A COINTEGRATION ANALYSIS OF THE DETERMINANTS OF INFLATION IN SWAZILAND

A paper prepared by

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SECTION 1

INTRODUCTION

1.1 OVERVIEW

The paper takes as a starting point the widely held assumption that South African prices are the dominant factor determining the inflation in Swaziland, even though there does not seem to be any major study supporting this assertion. However, despite this lack of empirical support the link is intuitively obvious given that Swaziland's currency, the Lilangeni, is linked directly to the South African Rand at parity. Moreover, the extremely strong trade links between the two countries, especially Swaziland's dependence on imports from South Africa, and the fact that South African retailers operate in Swaziland with common pricing policies, reinforces the view that inflation rates in the two countries must be closely linked.[1] It is estimated that approximately 50% of Swaziland's exports are destined to, and more than 80% of imports originate from, South Africa.

The arrangement under the auspices of the multilateral monetary area has rendered Swaziland's control of its money supply ineffective, as the Rand has continued to freely circulate side by side with the Lilangeni, and has also meant that interest rates are determined in a unified market. In addition, large fluctuations have been observed in the money supply as a large part of government revenues comes from customs union receipts, which enters the financial system at specific times of the year. The above observation leads to the supposition that there is no direct linkage not only between domestic interest rates and inflation, but also between the domestic money supply and inflation.

Another generally held view is that changes in the external value of the Rand (hence the Lilangeni) have contributed in part to the acceleration of the inflation rate in Swaziland. Despite the high proportion of imports from South Africa, a large depreciation of the exchange rate increases the cost of all goods that originate outside the Common Monetary Area (CMA[2]), such as petroleum. The exchange rate link with Swaziland prices is not surprising as approximately 20% of Swaziland's imports are directly from the rest of the world. This also means that foreign prices paid for inputs of goods and services from abroad and consumed in the process of production must be converted into domestic prices through the exchange rate.

Increases in nominal wages are another factor expected to have contributed positively to the rise in the price level in Swaziland over the period under review. Trade unions in Swaziland play a significant role in the wage negotiation process. Since wages constitute a very large fraction of national income and organised trade unions are very strong, a positive relationship is expected to exist between nominal wages and inflation. This is certainly plausible in the case of Swaziland where trade unions would sometimes

[1] South African retailers often produce advertising leaflets which gives a price in figures, for example the price of a sofa is given as 3,000. This can be distributed in either South Africa or Swaziland where the price is Rand.
[2] CMA members are currently Lesotho, Namibia, South Africa and Swaziland.

negotiate wage increases and benefits for their members without fully taking into account the economic and financial conditions affecting business at the time of wage negotiations. It can also be deduced from Graph 6 that increases in nominal wages were higher than the inflation rate in most years, and thus potentially contributed to inflationary pressures in the economy.

1.2 STUDY OBJECTIVES

The objectives of this paper include the following:

- To identify the relevant variables influencing inflation in Swaziland, using both theoretical and empirical frameworks;
- To ascertain which explanatory variables are significant determinants of Swaziland inflation.
- To ascertain the stability of the inflation function in Swaziland over the sample period; and
- To investigate the projected path of the inflation rate using available historical data.

1.3 METHODOLOGY

The period covered by the study is 1974-2000. Explanatory variables include real income, nominal money supply, nominal interest rate, nominal exchange rates, nominal wages, and South African consumer prices. These variables are typical of those applied in other empirical analysis of inflation in the Sub-Saharan African (SSA) countries. Swaziland prices are represented by the consumer price index, which is used, as the dependent variable in the estimation.

The study employs the econometric technique of cointegration and error correction modelling (ECM) in order to estimate a more specific relationship between inflation and its determinants. The ECM, as a tool of analysis, overcomes the problems of spurious regression through the use of appropriate differenced variables in order to determine the short-term adjustments in the model. Cointegration analysis on the other hand provides the potential information about long term equilibrium relationship of the model. Since time series generally exhibit a non-stationary pattern in their levels, unit root testing as a pre-testing device for cointegration will be carried out in order to determine the degree of stationarity. Structural stability testing procedure will also be carried out in order to determine the behaviour of the inflation function in Swaziland.

The study proceeds as follows. Section 2 provides the literature review, which discusses in detail the theoretical formulations of inflation as well as empirical findings in the context of African economies. Section 3 of this paper reviews the historical background of inflation in Swaziland and data trends. This is followed in section 4 by the modelling procedure on inflation in Swaziland beginning with the model specification and data analysis and ending with modelling strategy. Section 5 provides detailed analysis of the regression results. The paper ends in section 6 with some concluding remarks.

SECTION 2

LITERATURE REVIEW

2.1 THEORETICAL CONSIDERATIONS

2.1.1 The Purchasing Power Parity (PPP) Theory

Underlying the PPP theory is the assumption that all goods are tradable and are physically identical. This theory is used to explain changes in exchange rates in terms of differentials in inflation between countries and it suggests that in a common currency arrangement, the rate of inflation of the dominant country should influence the inflation rates of smaller countries. In other words, it assumes that the prices of the trading countries should be the same when expressed in the common currency, with the differential being accounted for by tariffs and transport costs. In a fixed exchange rate regime, PPP relates the price level in one country to that of another via the exchange rate, and can be expressed in terms of rate of changes as:

$$\dot{pd} = \dot{e} + \dot{pf}$$

(where, pd=domestic price level, e = nominal exchange rate and pf = foreign price level).

When investigating the validity of PPP in Swaziland, the expectation is that South African inflation (as a proxy for foreign inflation), and changes in the nominal exchange rate (reflecting price changes in imports from outside South Africa), would have an immediate "pass through" effect to Swaziland prices. This will be examined in detail in Section 4.

2.1.2 Cost-Push Theory of Inflation

Under the cost-push theory, prices rise due to increasing cost of the factors of production. This theory maintains that prices of goods and services rise because wages are pushed up by trade unions' bargaining power, or by the pricing policies of oligopolistic and monopolistic firms with market power.

Labour market rigidities and changes in the cost of labour are considered a major cause of inflation in developed countries, although not considered a major cause of inflation in most developing countries. In their studies of inflation in Africa, Chhibber and Shafik (1990) argued that "wage push inflation is rare in Africa", largely because wages constitute only a small part of national income. However, the Southern African Customs Union (SACU[3]) member countries are structurally different from most other countries in the continent. Not only there is a higher level of formal sector employment, but also there is a strong history and tradition of organised labour in Southern Africa, including Swaziland. The strong link between growth in wages and inflation in Swaziland depicted in Graph 6 indicates that wages could have an

[3] SACU members are currently Botswana, Lesotho, Namibia, South Africa and Swaziland.

important cost-push element in Swaziland, and that developments in the labour market are an important factor determining the overall level of inflation in the country.

Another potential cost-push cause of inflation that could be looked at in the Swaziland context is a rise in imported raw material prices and other goods and services costs caused by external shocks (leading to increased foreign prices of imports) or domestic currency depreciation. In the case of rising import prices and exchange rate depreciation, the major justification for including these variables is that they determine the export competitiveness of the economy. However, in an open and import dependent economy, where domestic inflation is largely determined by foreign prices and nominal exchange rate depreciation, the initial improvement of export competitiveness resulting from depreciation may eventually be offset by the consequent increase in prices.

2.1.3 Demand-Pull Theory

This school of thought postulates that inflationary pressures arise because of excess demand for goods and services resulting from expansionary monetary and fiscal policies. According to the demand-pull theory, it is essential to prescribe the correct anti-inflationary policy despite the ongoing debate as to whether inflation is a consequence of the upward push of costs, or upward pull of demand. The importance of the debate stemmed largely from the difference between the recommendations for anti-inflationary policy to which the two views of the cause of inflation lead. The demand-pull explanation recommends restrictive monetary and fiscal policies whilst the cost-push explanation favours policies directed at the process of price formation and wage determination.

2.1.4 The Quantity Theory of Money and Inflation

The debate between the cost-push and demand-pull theories of inflation led to the revival of the monetary explanation of inflation, a theory developed after World War I. Proponents of the Quantity Theory of Money agree with Milton Friedman that inflation is 'always and everywhere a monetary phenomenon' and is produced by a more rapid increase in the quantity of money than output. In other words, cost increases may occur, but they are only inflationary by allowing an increase in the money supply. Thus, a monetarist model would typically include rates of change in the money supply as having a positive correlation with inflation and growth in real income as having a negative correlation.

2.1.5 Keynesian Theory of Inflation

The initial Keynesian explanation of inflation evolved from Keynes' analysis of effective demand. It is based on the Keynesian saving-investment equilibrium condition that provides a direct approach to the question of inflation in terms of the demand for and the supply of goods. According to this theory, inflation

occurs when demand exceeds the potential output of the economy. In Keynes' analysis, the difference between aggregate demand and potential level of output at full employment is termed the inflationary gap.

The second Keynesian approach to price determination emphasised the importance of wage and salary costs in influencing the price level. This theory is therefore another version of the demand-pull and cost-push theories.

2.1.6 Inflation and Expectations

Expectations of future inflation are another important determinant of inflation. Two categories of expectations can be outlined in this regard, namely adaptive and rational expectations. According to rational expectations, both households and firms form their expectations of inflation based on recently observed inflation and this may affect the general price level. Proponents of the theory maintain that prices are rising because people expect them to rise and they expect them to rise because they have seen them rising. Rational expectations theory of inflation, on the other hand, assume that people use all the available information including that about current policies to forecast the future. The basic notion of the advocates of this theory is that if policymakers are credibly committed to reducing inflation, rational people will understand the commitment and quickly lower their expectation of inflation.

2.1.7 Recent Theories of Inflation

Literature on recent theories of inflation that have emerged in the past few years emphasised the role played by political stability, policy credibility and the reputation of the government and the political cycles in determining or explaining inflation. According to Selialia (1995), this emerging literature on inflation has come to be known as the political economy approach to macroeconomic policy. These recent theories of inflation have shifted attention away from traditional direct economic causes of inflation, such as money creation, towards political and institutional determinants of inflationary pressures. However, these theories have been criticised as they are theoretical and put emphasis almost exclusively on industrial countries. Since these factors are unquantifiable, they will not be considered for estimation purposes in this study.

2.1.8 Structural Factors

Structural factors are also believed to influence the rate of inflation in Swaziland. Examples of these are the weather conditions, and protective industrial and trading policies of the government. It can be argued that government protects infant industries from intra currency area trade and regulates domestic marketing of agricultural products by quantitative import restrictions through import permits or licensing. These policies are believed to have created monopolistic and oligopolistic structures of firms, which usually set their

prices well above border prices. The general feeling is that these policies may be highly inflationary as prices of some of the controlled items have risen quickly in Swaziland.

