

**INFLATION IN BELIZE:**  
**Concepts, Measurement and Forecasts**

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# INFLATION IN BELIZE: Concepts, Measurement and Forecasts

Marion A. Palacio<sup>1</sup>

## ABSTRACT:

Inflation refers to a state of increasing prices. The most popular measure of inflation is the percentage change in the consumer price index (CPI), and the compilation and publication of CPI statistics in Belize is the responsibility of the Central Statistical Office (CSO). This paper explores the conceptual and measurement issues relating to inflation aimed at providing a better understanding of the factors affecting inflation in Belize. The paper then proposes a univariate approach and an econometric approach that can be used to forecast the CPI. The findings should be of interest to a wide cross-section of the population.

**Key Terms:** consumer price index, producer price index, gross domestic product, deflator.

## 1. Introduction

Policy-makers, firms, trade unions and households have an on-going interest in the level and the monitoring of inflation. One can readily relate to the impact of inflation on disposal income, real interest rates, rate of return on investment, wage settlements, and other activities. The rationale for the interest in inflation has been summed up by Dornbusch and Fischer (1990, p. 12) who referred to inflation as one of the primary measures that is used to monitor the performance of an economy. The Economics Dictionary by Eatwell, Milgate and Newman (1987) uses a definition of inflation that had been put forward by Laidler and Parkin in their 1975 publication. Inflation, in the dictionary, is defined as "*a process of continuously rising prices, or equivalently, of a continuously falling value of money*".

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This paper examines a number of issues relating to inflation in Belize. The measurement of inflation is discussed in Section 2. Section 3 provides a brief history of monitoring inflation in Belize. Section 3 examines the relationship between Belize and US inflation rates. Section 4 features the relationship between the CPI and the GDP deflator. Section 5 discusses the relation between CPI and the money supply. The relation between CPI and the fiscal balance is explored in Section 7. Section 8 deals with forecast models of CPI, using the exponential smoothing technique and an econometric approach. In Section 9, the paper reviews the policy implications of the findings. Concluding remarks are in Section 10. Tables and computer output are contained in Appendix A and Appendix B respectively.

## **2. The Measurement Of Inflation**

Inflation is measured by the use of price indices, and there are three basic types of price indices that are used to monitor inflation. The three indices are (1) the Gross Domestic Product (GDP) deflator, (2) the Producer Price Index (PPI), and (3) the Consumer Price Index (CPI). The nature of these indices will be discussed briefly.

The GDP deflator is obtained by dividing the current price GDP for a particular period by the corresponding constant price GDP of that period. Clarke (1997) points out that the GDP deflator implicitly measures the change in the prices of all goods and services produced in the economy. Other National Accounts Aggregates, beside the GDP, may be used as a basis for computing deflators. Artis (1989, p. 33) refers to the use of the total final expenditure at market prices to compute deflators in the United Kingdom, and Dornbusch and Fischer (1990, p. 42) make reference to the use of the Gross National Product (GNP) deflator. Depending on what is produced in the economy, the range

of goods and services covered by the deflator may vary from year to year.

The PPI tracks the prices of a basket of finished goods. Clarke (1997) argues that the PPI may include goods that serve as inputs into other production processes and that the PPI is primarily exclusive of service activities. The PPI made may used to deflate some of the sub-sectors associated with the GDP by industrial origin.

The CPI also measures the change in the prices of goods and services, but unlike the deflator, the CPI measures the price changes of a fixed group of goods and services. This group of goods and services constitute the 'basket of goods', and the choice of items is determined by the results of a Household Expenditure Survey. The prices of the goods and services in the basket are deemed to be representative of the general level of prices in the economy. The CPI is the most popular measure of inflation, and one of the reasons cited by Clarke (1997) for this is that the CPI is underpinned by economic theory. One weakness in any CPI system is the difficulty of reflecting technological change on an on-going basis.

### **3. Monitoring Inflation In Belize**

The CPI and the GDP deflator, on the Belizean economy are both available, but the PPI is not currently available. The GDP deflator is essentially a by-product of the National Accounting Process, and the estimation and production of both the National Accounts Statistics and the CPI are the responsibility of the Central Statistical Office (CSO) of the Ministry of Finance.

