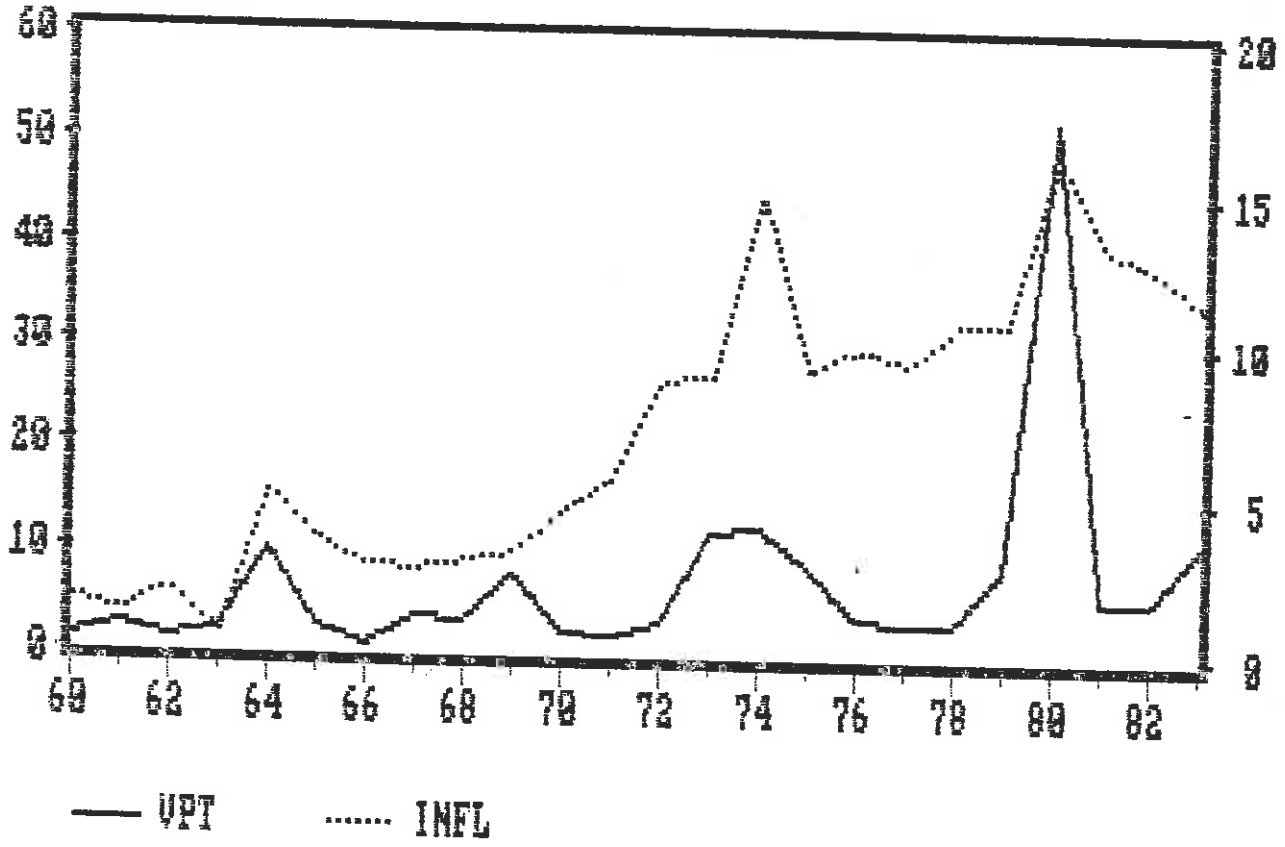

60
50
40
30
20
10
0
20
15
10
5
0
60
62
64
66
68
70
72
74
76
78
80
82
VPT
INFL

FIGURE 8:

FIGURE 9: INFLATION & SHORT TERM INTEREST RATES

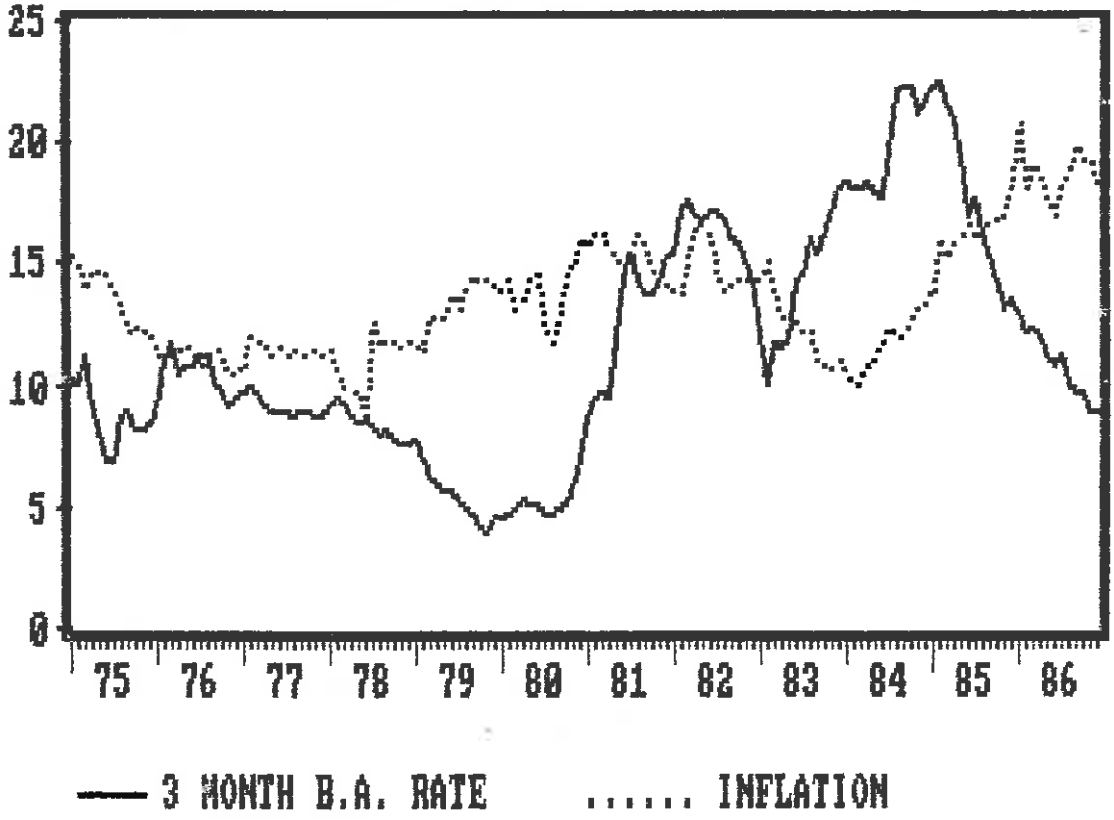


FIGURE 10: INFLATION & LONG TERM INTEREST RATES

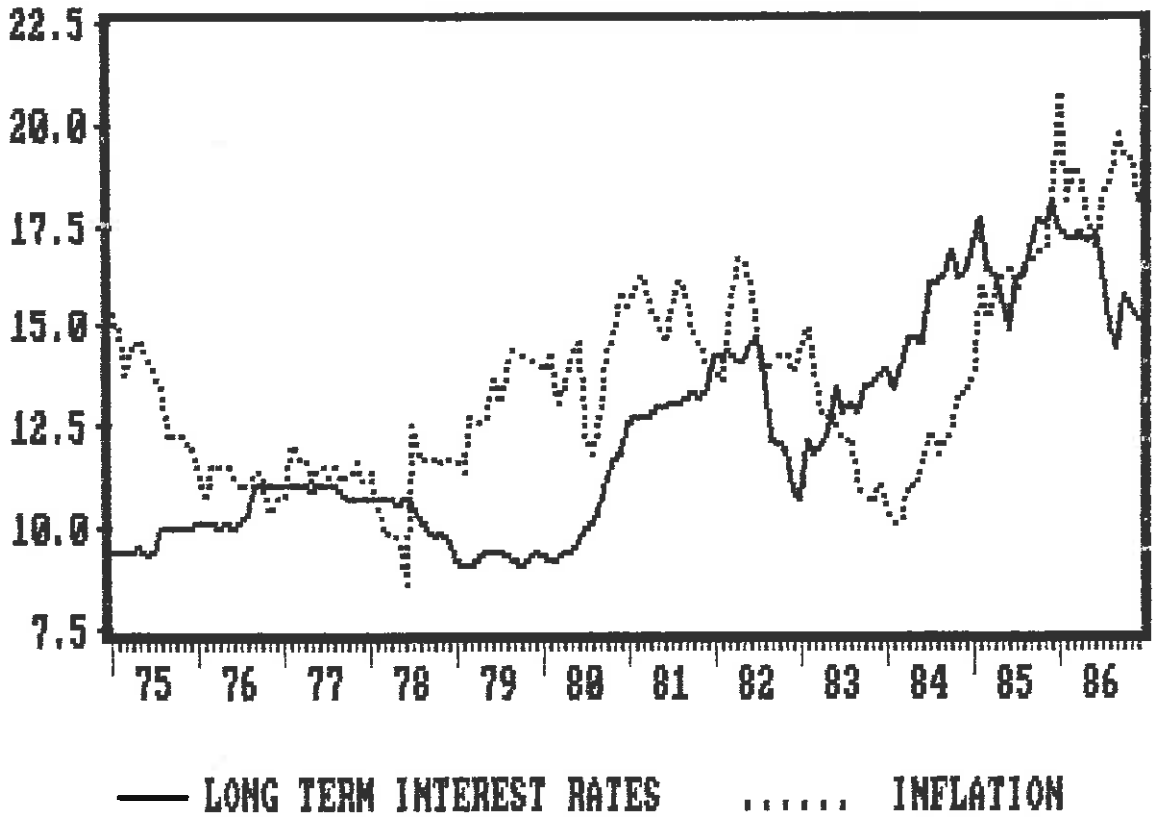