Weather conditions, crop failures or drought are some of the structural factors that are also believed to have a direct impact on the inflation rate in Swaziland given that food items carry the biggest weight in the computation of the CPI (24.5%). During good weather (rainy agricultural year), prices are in general expected to fall in the future and vice versa. For example, a rise in Swaziland's inflation rate during the year 2000 is believed to have been partially a result of the floods experienced during the first three months of 2000. Since these variables can not be easily quantified, and their impact is only significant in one-off periods, it was decided not to include these variables but to assign, where appropriate, structural dummies to account for their effects.

2.2 EMPIRICAL EVIDENCE

Several empirical studies have undertaken to identify the possible determinants of inflation in developing countries including African countries. In this section, the findings of some of the studies will be reviewed particularly those bearing some relevance to the case of Swaziland.

A study by Saini (1982) showed that the monetarist explanation of inflation does not always fully accord with the experience of the six Asian countries examined in terms of its implication for policy. The available empirical evidence may not be fully applicable to the African context for a variety of reasons, policymakers may be forced to reorient and recalibrate other aspects of policy such as those relating to central government budget policies and exchange rate setting practices. Rwegasira (1977) provided evidence to suggest that the characterisation of inflation as a monetary phenomenon is unsatisfactory in the case of Tanzania. It is probable that monetary factors, which may be shown to be statistically significant in determining the rate of inflation in Africa may be reflecting structural difficulties associated with the development process. Hence, it would be the correction of these difficulties that would eventually lead to a moderation of inflationary pressures.

Some of the studies have attempted to estimate the causes of inflation from a structuralist and monetarist perspective. Chhibber et al (1989) developed a detailed econometric model that models both monetary and structural factors of inflation in Zimbabwe. The study showed that nominal monetary growth, foreign prices, exchange and interest rates, unit labour costs and real income are determinants of inflation in the country.

Canetti and Greene (1991) used Granger and Pierce causality tests in order to investigate the role of domestic money supply on inflation in six African countries. This procedure was a complete departure from the common application of an econometric model. The model fitted reasonably well and the results

showed that growth in money supply (and the nominal exchange rate) had a significant casual influence on inflation. The findings also lent support on the issue of the exogeniety of the money supply.

Attempts to test the theoretical framework of PPP, or the law of one price, indicates that PPP does perform better for countries which are geographically close and trade linkages are high. Testing the PPP hypothesis within the context of the CMA countries of Southern Africa, Selialia (1998) found some evidence in support of the PPP hypothesis. According to the findings, about 75% of the inflation rate in Swaziland may be explained by that prevailing in South Africa. Historical data also revealed that the rate in the two countries were almost identical from 1980 till 1988. The results are not surprising given that Swaziland has strong trade links with South Africa and both are members of SACU. Swaziland's imports from, and exports to, South Africa currently stands at about 80% and 50%, respectively. Swaziland also has a fixed exchange rate mechanism with South Africa under the provisions of the CMA, and this would tend to make the "pass through" effect of foreign prices even greater.

Piers and Tsidi (1998) tested for stationarity and employed cointegration analysis in order to identify both short and long run price relationships. The study covered the 1974-88 period using quarterly data. The findings showed evidence of cointegration between the Swazi and South African inflation, money supply growth and the external value of the Rand/Lilangeni. The error correction term was significant and this term estimated the feedback in the current period from the previous time period (quarter) disequilibrium, which in that study was very small at 0.6%.

Gaomab II (1988) employed a general to specific method using an unrestricted autoregressive distributed lag model, stationarity testing, cointegration analysis and error correction modelling to distinguish clearly between short run and long run price relationships. The model incorporated a wide range of variables applicable to the Namibian situation, such as real income, broad money supply, nominal interest rate proxied by the prime lending rate), the nominal exchange rate of the Namibian Dollar against the US Dollar, and foreign prices as represented by the South African and American CPIs.

The results were a strong "pass through cointegrated relationship of 49% between South African and Namibian prices. The changes in Namibian broad money supply were also significant, with 8% influence on Namibian prices, The error correction term was –113% and highly significant, which indicated a more than 100% feedback from the previous year disequilibrium into the short run dynamic process.

The approach in this study follows closely the approach by Gaomob II (1998). There is a valid reason for following the same approach since both Swaziland and Namibia are heavily dependent on South African imports, and both countries are members of the CMA. Both are relatively open economies and are highly affected by regional and international economic developments, notably price movements in South Africa.

SECTION 3

HISTORICAL OVERVIEW OF INFLATION IN SWAZILAND AND DATA TRENDS

3.1 HISTORICAL OVERVIEW

The history of Swaziland inflation dates back to the independence era of 1968 when the country did not have any income and expenditure statistics. It was therefore not possible for the country to design the index based on known local consumption patterns. During this period an artificial index was compiled based assumed consumption patterns determined from other countries that were exhibiting similar consumption expenditure behaviour. At the beginning all estimates were made on the basis of the cost of living for low wage earning Swazis but only in the urban areas of Mbabane and Manzini. This index was subsequently known as index "B" whilst index "A" was compiled to show cost of living changes for middle and high income groups using prices collected from Mbabane only. Index "B" was therefore used to measure Swaziland inflation during this period up to 1987.

In 1988 the Central Statistical Office (CSO) started compiling a series of consumer price indices which were based on the results of a household income and expenditure survey conducted in 1985. The CSO was now able to calculate price indices according to consumption patterns in Swaziland and three price indices derived from the low income group defined as those earning less than E2,400 per annum, called "Index B", followed by the middle and high income group comprising those earning between E2,400-E8,760 per annum, this was called "Index A". A new income group called "All Income Groups" was introduced during this period. This index covered people who were earning E27,480 per annum and it was a combination of Indices A and B.

Another Household Income and Expenditure Survey was conducted in 1995 by the CSO to ensure that the CPI reflects the true picture of changes in the prices of goods and services purchased by the average household. A new basket was instituted comprising new weights and a larger number of items. For example, the weight for "Food" declined to 24.6% in 1995 from 30.7% in 1985. Another important index "Transport and Communications" in the basket also dropped drastically to 8.2% from 16.1%. The weight given to "Housing" grew significantly to become the second highest weight in the basket to 15.9%. The weights for "Alcohol" and "Personal Care" both fell to 0.888% and 0.709%, respectively. "Miscellaneous", "Fuel and Power" and "Education" were the other categories where weight showed an increase in the 1995 basket.

Table 1: Composition of the Swaziland CPI: Weights in 1985 and 1995

Category	Weight	
	1985	**1995**
1. Food	30.693	24.548
2. Alcohol & Tobacco	2.973	0.888
3. Clothing & Footwear	10.101	9.897
4. Housing	7.486	15.944
5. Fuel & Power	3.379	5.860
6. Furniture & Appliance	8.774	8.669
7. Household Operations	7.800	4.579
8. Health Care	1.754	1.723
9. Transport & Communications	16.099	8.223
10. Leisure	3.922	4.355
11. Education	3.329	7.155
12. Personal Care	1.455	0.709
13. Miscellaneous	2.235	7.449

Table 2: Comparison of the Swaziland and South African CPI: Weights in 1995

Category	**Weight**	
	Swaziland	RSA
1. Food	24.548	19.48
2. Non-Alcoholic Beverages	-	0.82
3. Alcohol & Tobacco	0.888	2.21
4. Clothing & Footwear	9.897	5.07
5. Housing	15.944	22.45
6. Fuel & Power	5.860	3.54
7. Furniture & Appliance	8.669	4.34
8. Household Operations	4.579	4.87
9. Health Care	1.723	5.81
10. Transport & Communications	8.223	16.86
11. Leisure	4.355	2.87
12. Education	7.155	1.82
13. Personal Care	0.709	3.08
14. Miscellaneous	7.449	6.78

Although weight on Food in the Swaziland basket declined from 30.7% to 24.6%, it still showed higher weighting than the South African basket that reflected 19.5%. The highest weight in the South African basket was “Housing” with 22.5% against 15.9% in the Swaziland basket. The South African basket also reflects “Health”, and “Transport and Communications” as very important. “Health Care”, and “Transport and Communications” have 5.8% and 16.9 percent compared to 1.7% and 8.2% in the Swaziland basket, respectively. For more details on weighting see Tables 1 and 2 above.

3.2 DATA TRENDS

It is important to reproduce the inflation trends for analytical purposes by comparing them with the trends of the other variables

3.2.1 Swazi Inflation and South African Inflation

The visual examination of Graph 1 of the two inflation rates shows that prior to 1988, the inflation rates of the two countries had a positive relationship and were therefore moving in the same direction. The of annual inflation in Swaziland is largely determined by the developments of the South African economy in view of the close integration of the two economies. Moreover, total consumption in Swaziland contains a high proportion of imports from South Africa. However, after 1988 the Swaziland inflation began to take a divergent pattern. Factors responsible for driving developments in prices in different directions in Swaziland and South Africa are believed to be as follows:

- The different weights assigned to each product that reflects different consumption habits (for example, the food index has a weight of 24.5% in Swaziland compared to 19.5 % in South Africa).

- Pricing of goods and services produced in Swaziland (for example, education, housing, domestic operations (there was a considerable increase in wages for domestic servants after several years in which the gazetted minimum wage had not been adjusted) and fuel.

- Different rates of tax imposed on different products have somewhat contributed to the divergent inflation rates in the two countries. In the late mid-nineties the VAT has been introduced in South Africa and has been maintained at 14% whilst sales tax in Swaziland was at 12% until July 2001 when it was increased to 14 percent.

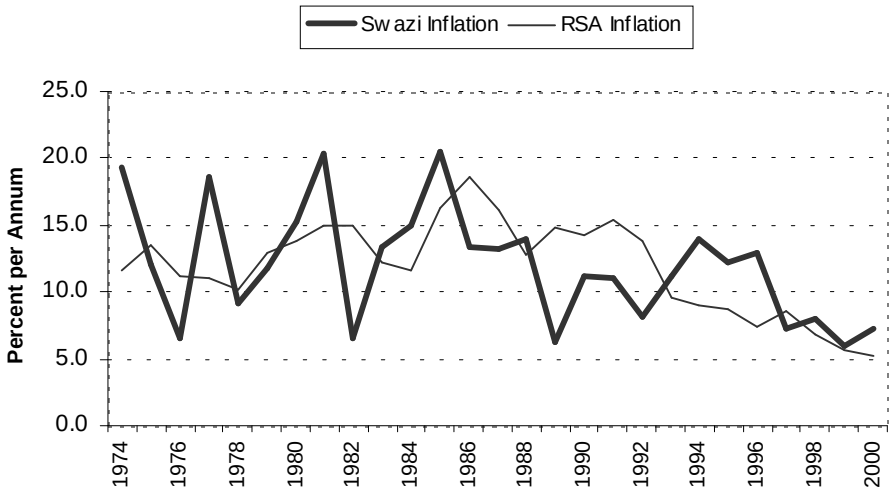
- Price controls on locally produced and imported goods such as electricity (although a bulk of the electricity is imported from South Africa, decisions on price increases are taken in Swaziland and do not necessarily reflect prices by ESKOM). The government sets prices of milk, bread, and fuel, despite the fact that the price of the latter is also influenced by many factors including the levy on fuel.