Estimates of GDP are currently compiled on an annual basis, and this has meant that the GDP deflator only becomes available

annually. The GDP deflator is an implicit measure of price changes, but, presently, it is not a widely sought measure of inflation in Belize. The CSO, therefore, gauges the level of inflation by way of the changes in the CPI.

The framework for the current CPI system in Belize was established following the 1980 Household Expenditure Survey (HES80). The results of that survey facilitated the establishment of a basket of goods, with just over 100 items, and the setting up of a CPI system with 1980 as the base year. The 1980 basket of goods was to remain in place until it was revised following the 1990 Household Expenditure Survey (HES90). The HES90 results made it possible for substantial revisions to be made to the CPI system. The two main revisions would be the expansion of the basket of goods to include some 277 items and for price collection to be expanded to include Belmopan, Benque Viejo Town and San Pedro Town. Price collection for the CPI is, therefore, conducted in all urban centres of Belize. The index is compiled quarterly; the collection of prices is conducted during the middle of the quarter, and this collection is completed within two weeks. The index is available about a month after the prices are collected. Finally, the 1990 based CPI has been linked with the 1980 CPI series.

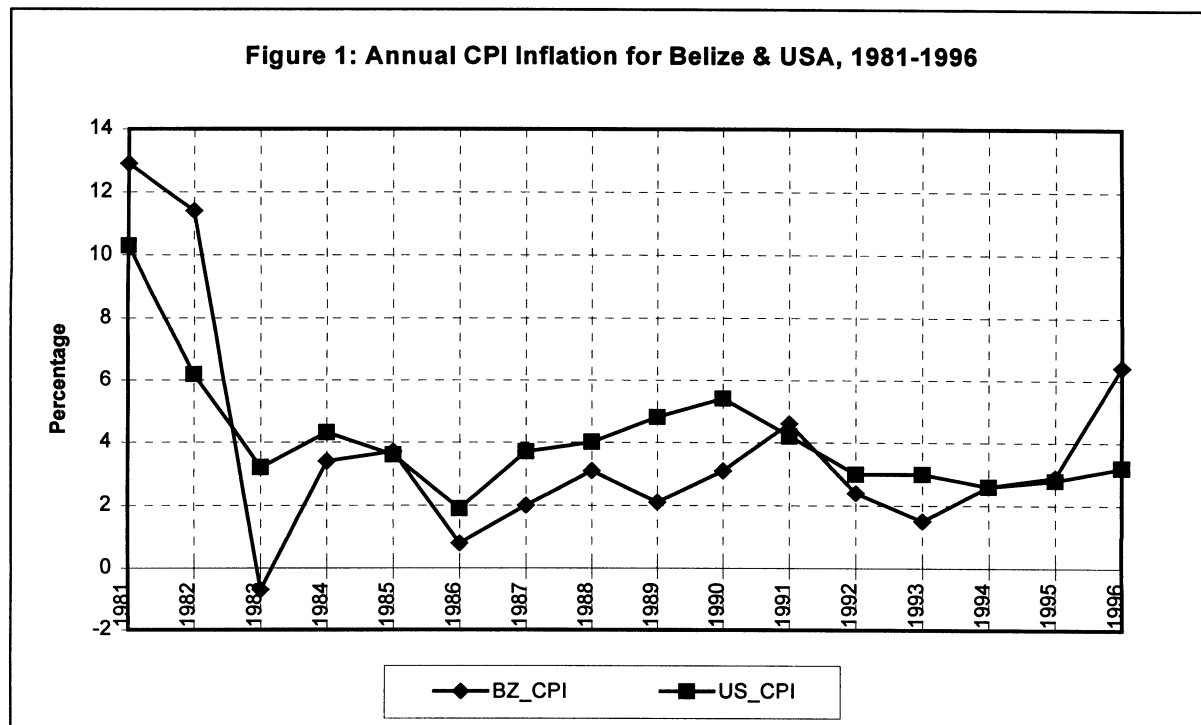
#### **4. Relationship Between the Belize CPI and the US CPI**

There is a consensus of opinion in Belize that the Belize CPI is influenced significantly by the domestic prices of the US. Such an expectation would be based on two factors. The first factor has to do with trade; trade data from the CSO<sup>i</sup> suggest that the USA is the most important trading partner of Belize. The data on recorded imports indicate that, in recent times, the USA accounted for almost 55% of imports into Belize. The second and

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<sup>i</sup> Belize Abstract of Statistics - 1996, pp. 102.

more important factor has to do with the exchange rate; the Central Bank of Belize<sup>ii</sup> indicates that, since May 1976, Belize has operated a fixed exchange rate system such that US\$1.00 = BZ\$2.00.