FIGURE 11: REAL INTEREST RATES: SHORT TERM & LONG TERM

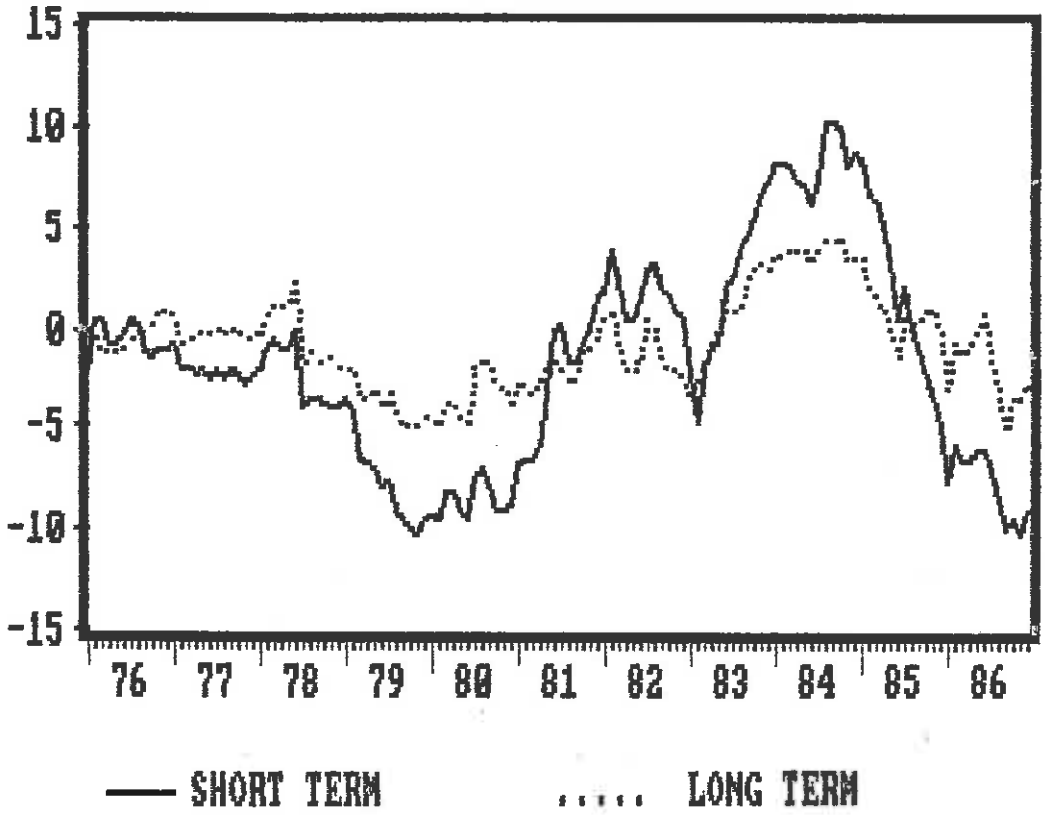


FIGURE 12: BUSINESS CYCLE & REAL INTEREST RATES (SHORT TERM)