- Political decisions that have an impact on the price level, for example, restrictions on importation of certain products (some price-controlled items have risen quickly in Swaziland than in South Africa).

- Possible errors may be present in the price collection methods, coverage, weights and weighting patterns, item and outlet substitution, the transcription and computation of the Swaziland CPI.

However, the relationship between the inflation rates of the two countries resumed in 1995. This was partly due to the increasing importance of changes in food prices on the overall South African inflation basket.

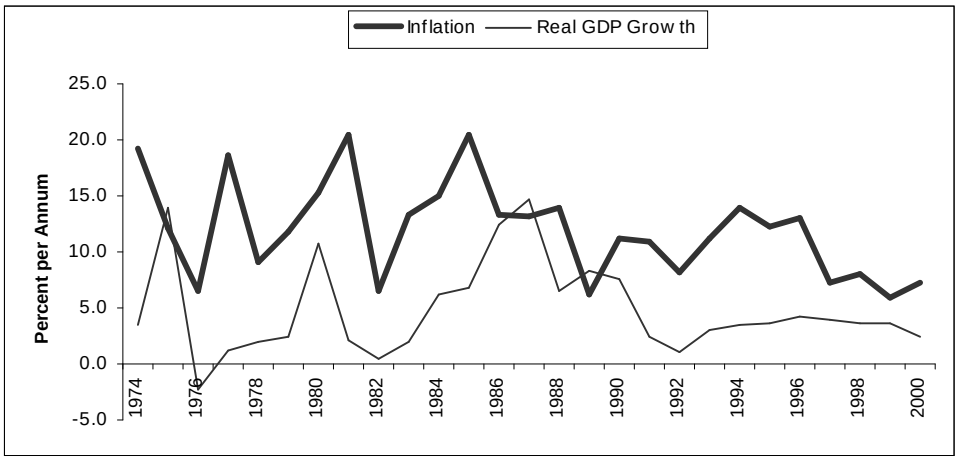
Graph 1: Swazi Inflation and South African Inflation



3.2.2 Inflation and GDP Growth

Comparing Swaziland inflation rate against the growth rate of real GDP, one would expect a negative relationship as dictated by economic theory. A visual inspection of Graph 2-inflation rate plotted against real GDP for the period 1974 to 2000 using annual figures indicated a very inconclusive picture. For the period 1974 to 1985, inflation rate seemed to be erratic, cyclical and higher than real GDP growth. A possible explanation would be that there is no relationship between the two variables. In fact the inflation rate remained above real GDP growth for the whole period under review except for year 1975, 1986 and 1989 where real GDP growth was higher than the inflation rate. Clearly from this graph, one can conclude that Swaziland is not pursuing policies tailored to address the economic situation in times of high inflation rates or otherwise. This has resulted in high inflation rates, as no corrective measures were undertaken whilst real GDP continued to post low growth rates.

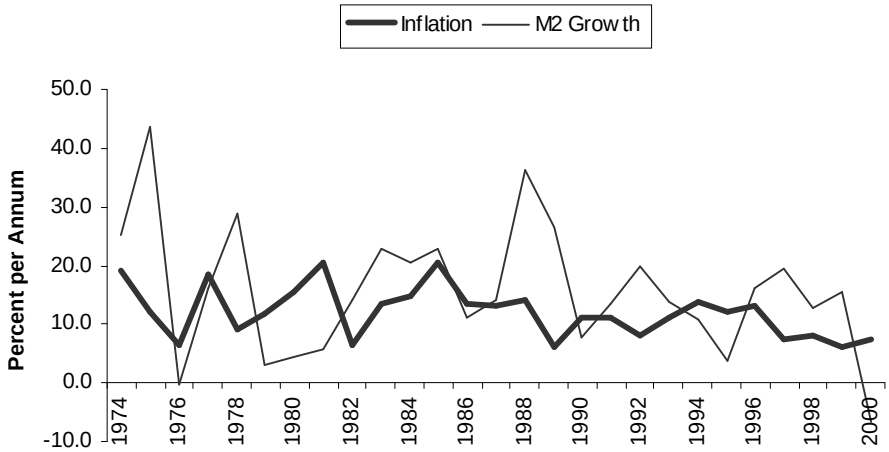
Graph 2: Inflation and Real GDP growth



3.2.3 Inflation and Money Supply (M2)

Broad money supply, M2, showed considerable expansion in 1975, 1978 and 1998 and low growth rates in 1976, 1979 and 1995. M2 growth remained stable in 1992, 1996-1999 and recorded negative growth in 2000. The erratic manner of M2 growth in Swaziland is due to disproportionately large effects of government deposits on government revenue from SACU receipts. At times M2 grows dramatically whilst in other periods growth is slow or negative. The periods of high monetary growth from the mid-1970s to the late 1980s coincided with a high inflationary trend, although this does not appear to be case in the 1990s. In fact, in the early nineties M2 and inflation were actually moving in different directions. When M2 increased the inflation rate was experiencing a slowdown and vice versa. Although statistical methods indicate a close correlation between changes in money supply and the rate of inflation, Swaziland can not control its M2 due to her membership to the CMA. Under the CMA arrangement, the Lilangeni and the Rand are pegged at parity. In this regard, Swaziland has limited control over its M2, as rand notes and coins circulate freely and interest rates are determined in a unified market. From Graph 3, it is difficult to tell whether there is a relationship between M2 and inflation.

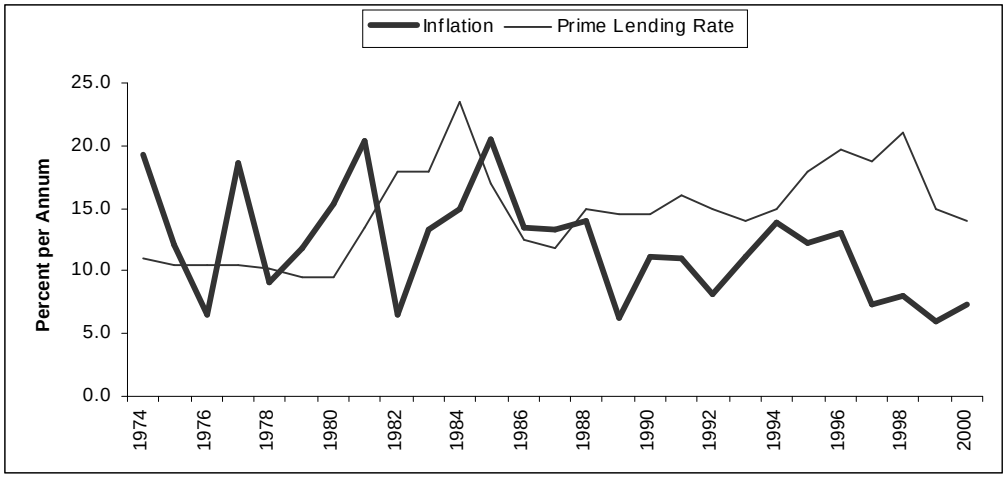
Graph 3: Inflation and M2 Growth



3.2.4 Inflation and the Prime Lending Rate

There is supposed to be a positive relationship between the inflation rate and the nominal prime-lending rate according to theoretical expectation. There seemed to be a cyclical movement of the inflation rate whilst the prime-lending rate is stable for the period 1974 to 1980 (see Graph 4). However, the period 1987 to 2000, nominal prime lending rate remained higher than the inflation rate prevailing in the same period and this development cannot be explained by theory. In fact, there is a gap as the inflation rate is falling whilst the prime-lending rate is rising.

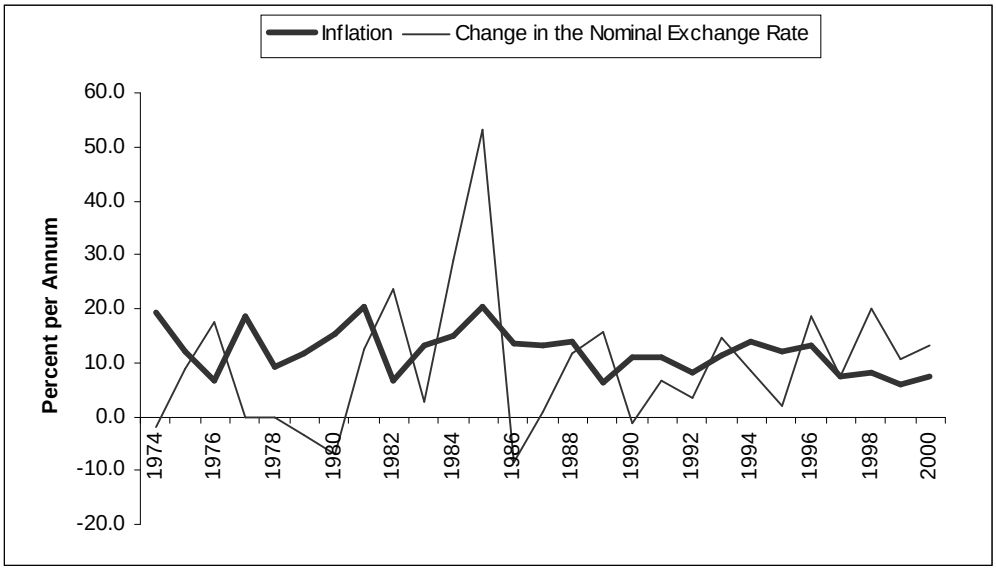
Graph 4: Inflation and the Prime Lending Rate



3.2.5 Inflation and the Nominal Exchange Rate

According to the simple purchasing power parity model, not only will inflation from South Africa (with whom the exchange rate is fixed) directly affect inflation in Swaziland, but so will changes in the external nominal exchange rate. Moreover, as can be seen from Graph 5, there does seem to be a simple straightforward relationship between changes in the nominal exchange rate and the rate of inflation in Swaziland. As expected, a depreciation seems to be associated with generally higher levels of inflation, than that prevailing at a time when the currency is stable. Whilst it is true that Swaziland imports about 80% of her goods from South Africa, it is also true that the remaining 20% of the Kingdom's imports come from countries outside the CMA, which is directly affected by exchange rate movements. Of the 80% of imports bought from South Africa there is an unknown proportion, which South Africa imports from the rest of the world, which again is influenced by the exchange rate developments. Also, changes in international prices, notably oil, have an impact over and above that of the exchange rate, since even foreign prices must be converted into domestic prices through the exchange rate.