CPI data for the US were obtained from various issues of the International Financial Statistics that is published by the IMF. The annual CPI inflation rates for both Belize and the USA are featured graphically in Figure 1. The pattern of the data points in the graph suggests that the two indices appear to be related. Such a feature would be consistent with the observations of Freedman (1991, p. 126) who argued that "a country that fixes its exchange rate (permanently) trades off its ability to influence domestic nominal variables in return for the rate of inflation of its larger partner". European countries which have currencies associated with the German mark and Francophone countries of Africa which have their currencies associated with the French

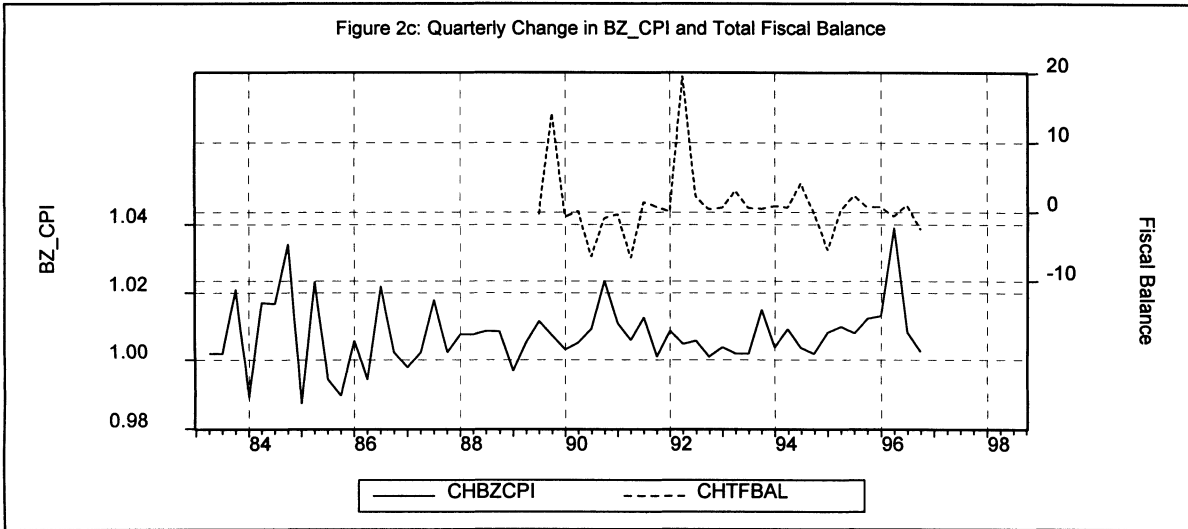
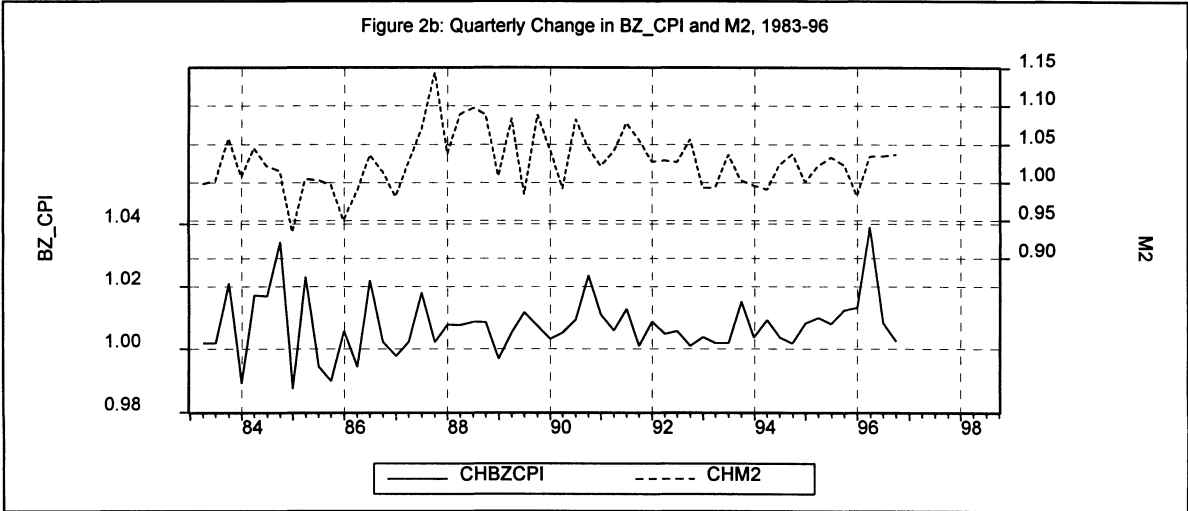
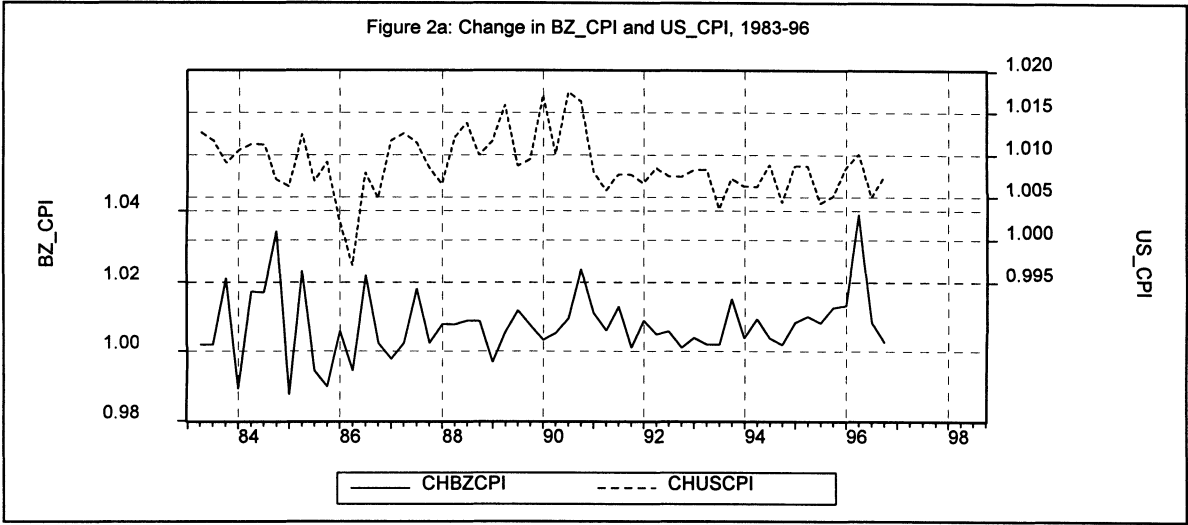
<sup>ii</sup> Central Bank of Belize, Statistical Digest - 1995.