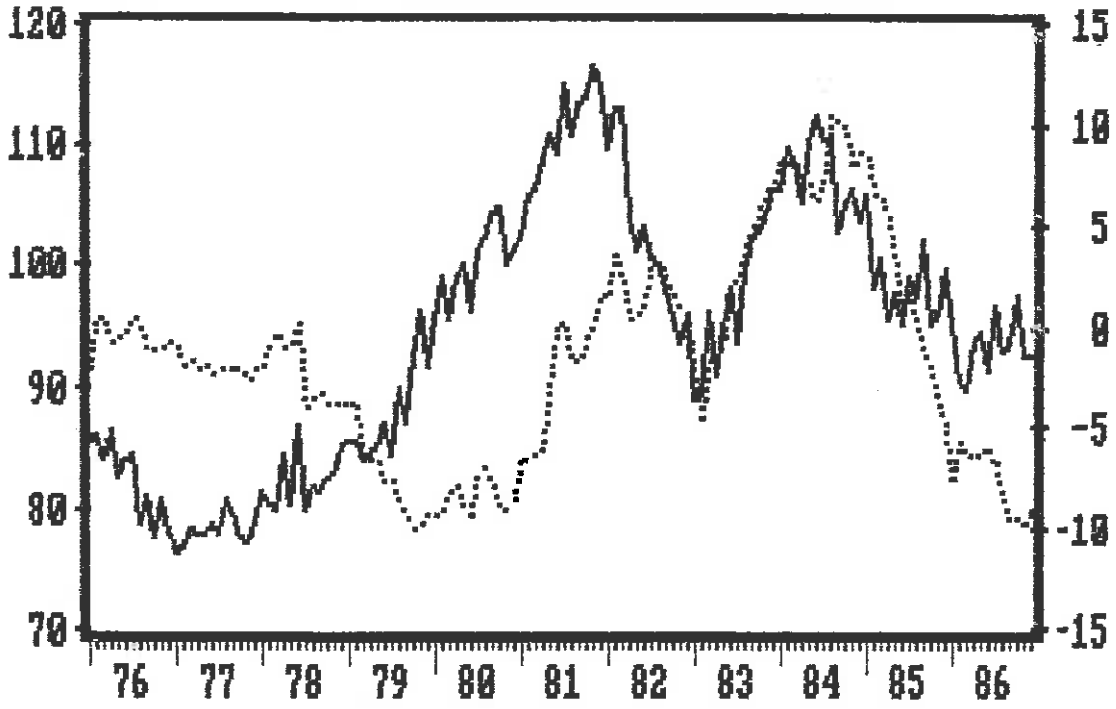


FIGURE 13: BUSINESS CYCLE & LONG TERM INTEREST RATES