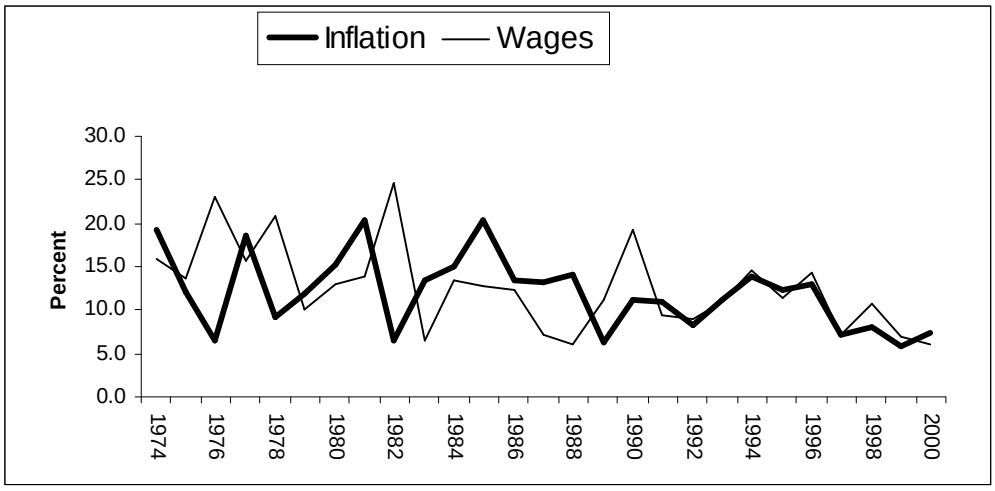
Graph 5: Inflation and the Nominal Exchange Rate



3.2.6 Inflation and Nominal Wages

Economic theory postulates a large degree of interdependence between wages and prices. The positive relationship between nominal wages and inflation is illustrated in Graph 6. An increase in wages corresponds with higher inflation throughout the 1974-2000 period. This seems reasonable since every time the government announces a cost of living adjustment for civil servants, prices of goods and services are adjusted immediately by retail shops. Graph 6 also tells us that we could be having what is known as the wage-spiral – a situation whereby wages rise because prices rise and prices rise because wages rise. However, in this study we will support the school of thought that maintains that prices rise due to rising cost of factors of production (of which labour is the major component). Proponents of this theory maintain that the cost of goods and services rise because wages are pushed up by trade union's bargaining power.

Graph 6: Inflation and Nominal Wages



SECTION 4

MODELLING INFLATION IN SWAZILAND

4.1 MODEL SPECIFICATION

From the above theoretical and empirical discussion, the inflation function for Swaziland can be specified in the following manner:-

$$\ln P_t = \ln \alpha + \beta_1 \ln Y_t + \beta_2 \ln R_t + \beta_3 \ln E_t + \beta_4 \ln M_t + \beta_5 \ln SP_t + \beta_6 \ln W_t + \mu_t$$
$$where\ \mu_t = NID\ (0; \sigma^2) \qquad 4.0$$

In the above equation, P represents the Swaziland consumer prices; Y is real income; R and E are the nominal interest and exchange rates, respectively; M is the nominal money supply; SP represents the South African consumer price index; and W is the average nominal wage index. Table 3 provides the full definitions of variables obtained from data sources.

Table 3: Data Definitions of Variables

Variables	Definitions
P	Swaziland Consumer Price index (at 1990 = 100)
Y	Real Gross Domestic Product at 1990 constant prices (Millions of Emalangeni) – adjusted by the Swaziland CPI
R	Nominal Prime Lending Rate
E	The value of Lilangeni against the US Dollar (Nominal)
M	Broad Money Stock in Swaziland – notes and coins outside the Banking system + Demand Deposits + Savings + Time Deposits
SP	South African Consumer Price Index (1990 = 100)
W	Average Nominal Wage Index (1990 = 100)

All the coefficients on the variables are expected to have a positive sign, except for real income. While in a monetarist model real income would be expected, a priori, to have a negative sign, it is also an empirical issue depending on the nature of the economy. All variables in the equation are expressed in a log-linear form.

The reason for the inclusion of the South African CPI is necessitated by the fact that South Africa still remains Swaziland's main source of imports and its main market for non-traditional exports. As mentioned earlier, over 50% of the Kingdom's export commodities are sold to the South African market and over 80% of its imports originate from that country.

4.2 DATA ANALYSIS

The most important concern here stems from the nature and availability of data. A long enough time series for some of the relevant variables was not available. Specifically, gross domestic product (GDP) figures are on annual basis and the latest GDP data available are for the year 2000 and the longest reliable series begin in 1974. Therefore, the use of quarterly data in the case of Swaziland was not possible.

All the figures of the data collected are expressed in millions of Emalangeni, unless otherwise stated. The data are annual, covering the period of 1974 to 2000, or a total of 27 time series observations.[4] The data on P, Y and W were obtained from the Central Statistical Office (CSO) of Swaziland. The R, E and M variables were obtained from the "Quarterly Reports" of the Central Bank of Swaziland. The data on SP was taken from the "Quarterly Bulletin" (various issues) of the South African Reserve Bank (SARB).

Traditionally, GDP is employed as an income measure. Ideally, a GDP deflator would have been more appropriate measure for deflating nominal figures. We choose to use the CPI, though this choice is determined to a greater extent by the fact that the CPI is the only price data series available for Swaziland. Using a CPI measure is acceptable if it is a true reflection of the real prices faced by the consumers.

4.3 MODELLING STRATEGY

4.3.1 Stationarity and Non-stationarity

The importance of the concept of stationarity arises from the fact that virtually all the entire body of statistical estimation theory is based on asymptotic convergence theorems i.e., the weak law of large numbers, which assume that all data series are stationary. In real life, however, non-stationarity is extremely common in macroeconomic time series such as income, consumption, money, prices and trade data. Treating non-stationary series as if they were stationary will bias the Ordinary Least Squares (OLS) and thus result in misleading economic analysis. For example, the model will systematically fail to predict outcomes and can also lead to the problem of spurious (misleading) regressions where R-squared is approximating unity, t and F-statistics look significant and valid. In essence, the problem lies with the presence of spurious regression that arises where the regression of non-stationary series, which are known to be unrelated, indicates that the

[4] Because of the short data series, the regression results suffer from insufficient degrees of freedom. An attempt to increase the degrees of freedom was made through the deletion of statistically least significant or less relevant variables in the various regressions.

series are correlated. Hence, there is often a problem of falsely concluding that a relationship exists between two unrelated non-stationary series. This problem generally increases with the sample size, and is not normally solved by including a deterministic time trend as one of the explanatory variables in order to induce stationarity.

In order to avoid the spurious regression problem, with its related non-stationary pattern of the variables, differencing has become the common method of bringing non-stationary series to stationarity. A variable is said to be integrated of order one, or I(1), if it is stationary after differencing once, or of order two, I(2) if differenced twice. If the variable is stationary without differencing, then it is integrated of order zero, I(0). The value of the mean of a stationary series is independent of time, and thus no matter at what point in its history the series was examined we would always recover the same information about its structure. In contrast, a non-stationary series contains a clear time trend and has a variance that is not constant overtime. If a series is non-stationary, it will display a high degree of persistence i.e. shocks do not die out.

A graphical representation reveals a striking graphical difference between I(0), I(1), and I(2) variables. Appendix 2.1 shows the variables P, Y, R, E, M, SP, and W. All the series, except for R, exhibit either upward trending movement over time. R shows a weak stationary pattern, although it also shows a continued, albeit slow, trend over the estimated time period. Differencing all the variables (see Appendix 2.2) shows no evidence of trending in any of the variables, except for E that continues to exhibit an upward trending movement. The large volatility in the movements of the series suggests the presence of outliers and structural-breaks in the differenced trends. Differencing all the variables again twice (see Appendix 2.3) gives a reliable picture of stationary variables, since the trends are fluctuating around the zero level. This suggests constant means and variances compared to the first differenced variables which fluctuated widely around non-zero variables. A visual inspection of the graphs tentatively suggests that all the variables appear to be at least I(1) or higher. The following unit root testing will, however, validate this conclusion.

4.3.2 Unit Root Testing

Having established the vector of variables of interest we now consider the order of integration (or stationarity) of each series using the Augmented Dickey Fuller (ADF) unit root tests.[5] This is a 't' test that relies on rejecting the hypothesis that the series is a random walk in favour of stationarity. This requires a negative sign and significant test statistic. The tests for integration of order zero I(0) are carried out on the level of the variables and the tests for integration of order I(1) and I(2) are carried out on the first and second differences of the variables, respectively.

[5] All the unit root testing was carried out on E-Views 3.0.

The results of the tests and the relevant critical values, as well as the number of lags to get rid of serial correlation, are provided in Table 4 below.

The results show that all variables have a unit root in their levels in the presence of structural breaks, thus indicating that the levels are non-stationary. The first differenced series of P, Y, R, M, SP, and W, however, clearly rejects unit roots suggesting that the differenced variables are all stationary. The variable E becomes stationary after differencing the series twice. The unit root testing has been calculated using the ADF unit root formula taking into account the intercept and the time trend and the lags to get rid of any serial correlation problems. This is plausible given the fact that all the series seem to contain a trend in their levels.

We could have confirmed the unit root testing results by carrying out further tests, such as Sargan-Barghava Durbin Watson Statistic (SBDW) and Phillips-Perron (PP) tests. The ADF tests tend to have low predictive power when the series is correlated at higher order lags, that is, the ADF test is valid only if the series follows an autoregressive (AR) process. The other tests, however, show greater bias in terms of finite samples, such as the one being studied. Thus, the unit root testing results of the ADF tests are treated as reliable, and hence it would seem reasonable to proceed on the basis that all variables are I(1), except for E which is I(2). Table 5 provides the additive dummies for the period under review.

Table 4 ADF Tests for Unit Roots (Order of Integration)

Variables	Test Statistic	Longest Lag	Order of Integration
P	-0.07	2	
DP	-3.77**	1	I(1)
Y	-2.44	2	
DY	-3.36*	2	I(1)
R	-2.80	3	
DR	-3.77**	4	I(1)
E	0.50	4	
DE	-3.09	1	
DDE	-5.05***	2	I(2)
M	-0.84	2	
DM	-3.48*	1	I(1)
SP	-1.89	2	
DSP	-4.38**	2	I(1)
W	-2.74	5	
DW	-3.97**	2	I(1)

Notes: *Reject at 10% (*), 5% (**) or 1% (***) significance levels.*

Critical Values for Unit Root Tests	
At 1%	-4.39
At 5%	-3.61
At 10%	-3.25

After estimating equation, inclusive of the above mentioned dummies, all of them, save for D85, proved to be insignificant in the overall equation and were thus excluded from subsequent analysis on the inflation function in Swaziland. The final preferred long-run equation was Equation 3.0 with the addition of the dummy variable, D85.