franc were observed to have inflation rates closely related to that of Germany and France respectively.

Figure 1 highlights the very high inflation rates that prevailed in both Belize and the US during the early 1980's; the high rates would have been due to sharp increases in production and other costs following the oil price shock of 1979. The CPI increased again in 1990 and 1991 in the USA and Belize respectively; this would have been the effect of the 1990 Iraqi invasion of Kuwait, two oil producing nations. The quarterly changes in the Belize CPI and in the US CPI, during the period 1983 to 1996, are shown in Figure 2a on page 7; similarities are apparent in the pattern of the two series. The quarterly series also indicated that there exists a very high correlation of 0.98 between the Belize CPI and the US CPI.

Following the introduction of a value added tax (VAT) system in April 1996, there was a significant increase in the Belize CPI in 1996. The CPI bulletin (October 1996) points out that the 15% VAT was introduced in order to compensate for the revenue losses to central government when (a) import duties were reduced in line with the common external tariff of CARICOM, and (b) government revoked the Gross Receipts Tax (GRT) and the stamp duties on imports. The bulletin went on to state that the expectation was for these tax changes to have either no effect or only a negligible effect on prices. There were, therefore, certain measures that were set in place prior to the VAT being implemented, and the measures were designed to neutralize or minimize the effect of the VAT. The increase in the Belize CPI in 1996 can be seen in the chart of the annual series, Figure 1, and in the chart of the quarterly series, Figure 2a on page 7. The fact that the increase in prices was higher than expected would be consistent with studies that have been made on VAT

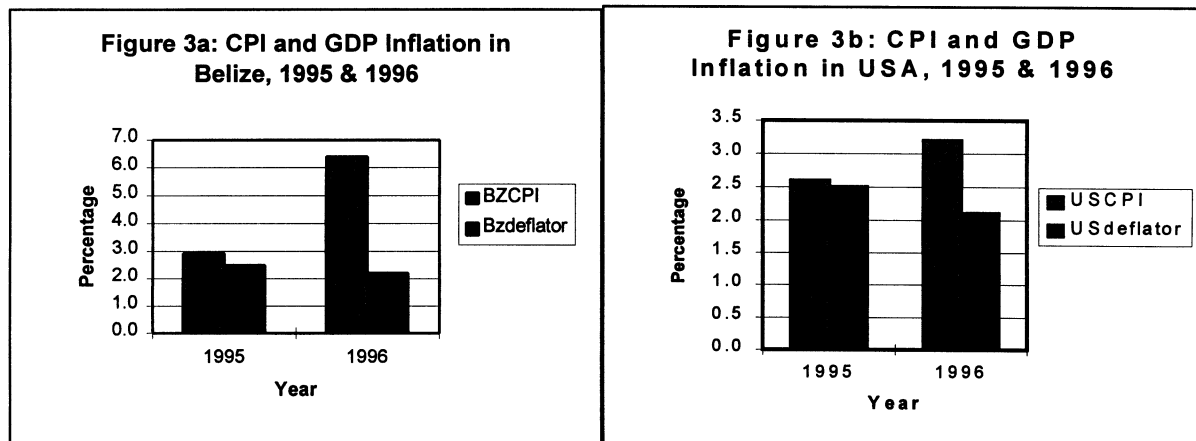




implementation. Tait (1988, p. 191), in particular, stated that "traders might well attempt to widen margins as a contingency against uncertainty, and the public may be persuaded to accept higher prices because speculation has suggested that they should expect them".

### 5. Relationship Between the CPI and the GDP Deflator

There is often a misconception that movements in the CPI must be consistent with movements in the GDP deflator. Under the earlier section entitled 'The Measurement of Inflation', the point was made that each of the indices had its own particular focus. Consequently, it would be expected that movements in the two measures would not necessarily be in unison. Dornbusch and Fischer (1990, p. 43) state that "the two main indexes used to compute inflation, the GNP deflator and the CPI, accordingly differ in behavior from time to time".



The empirical evidence indicates that the expectation is justified. Figure 3a highlights the Belize situation where CPI inflation increased from 2.9% in 1995 to 6.4% in 1996, but the GDP inflation decreased from 2.5% in 1995 to 2.2% in 1996. Figure 3b features the USA situation where the CPI inflation increased

from 2.6% in 1995 to 3.2% in 1996. The GDP inflation registered a decrease; it was 2.5% and 2.1% in 1995 and 1996 respectively.

In a study on monetary policy, Freidman (1988) noted that *"the overall US inflation rate, as measured by the GNP deflator, had risen from a post-recession low of 6.4% in 1976 to 8.9% in 1979. The comparable rise measured by consumer prices was from 4.8% to 13.3%"*.

## **6. CPI Inflation and Money Supply**

The relationship between money supply and inflation revolves around the Quantity Theory of Money which is discussed in just about every textbook on macroeconomics. The basic premise that is offered is that an increase in the level of money supply in an economy would have a number of effects such as increased economic activity providing that national output is not yet at its optimum. Dornbusch and Fischer (1990, p. 643) point out that the precise nature of the results is still the subject of debate by monetarists. Meir (1989, p. 187) noted that the growth in money supply would be inflationary if the growth was in excess of what was wished for by households and business establishments. The empirical relationship, with respect to Belize, was explored in this paper.