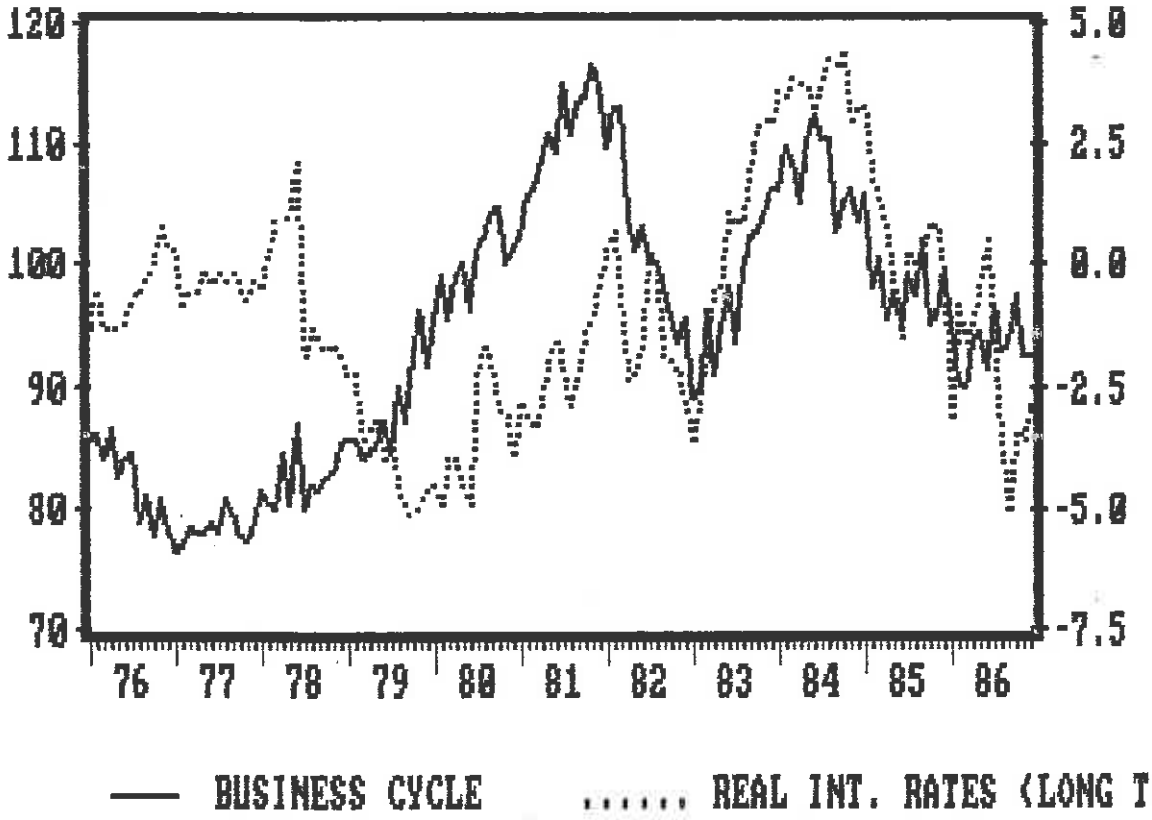
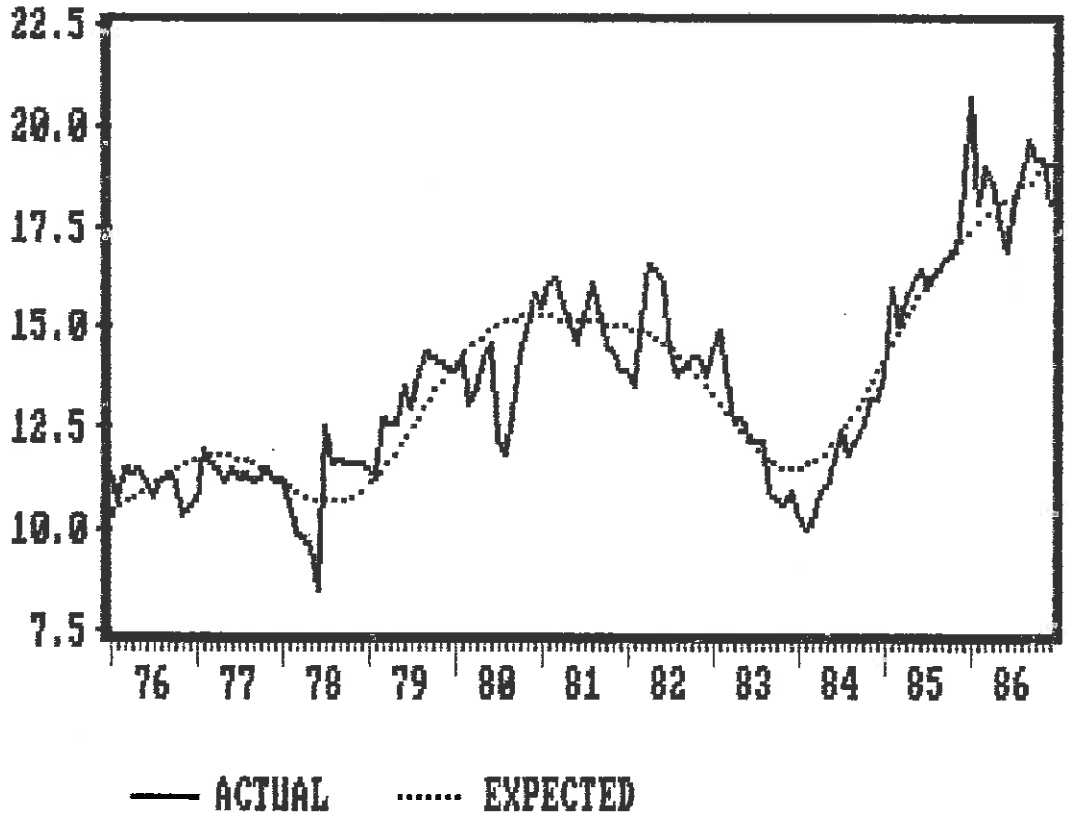