Table 5: Dummy Variables

D85	Sharp depreciation of the Lilangeni in 1985
D88	Restrictive Monetary Policy of South Africa from 1988 onwards
D92	Drought of 1991-92
D98	Asian Crisis of 1997-98

4.3.3 Cointegration Analysis

This analysis tests whether if variables are integrated of the same order, a linear combination of the variables will also be integrated of the same order or lower order. The idea behind cointegration analysis is that although macroeconomic variables may tend to trend up and down over time, groups of variables may drift together. If there is some tendency for some linear relationships to hold among a set of variables over long periods of time, then cointegration analysis helps us to discover it. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary, or I(0), linear combination exists, the non-stationary (with a unit root), time series are said to be cointegrated. That is, they are individually non-stationary, integrated of the same order but their linear combination is integrated of a lower order. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship between the variables.

Cointegration provides a means of partitioning the evolution of time series data into its components:

- Long run equilibrium characteristics (the cointegrating vector)
- Short run disequlibrium dynamics

Here we have a direct link between cointegration and the so-called error (or equilibrium) correction model. Therefore, cointegration allows us to include a combination of long and short run information in the same model. This helps us to cover some drawbacks associated with the loss of information from simple attempts to achieve a stationary series, for example, by differencing.

The procedure for cointegration followed in this paper is the Engle-Granger (E-G) approach. The limitation of the E-G approach is applicable when more than two variables are involved in the model. Nevertheless, in spite of its limitations, it is a widely used method for its simplicity and straightforward application. The Johansen Maximum Likelihood procedure is an ideal approach to estimate when there are more than one cointegrating vectors or variables in the case of Equation 4.0. Since this approach is complex and difficult to estimate, it was preferable to use the E-G approach in this study.

The static long-run Equation 4.0 is first estimated inclusive of the one significant dummy variable, D85 (see Appendix 3.1). As evidenced from the appendix, the broad money stock, the prime lending rate, and real income were the only variables found to be highly insignificant, with coefficients showing a 3.2%, 2% and 2.8% effects on prices, respectively. At this juncture, the variable deletion test was carried out (see Appendix 3.2), and based on the results it was considered appropriate to exclude the insignificant variables from Equation 4.0. The insignificance of the prime lending rate and money supply is not unexpected since Swaziland has very little discretionary monetary and exchange rate policies under the existing arrangements and agreements, which bind it closely to the South African economy – mainly the CMA agreement. A combination of fixed parity in the currencies and full freedom of capital to move between the CMA member states means that the Central Bank of Swaziland is unable to control the money supply in Swaziland. Money Supply cannot be measured with certainty; neither the Central Bank can pursue an independent interest rate policy because the ensuing movements of funds would frustrate it. Consequently, the inflation rate is largely taken from South Africa because there is no monetary policy capacity in Swaziland for a significantly different outcome.

It is noticeable that the income elasticity is not only insignificant but also positive. This finding supports the view that in Swaziland the effects of higher real income on raising the price level outweigh the impact that the increased supply of goods and services can have on curbing price rises. This is certainly plausible in the Swaziland context, because a large proportion of output, such as commercial agriculture and manufacturing is strongly geared towards production for export, and hence growth in these sectors does not provide additional goods and services for the domestic economy. This may also indicate that demand-pull effects on prices from real output are more important than the monetary effect. This supports the initial Keynesian explanation of inflation that evolved from Keynes' analysis of effective demand. According to theory, inflation occurs when demand exceeds the potential output of the economy. In Keynes' analysis, the difference between aggregate demand and potential level of output at full employment is termed the inflationary gap.

The insignificant impact of real income on inflation can be further explained by the fact that in Swaziland there are few firms and public enterprises that may have important price setting powers in the country. Such oligopolistic or monopolistically competitive environment engenders inflation, because

imperfectly competitive firms tend to ask a higher price for their products than would have been the case in a competitive market. In other words, prices that are determined under imperfectly competitive conditions are less sensitive to changes in demand than prices determined in more competitive markets. Hence, it can be concluded that policies that would promote more competition, or a "level playing field", in the economy could also increase economic growth and may result in significant decline in prices.

The final preferred long-run equation using the full sample period is as follows, with their respective coefficients and t-values in parentheses (see also Appendix 3.2).

$$\underset{}{P_t} = \underset{[5.06]}{0.621} + \underset{[5.48]}{0.236E_t} + \underset{[5.66]}{0.385SP_t} + \underset{[8.69]}{0.411W_t} + \underset{[2.90]}{0.072D85_t}$$

$$R^2 = 0.999 \quad F(5,23)12904[0.000] \quad DW = 1.64 \quad N = 27$$
$$X^2(12)\,LM\ test = 23.2921[0.025] \quad X^2(11)\,ARCH\ test = 9.3883[0.586] \qquad 4.1$$

It is noticeable that all the elasticities in Equation 4.1 are significant and have the expected signs. The high R-squared of close to unity indicates the high degree to which variations in the price level is explained by variations in the explanatory variables. The F-statistic, with a p-value of zero, indicates the joint significance of the explanatory variables. The LaGrange Multiplier Statistic (LM-tests) of no serial correlation and the Autogressive Conditional Heteroscedasticity (ARCH) tests of homoscedasticity were carried out. The results show that they could not be rejected at 5% significance level.

The dummy variable is also significant at the 5% level, suggesting that the depreciation of the Lilangeni in 1985 had a significant impact on prices: they were 7.2% higher in the post-1985 period. It would be advisable at this stage to refrain from interpreting the coefficients of the explanatory variables, as a cointegrating relationship has to be established first. As mentioned earlier, if there is a cointegrating relationship in the above equation, then it becomes valid for a long-run interpretation of the price level in the Swaziland economy. Hence, the procedure is to obtain the residual in Equation 4.0, which should be I(0), or stationary, in its level in the case that the variables in the equation are all I(1) and are cointegrated. The stationarity of the residual from the long-run equation is thus tested using the ADF testing procedure, but excluding the trend and the intercept.

$$\Delta\mu_t = \underset{[-3.7194]}{-0.676\mu_{t-1}}$$
$$R^2 = 0.3897 \quad DW = 1.99; \quad N = 26;$$
$$F(serial\ correlation(1,24)\ test = 0.3149[0.9216] \qquad 4.2$$

The Dickey Fuller Statistic, obtained from the cointegration procedure on equation 4.2 is –3.7194, and the LM statistic indicates no serial correlation without the addition of lags to correct for serial correlation. Comparing the results at the 5% and 10% critical values of –2.985 and –2.6318 respectively, indicates that the null hypothesis of a unit root in the residuals can be rejected convincingly at both levels, thus leading to the conclusion that the residuals are stationary and integrated of order zero or I(0). The residuals also appear to be stationary when shown graphically (see Appendix 3.2).

The above conclusion leads to the reasonable expectation that a long-run function exists in the estimation of the inflation function in Swaziland. Thus, it can be reasonably assumed that an error correction representation exists in the equation as well.

4.3.4 Error Correction Modelling (ECM)

The existence of at least one cointegrating vector among the variables implies that an ECM can be estimated. Th ECM approach used here is useful for the formulation of a short term price adjustment model, which models changes in Swaziland prices in terms of changes in the other variables in the model, and the adjustment towards the long run equilibrium in each time period. This draws upon the error correction formulation, which is the counterpart of every long run cointegrating relationship.

The error correction model took the form:

$$\Delta P_t = \alpha + \beta_1 E_t + \Delta\beta_2 E_{t-1} + \Delta\beta_3 SP_t + \Delta\beta_4 SP_{t-1}$$
$$+\Delta\beta_5 W_t + \Delta\beta_6 W_{t-1} - \beta_7 \mu_{t-1} + \varepsilon_t$$

$$where\ \varepsilon_t = NID(0, \sigma^2) \qquad 4.3$$

All variables were entered in first difference form, with the exception of E, which was entered in second difference form. In this equation, μ_{t-1} is the lagged error correction factor, given by the residuals from the static cointegration Equation 4.0, including the dummy variable. In other words, μ_t , is the long run information set, represented by what economic theory posits as the equilibrium inflation behaviour. It is a stationary linear combination of the variables postulated in theory. It is a cointegrating vector. The coefficient of β_7 shows the speed of adjustment to long run solution that enters to influence short run movements in inflation. It should be negative and less than unity in absolute terms, since we do not expect a 100% or instantaneous adjustment. The initial estimation was carried out with one lag on each variable (see Appendix 3.4) due to the small number of observations and also because lags of two or more produced meaningless

results and led to serial correlation. On the basis of this broadly specified error correction model, the terms with insignificant coefficients were progressively eliminated from the equation (starting with those with the lowest t-ratios) in order to achieve a parsimonious model. The lags of all the variables (except for the exchange rate) were thus excluded from the equation, as they were either insignificant or wrongly signed. Hence, the following results are produced in the following equation of a short run ECM.

$$\underset{}{\Delta P_t} = \underset{[0.34]}{0.007} + \underset{[1.14]}{0.059\Delta E_t} + \underset{[2.87]}{0.212\Delta E_{t-1}} + \underset{[3.70]}{0.536\Delta SP_t} + \underset{[4.33]}{0.411\Delta W_t} - \underset{[-2.04]}{0.201\Delta W_{t-1}} - \underset{[-2.39]}{0.370\mu_{t-1}}$$

$$R^2 = 0.766 \quad F(7,19)9.847[0.000] \quad N = 26$$
$$F(1,18)Serial\,Correlation = 0.0126[0.911]$$
$$F(1,15)Heteroscedasticity = 7.461[0.761] \qquad 4.4$$

The equation shows that all the short run impacts are correctly signed, according to theoretical expectations (with the exception of changes in lagged nominal wages, which has an unexpected negative sign). The changes in the lagged exchange rate, LDE, average nominal wage, DW, and the South African inflation, DSP, are statistically significant at the 5% level. The change in the exchange rate, DDE however, is insignificant in the ECM equation. Dropping the insignificant DDE variable from the ECM equation therefore yields the final preferred equation (Equation 4.5).

$$\underset{}{\Delta P_t} = \underset{[0.73]}{0.015} + \underset{[2.94]}{0.151\Delta E_{t-1}} + \underset{[3.73]}{0.544\Delta SP_t} + \underset{[4.21]}{0.402\Delta W_t} - \underset{[-2.15]}{0.213\Delta W_{t-1}} - \underset{[-2.70]}{0.421\mu_{t-1}}$$

$$R^2 = 0.749 \quad F(7,19)11.369[0.000] \quad N = 26$$
$$F(1,18)Serial\,Correlation = 0.0126[0.911] \quad (1,15)Heteroscedasticity = 7.461[0.761]$$

$$X^2(2)LM\ test = 13.529[0.332] \qquad X^2(10)ARCH\ test = 9.657[0.471] \qquad 4.5$$

Equation 4.5 shows that the changes in the lagged exchange rate, LDE, South African inflation, DSP, and the average nominal wage, DW, are statistically significant at the 5% level. The R-squared, which measures the "goodness of fit" of the equation is satisfactory at 75%, indicating that 75% of the variations in the Swaziland inflation rate are explained by variations in the changes in the lagged exchange rate, the inflation rate in South Africa, the average nominal wages, and the residual error term. The F-test statistic of 11.4, with a p-value of 0.00, indicates that all three variables jointly determine inflation in Swaziland.

All the diagnostic tests are satisfactory, and pass at both 5% and 10% significance level. The results of the LaGrange Multiplier Statistic (LM-tests) of no serial correlation and the Autogressive Conditional Heteroscedascity show that they could not be rejected at 5% as well. That is, the tests suggest that there is no serial correlation, or that there is not a problem of association between the residuals, and that disturbances all have the same variance (they are homoscedastic). The disequilibrium error term is significant and negative confirming the earliest assertion that the variables are cointegrated. The error term of –0.42 indicates that there

is a 42% feedback from the previous year disequilibrium into the short run dynamic process, and that errors or residuals within the estimated equation are corrected 42% in a year.

SECTION 5

THE RESULTS AND THEIR INTERPRETATION

5.1 ECONOMIC POLICY IMPLICATIONS

The results are presented in the following table. (Table 6 implies the following average significant relationships under the assumption of ceteris paribus).

Table 6: Long and Short Run Elasticities

	Exchange Rate	South African Price Level	Nominal Wages	Lagged Nominal Wage
Long Run	0.236*	0.385*	0.411*	N/A
Short Run	0.151*	0.544*	0.402*	-0.213*

*Rejects null hypothesis of $\beta_1 = 0$ at 5% significance level.

As theory predicts, a depreciating exchange rate tends to play a significant part in determining inflation in Swaziland. The results of this study show that a 1% depreciation of the exchange rate leads to a 0.24% increase in long run inflation. The rapid depreciation of the rand/lilangeni over the period under review implies that the price of imported commodities has increased when expressed in local currency. The exchange rate link with Swaziland inflation can be both direct and indirect, as approximately 20% of Swaziland's imports are directly from the rest of the world, and an unknown proportion of South African imports are from world markets and only traded through South Africa and into Swaziland. In the case of the short rum impact, the changes in the exchange rate are also found to be positive, although the effect on inflation has one-year lag. In the short run the change in lagged inflation explains about 15% of Swaziland inflation.

The results of the study further show that a 1% increase in nominal wages leads to a 0.41% increase in long run inflation. It can be argued that labour costs constitute a large proportion of production and distribution costs in Swaziland. Such wage claims may force producers of goods and services to increase producer prices, thereby sparking inflation. Wage increases without an accompanying improvement in productivity can be singled out as one of the major causes of high inflation in Swaziland. Trade unions play an important part in the wage negotiation process. They sometimes negotiate wage increases and benefits for their members without fully taking into account the demand for labour, the demand for the product, the profitability of the business or the productivity of the workers. If wage increases were accommodated by an increase in the total money supply, so that the cost of wage increases could be recovered through higher prices, this would contribute towards higher inflation. If a wage increase is not accommodated by an increase in productivity, or by price increases, employers have to accept lower profit margins and in this way absorb

the increased labour costs, or attempt to restore their former income levels by retrenchment of workers or a reduced rate of employment. As regards to the short run effects, nominal wages explain about 15% of Swaziland inflation. The 15% impact of the changes in nominal wages on Swaziland inflation is however offset by a 21% negative influence of nominal wages lagged by one year (whose coefficient has the unexpected negative sign). The impact of lagged nominal wages in the short run, while significant, does not fit easily with the expected results and is not easily explained.

The results also show that there is a strong influence of South African prices on Swaziland prices. In the long run, about 38% of the increase in domestic price level is explained by increases in the South African price level. The strong influence of South African prices is not surprising given that South Africa still remains Swaziland's major trading partner. Therefore, the rate of annual inflation in Swaziland is largely determined by the developments of the South African economy in view of the close trade relations between the two economies, which has meant that total consumption in Swaziland contains a high proportion of imports from South Africa. As regards the short run effects, South African inflation explains about 54% of Swaziland inflation.

5.2 STRUCTURAL STABILITY AND FORECASTING

This section attempts to find out whether the final preferred inflation function (Equation 4.5) encountered structural changes over the sample period and whether it can be reliable for predictive purposes. The approach employed was to conduct two tests: the Chow tests for structural stability and the predictive failure test for prediction purposes. Since Equation 4.5 is preferred as the final equation, tests were conducted by setting the breaking point in 1985. The results revealed that the tests do not reject the null hypothesis of structural stability and predictability (see Appendices 3.7 and 3.8), indicating that the inflation function in Swaziland, does have a structurally stable inflation function which can reliably be used for predictive purposes. This result also indicate that in order to forecast Swaziland inflation for the future, it would be appropriate to take into account the current and future trends in the lagged exchange rate, South African inflation and nominal wages.

Appendix 3.6 also shows that actual inflation does not always follow the fitted inflation trend, which suggests that there are other important variables that influence inflation in Swaziland which are not included in the above equation.

SECTION 6

CONCLUSION

The purpose of this study was to determine the causes of inflation in Swaziland using the appropriately available econometric techniques.

The impact of the money supply variable on inflation was found to be insignificant, suggesting that money supply growth in Swaziland does not accord with normal behavioural expectations towards inflation. However, this can be explained largely as a result of membership of the CMA and the limited control Swaziland has over its money supply. The insignificance of the money supply can also be because there is, as of yet, no deficit financing of the government by the Central Bank of Swaziland that could lead to the expansion of money supply in Swaziland and engender inflationary pressure. Nevertheless, the monetary authorities in Swaziland should guard against decision to increase the money supply in Swaziland through fiscal monetisation and should consider potential economic implications of such a move on the economy.

Interest rates seem to play no significant role in the inflation function for Swaziland. This is in line with the theory that in most developing countries, interest rates tend to be inoperative. In most developing countries, like Swaziland, where there is virtually non-existence of a well-developed money market and the fact that interest rates do no necessarily reflect money market conditions but are institutionally pegged, it is, therefore, difficult to ascertain whether interest rates affect prices or not.

The positive, but insignificant long run relationship between real income growth and inflation suggest that economic growth does not necessarily lead to reduced inflation, but can lead to increased inflation due to the existence of monopolistic or oligolopolistic elements in the economy. The results of this study calls for a need to put in place a more competitive commercial and trading environment which will limit the ability of traders to pass on price rises to consumers. The results also suggest that demand-pull effects on prices from real output are more important than the monetary effect.

Since the money supply, real income and the prime lending rate variables did not play any significant role in the long run inflation equation, they were, thus dropped and not considered for subsequent analysis on the inflation function in Swaziland.

The study found that the exchange rate has a significant long-run influence on the level of prices in Swaziland. In the short run, only the changes in the lagged exchange rate significantly influence inflation in Swaziland. A relatively open economy, such as Swaziland's, is subjected to inflationary impulses transmitted from trading partner countries to the domestic economy. In each sector of an economy, output prices are largely determined by the average price paid for inputs of goods and services that are purchased from abroad, and consumed in the process of production. Foreign prices, must, however, be converted into domestic prices through the exchange rate. A depreciation of the Lilangeni against a basket of other currencies will lead to an

increase in the cost of imported goods and, consequently, to an increase in the domestic price level. Given that the import component from countries outside the CMA stands at 20%, it is likely to exert a high degree of influence on the local prices. The high correlation between exchange rate fluctuations and the consumer price index confirms Swaziland's vulnerability towards exchange rate movements. The state of the economy at the time of the depreciation, or appreciation, will determine to what extent these exchange rate-induced prices will be transmitted to the end consumer.

The study also found that the foreign price as proxied by South African CPI have a significant long-run influence on the level of prices of Swaziland. In the short run, inflation is also significantly influenced by the inflation emanating from South Africa. This ultimately suggests that Swaziland is extremely open and imports dependent economy, which makes the country vulnerable to foreign price developments, especially in South Africa. The results, however, do not show significant evidence of the law of one price being applicable between Swaziland and South Africa. This could be due to a number of reasons, such as transportation and mark-up costs differentials, the different structure of the markets and the lack of competition in product markets whereby producers take advantage of price differentials in the short term.

In order for Swaziland to reduce its dependence on imports, and for policy makers to have greater control to meet the objective of maintaining price stability, the policy implication from this study is the need to place more emphasis on the promotion of the manufacturing base in Swaziland. This should help to reduce the country's dependency on imports, and the changes in prices of these imports.

As economic theory predicts, the results postulate a large interdependence between wages and inflation both in the short and long run. An increase in nominal wages broadly corresponds with higher inflation. The results also tells us that the costs of producing a unit of output will increase if the various factors of production become less productive while receiving the same remuneration. In order for Swaziland to curb the potential inflationary impact associated with high wage demands and decreased productivity, the policy implication from this study is the need to review our Labour Relations Act. This review would have to emphasise an increased sensitivity of changes in real wages to the underlying conditions of supply and demand in the labour market, within a regulatory framework that provides stability and protection to workers. The impact of lagged changes in nominal wages, while significant, is not easily explained and requires further investigation.

Finally, structural and predictive tests reveal that using changes in the lagged exchange rate, South African inflation, and the nominal wage as key determinants of changes in the consumer price index, the inflation function (Equation 4.5) can reliably be used for forecasting purposes.