FIG 14: INFLATION & EXPECTED INFLATION



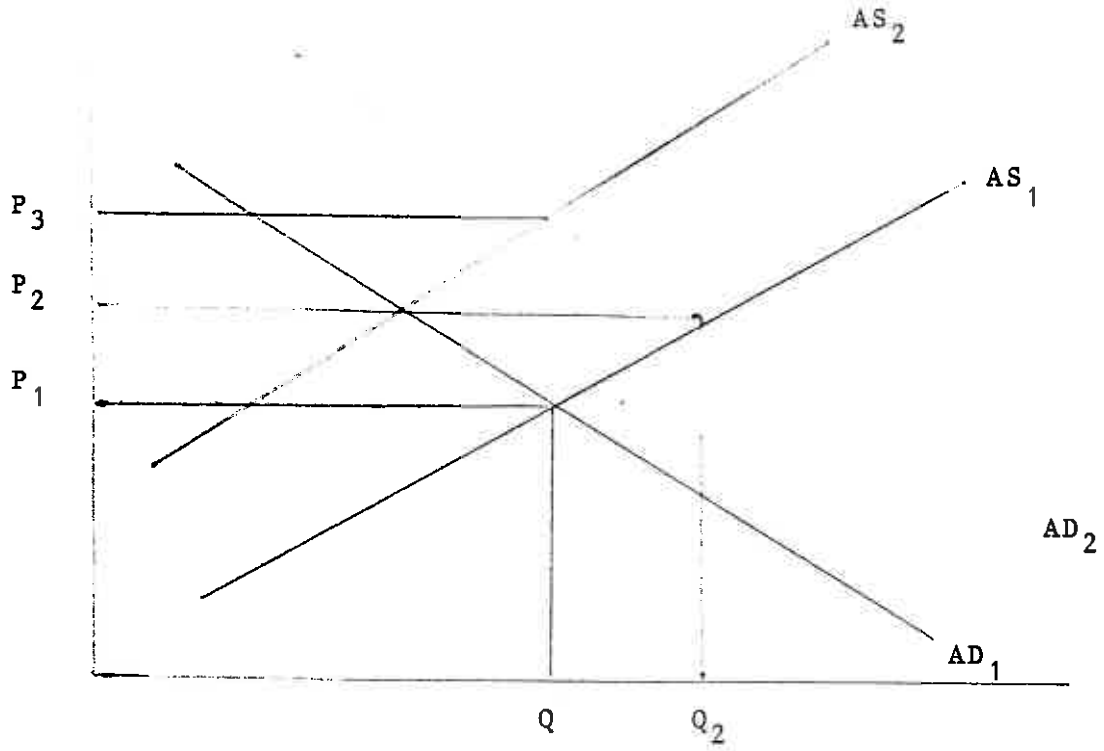


FIGURE 15:

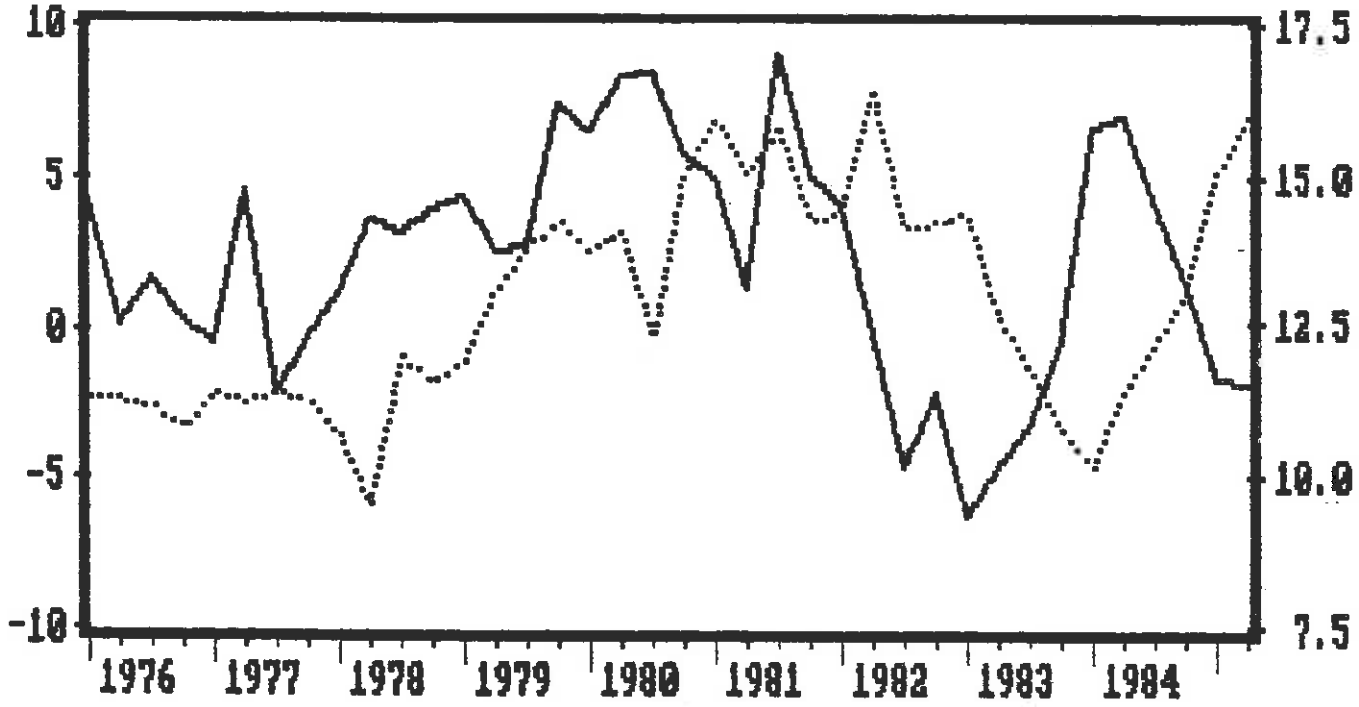

10
5
0
-5
-10
17.5
15.0
12.5
10.0
7.5
1976
1977
1978
1979
1980
1981
1982
1983
1984
RYPER
IMFL
REAL GDP
% CHANGE
INFLATION