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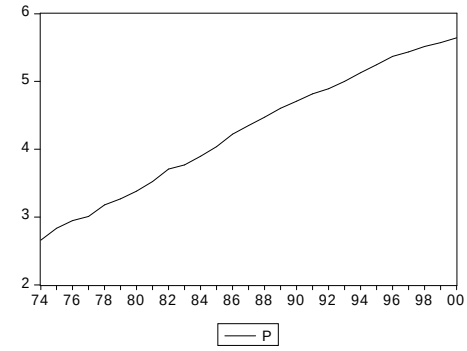
APPENDICES

Appendix 1

List of Variables and Their Descriptions

SWACPI	Swaziland Consumer Price Index
NGDP	Nominal GDP
SWAM	Swaziland Broad money Supply
SWALER	Swaziland lending Rate
NER	Nominal Exchange Rate (L = US$)
RGDP	NGDP / SWACPI*100
RSACPI	South African CPI
USACPI	United States CPI
SP	log (RSACPI)
UP	log (USACPI)
Y	log (RGDP)
P	log (SWACPI)
R	log (SWALER)
M	log (SWAM)
E	log (NER)
INFLA	((SWACPI/SWACPI (-1))-1)*100
DP	P-P (-1)
DDP	DP-DP (-1)
DY	Y-Y (-1)
DDY	DY-DY (-1)
DM	M-M (-1)
DDM	DM-DM (-1)
DE	E-E (-1)
DDE	DE-DE (-1)
DR	R-R (-1)
DDR	DR-DR (-1)
DSP	SP-SP (-1)
DDSP	DSP-DSP (-1)
RES1	Cointegration Residual
LRESID1	RESID1 (-1)

Appendix 2.1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5
4
3
2
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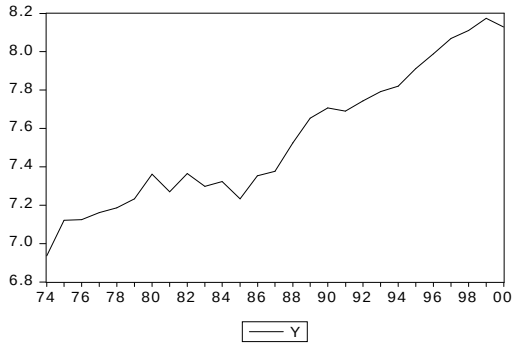
P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7.6
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7.0
6.8
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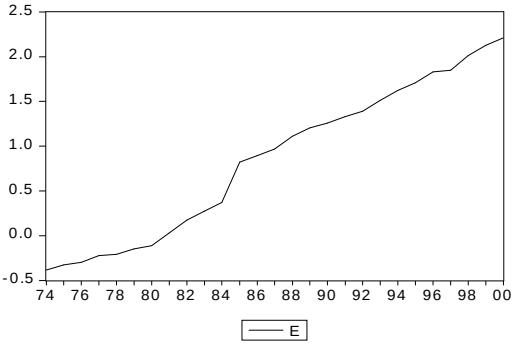
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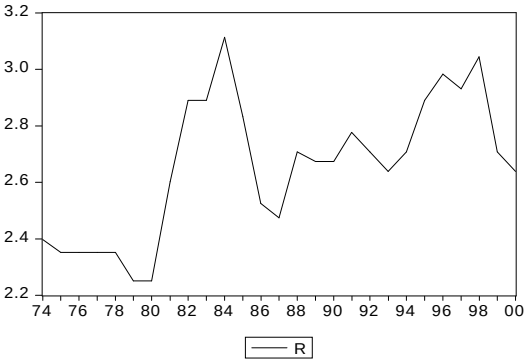
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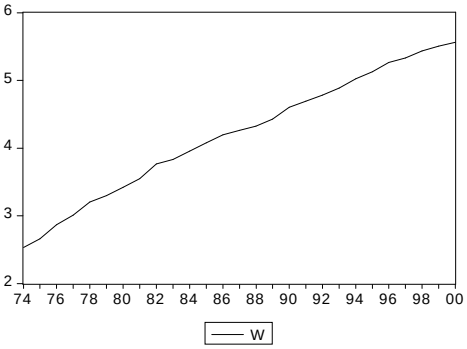
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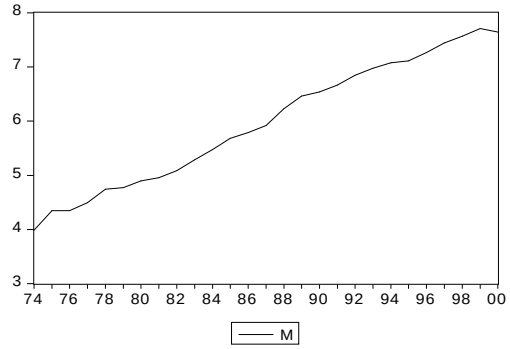
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6
5
4
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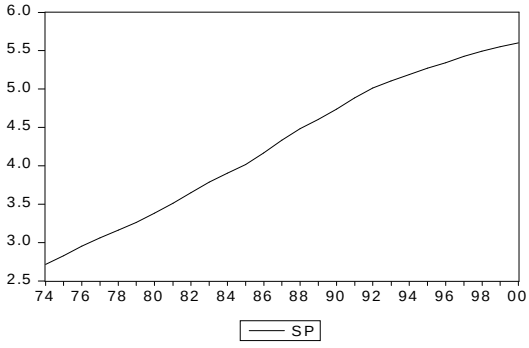
M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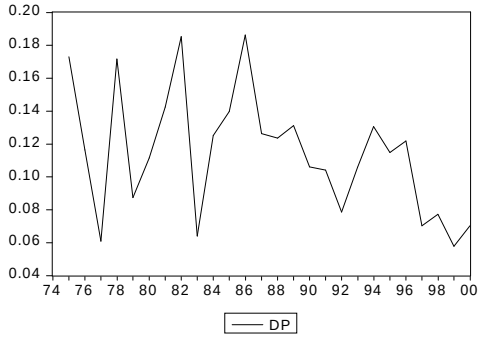
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0.06
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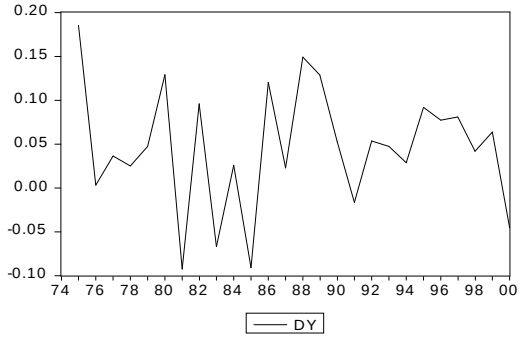
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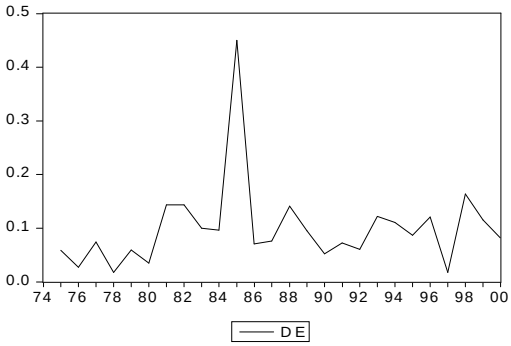
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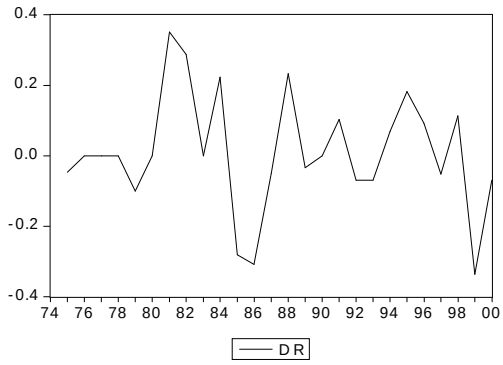
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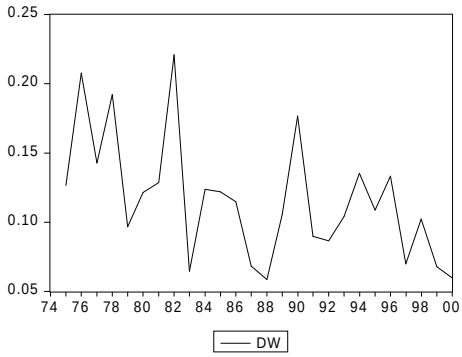
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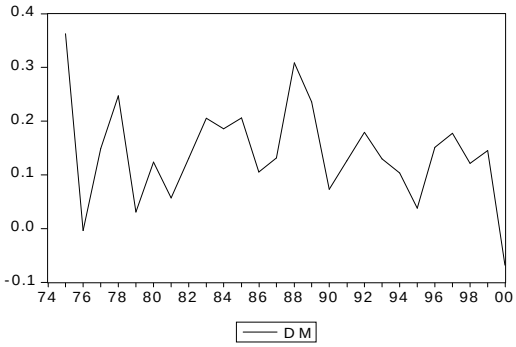
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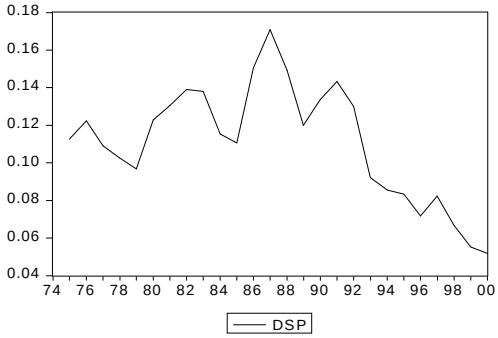
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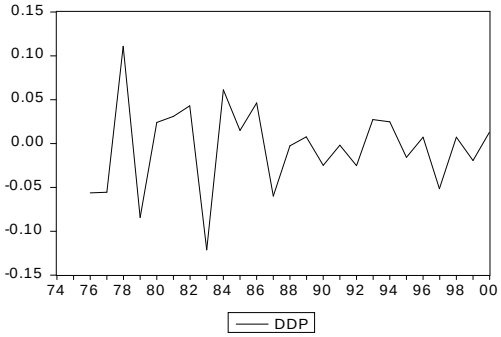
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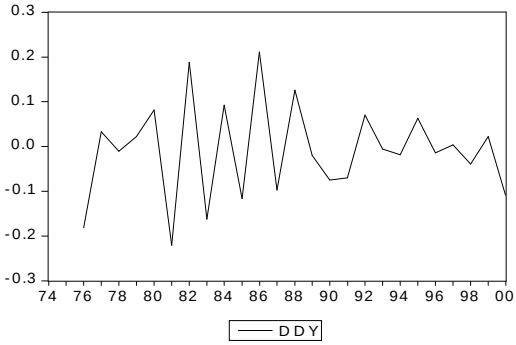
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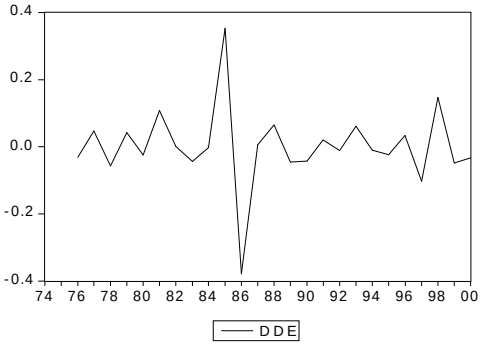
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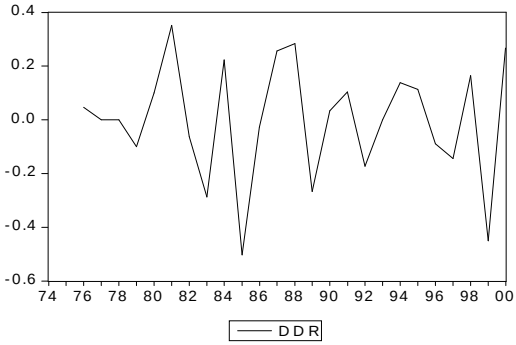
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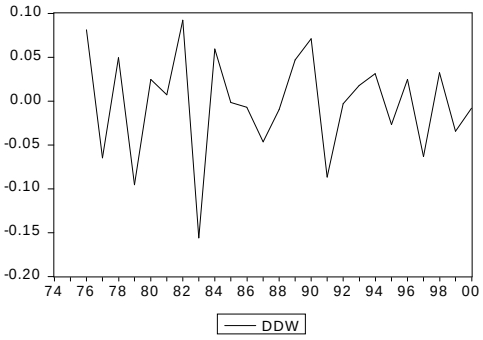
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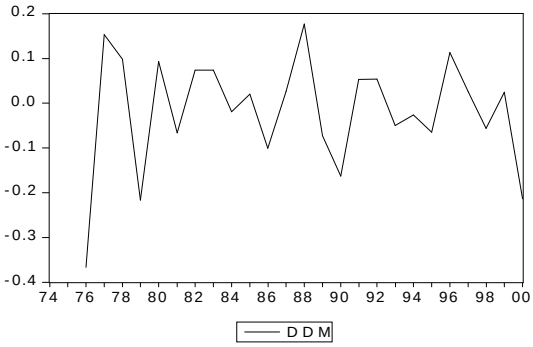
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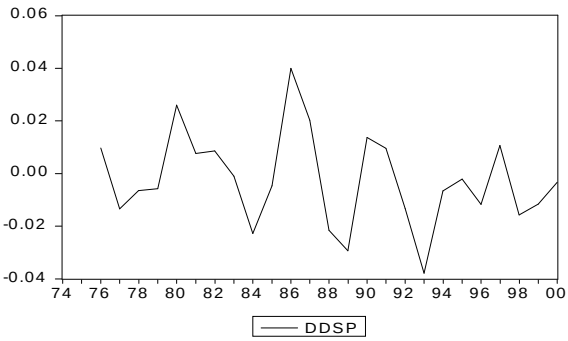
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DDSP