FIGURE 16:

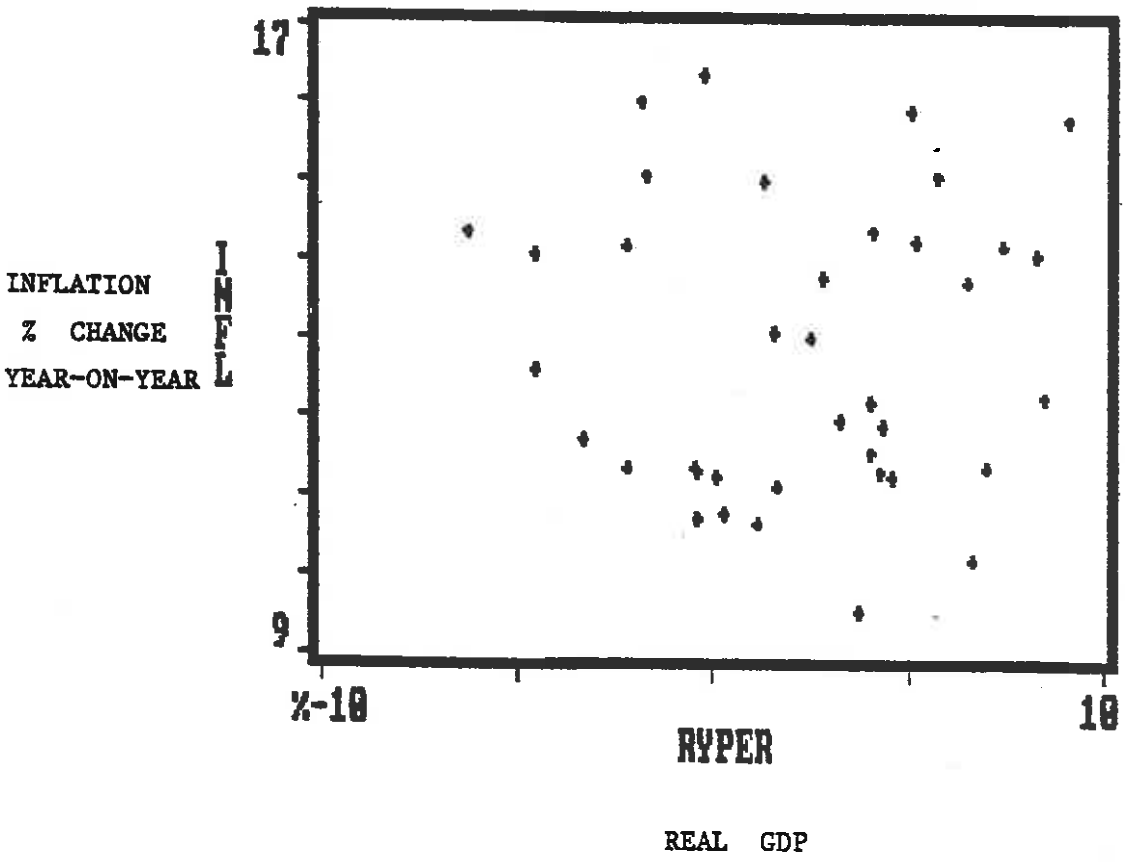


FIGURE 17:

FIGURE 18: BUSINESS CYCLE AND INFLATION

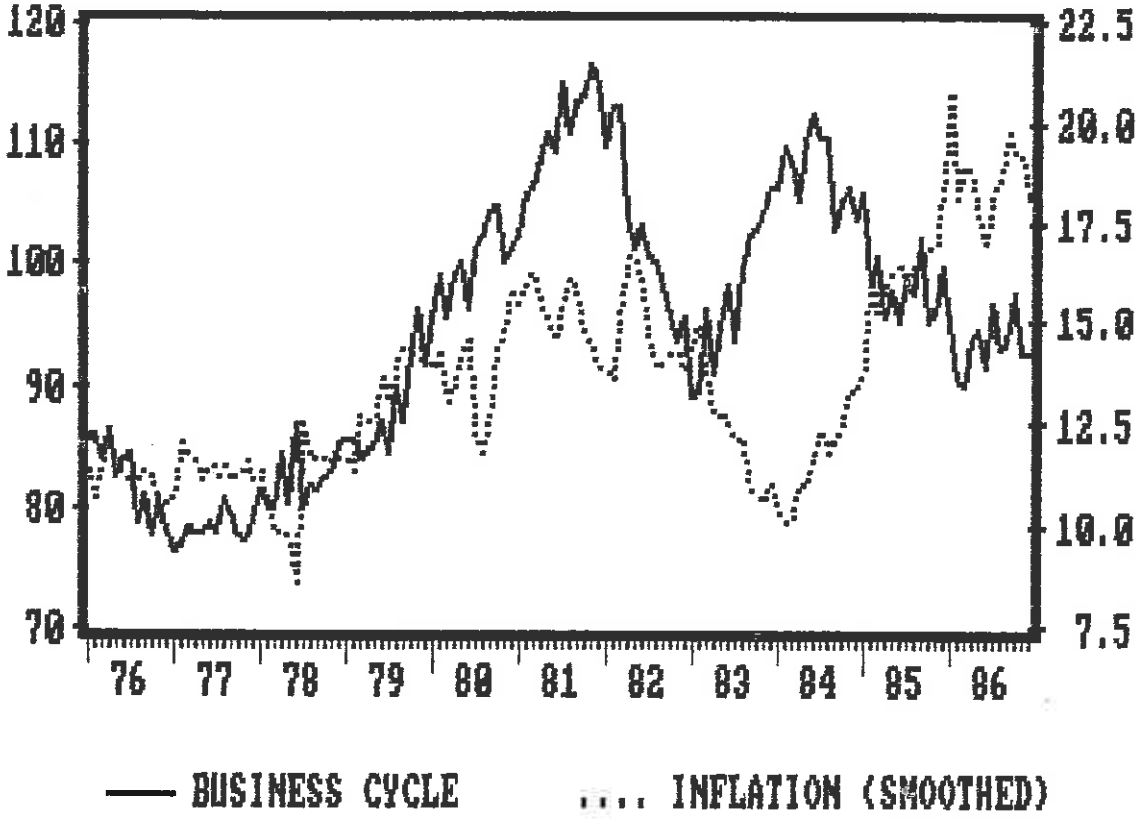
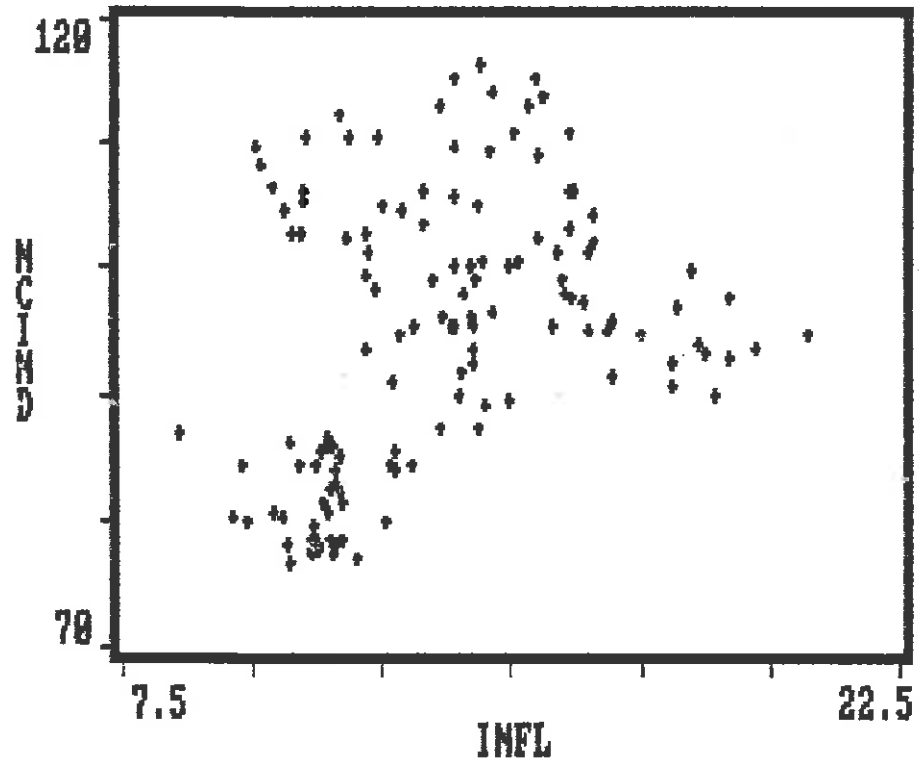


FIGURE 19: THE BUSINESS CYCLE(NCIND) & INFLATION(INFL)
76.01-86.12



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