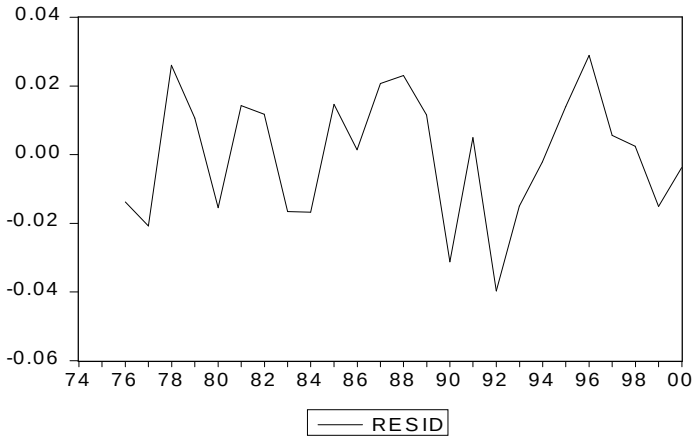
Appendix 3.1

Dependent Variable: P
Method: Least Squares
Sample: 1974 2000
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.390369	0.377809	1.033245	0.3145
W	0.394224	0.053725	7.337749	0.0000
SP	0.350419	0.108517	3.229170	0.0044
E	0.233658	0.049008	4.767731	0.0001
M	0.032154	0.083123	0.386828	0.7032
R	0.019540	0.026728	0.731090	0.4736
Y	0.027922	0.069755	0.400282	0.6934
D85	0.068906	0.032663	2.109615	0.0484

R-squared	0.999600	Mean dependent var	4.267163
Adjusted R-squared	0.999452	S.D. dependent var	0.945466
S.E. of regression	0.022123	Akaike info criterion	-4.543212
Sum squared resid	0.009299	Schwarz criterion	-4.159260
Log likelihood	69.33336	F-statistic	6781.239
Durbin-Watson stat	1.518396	Prob(F-statistic)	0.000000

Appendix 3.2
Plot of residuals



Appendix 3.3
Variable Deletion Test (OLS Case)

Dependent Variable: P
Method: Least Squares
Sample: 1974 2000
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.620577	0.122638	5.060233	0.0000
W	0.411273	0.047340	8.687719	0.0000
SP	0.384832	0.067957	5.662869	0.0000
E	0.236162	0.043081	5.481799	0.0000
D85	0.072417	0.024949	2.902614	0.0083

R-squared	0.999574	Mean dependent var	4.267163
Adjusted R-squared	0.999497	S.D. dependent var	0.945466
S.E. of regression	0.021215	Akaike info criterion	-4.702634
Sum squared resid	0.009902	Schwarz criterion	-4.462664
Log likelihood	68.48556	F-statistic	12904.20
Durbin-Watson stat	1.636073	Prob(F-statistic)	0.000000

Appendix 3.4

Dependent Variable: DP
Method: Least Squares
Sample(adjusted): 1976 2000
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.012290	0.025173	0.488231	0.6316
DDE	0.063237	0.053990	1.171275	0.2576
LDE	0.205510	0.077315	2.658098	0.0166
DW	0.404083	0.098660	4.095704	0.0008
LDW	-0.212494	0.104832	-2.026990	0.0586
DSP	0.642535	0.306670	2.095202	0.0514
LDSP	-0.124747	0.314025	-0.397250	0.6961
LRES1	-0.386344	0.163458	-2.363565	0.0303

R-squared	0.768633	Mean dependent var	0.112404
Adjusted R-squared	0.673364	S.D. dependent var	0.036416
S.E. of regression	0.020812	Akaike info criterion	-4.652204
Sum squared resid	0.007364	Schwarz criterion	-4.262163
Log likelihood	66.15255	F-statistic	8.068047
Durbin-Watson stat	1.715767	Prob(F-statistic)	0.000223

Appendix 3.5

Dependent Variable: DP
Method: Least Squares
Sample(adjusted): 1976 2000
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.007236	0.021206	0.341203	0.7369
DDE	0.059303	0.051817	1.144463	0.2674
LDE	0.211889	0.073838	2.869654	0.0102
DW	0.410685	0.094948	4.325368	0.0004
LDW	-0.201115	0.098456	-2.042696	0.0560
DSP	0.535872	0.144656	3.704463	0.0016
LRES1	-0.379740	0.158761	-2.391900	0.0279

R-squared	0.766485	Mean dependent var	0.112404
Adjusted R-squared	0.688647	S.D. dependent var	0.036416
S.E. of regression	0.020320	Akaike info criterion	-4.722964
Sum squared resid	0.007432	Schwarz criterion	-4.381678
Log likelihood	66.03705	F-statistic	9.847153
Durbin-Watson stat	1.669707	Prob(F-statistic)	0.000071

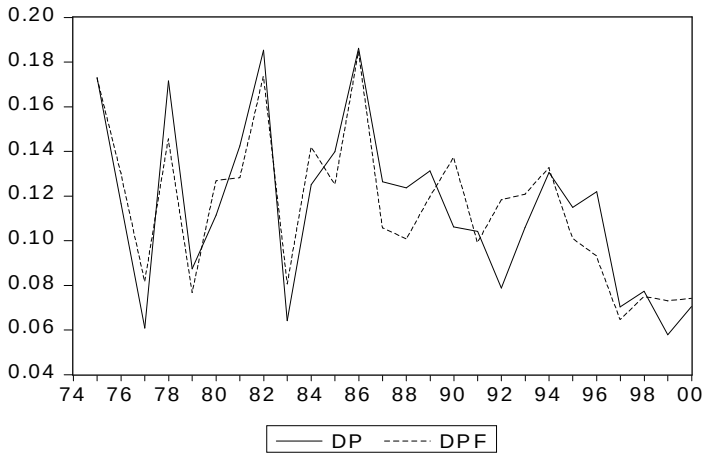
Appendix 3.6

Dependent Variable: DP
Method: Least Squares
Sample(adjusted): 1976 2000
Included observations: 25 after adjusting endpoints

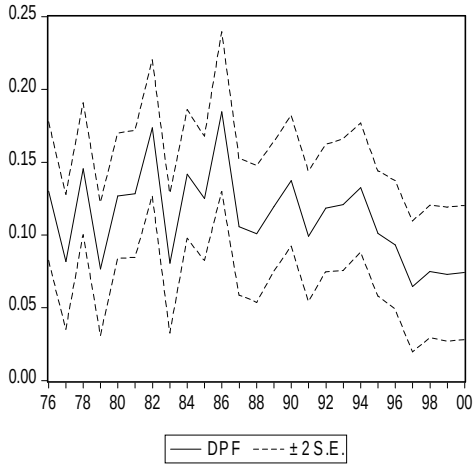
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.014858	0.020297	0.732025	0.4731
LDE	0.150552	0.051202	2.940327	0.0084
DW	0.402156	0.095424	4.214426	0.0005
LDW	-0.212676	0.098731	-2.154097	0.0443
DSP	0.543955	0.145656	3.734507	0.0014
LRES1	-0.421347	0.155797	-2.704456	0.0141

R-squared	0.749493	Mean dependent var	0.112404
Adjusted R-squared	0.683570	S.D. dependent var	0.036416
S.E. of regression	0.020485	Akaike info criterion	-4.732723
Sum squared resid	0.007973	Schwarz criterion	-4.440193
Log likelihood	65.15904	F-statistic	11.36925
Durbin-Watson stat	1.742296	Prob(F-statistic)	0.000035

Appendix 3.7 – Actual and Fitted Values



Appendix 3.8 – Forecast Analysis



Forecast: DPF
Actual: DP
Sample: 1976 2000
Include observations: 25

Root Mean Squared Error	0.017858
Mean Absolute Error	0.015207
Mean Abs. Percent Error	15.06719
Theil Inequality Coefficient	0.076153
Bias Proportion	0.000000
Variance Proportion	0.071965
Covariance Proportion	0.928035