The first stage in the exploration was to evaluate the graph of the quarterly percent changes in M2, the broad measure of money supply. The graph is shown as Figure 2b on page 7. There appears to be some similarities in the pattern exhibited by changes in CPI inflation and M2, but the magnitude of the changes are dissimilar.

Consideration was also given to the level of correlation between CPI and M2. It was found that that CPI and money supply were very highly correlated; the correlation coefficient was 0.99.

Finally, the possible impact of money demand on inflation was explored. Meir (1989, p. 188) suggests a method of estimating the rate at which money supply should increase so as not to have an inflationary effect on the economy. The methodology makes use of the elasticity of demand for money and the base year ratio of M1 to GDP. Palacio (1997) has estimated the elasticity of money demand in Belize to be 1.2 and the ratio of M1 to GDP, in the base year of 1984, to be 0.12. The product of these two measures,  $(1.2)(0.12)=0.15$ , suggests that the increase in per capita money holdings would need to be about 15% of the increase in the per capita GDP. Consequently, if GDP per capita, in real terms, were to increase by 4%, then the non-inflationary increase in real money holdings would need to be about 0.6% of the per capita GDP.

Later in Section 8, the M2 is used in an econometric model to forecast CPI inflation.

## **7. CPI Inflation and Fiscal Balance**

Inflation can also affect government policy. High inflation can lead to short falls in the tax revenues collected by government if there are substantial delays in the collection of the taxes. In Belize, the Income Tax Department has a monthly interest charge 1% on any outstanding collections so that collections would not be adversely affected by Belize's current low rate of inflation. The VAT Unit also has a substantial measures and penalties that it can impose that would well be above the current rate of inflation. The situation with other government revenue departments was not investigated by the author, and it could well be the subject of a future study.

More important, however, is the impact of government's fiscal policy on inflation. The theory behind the relationship between inflation and the fiscal balance is summed up by Meir (1989, p. 189) in the following *"when financing of government expenditures by money creation exceeds the non-inflationary limit, total spending in the country becomes greater than production valued at stable prices. Prices rise, and the balance of payments tends to go into deficit"*. The World Bank (1991, p. 110) summarizes this view by saying that *"fiscal deficits affect both balance of payments, and depending on how they are financed, the rate of inflation"*.

Belize has a relatively open economy; hence the impact of government policy was explored by first looking at the quarterly percent change in the total fiscal balance vis-à-vis the quarterly CPI inflation. Figure 2c on page 7 features the comparison of the two data sets. Even though the quarterly data series for fiscal balance was only available from the second quarter of 1989, there appears to be some similarities in the patterns exhibited by the two data sets.

Section 8 makes use of the total fiscal balance to fit an econometric model that can be used to forecast CPI inflation.

## **8. Forecasting CPI Inflation**

Having discussed the concept of inflation and the factors that influence it, one can now proceed to develop forecasting models of inflation. A range of forecasting techniques can be used to forecast inflation, and two techniques have been considered for this paper. The first approach is a univariate time series technique known as exponential smoothing; the quarterly time series data from 1983 to 1996 was used for the model. There are

no restrictions on the time span that the model can provide forecasts for. The second approach, an econometric study, has multiple variables, and it made use of quarterly data from 1989 to 1996. The model fitted can only provide one period ahead forecasts. The two techniques and their associated results are discussed below.

### **8.1. Forecasts Based On Exponential Smoothing**

The Holt-Winters additive seasonal model, which has three parameters, was used for the smoothing and forecasts. The model is made up of four equations of the form following.

(1) Smoothing estimate:

$$F_t = \alpha (X_t - S_{t-p}) + (1 - \alpha)(F_{t-1} + T_{t-1})$$

(2) Trend estimate:

$$T_t = \lambda (F_t - F_{t-1}) + (1 - \lambda)T_{t-1}$$

(3) Seasonal estimate:

$$S_t = \beta (X_t - F_t) + (1 - \beta)S_{t-p}$$

(4) Forecast estimate:

$$W_{t+h} = F_t + h T_t + S_{t-p+h}$$

where

$\alpha$  = alpha, the smoothing parameter

$\lambda$  = lambda, the smoothing constant for trend estimate

$\beta$  = beta, the smoothing constant for seasonal estimate

$(0 < \alpha < 1)$ ,  $(0 < \lambda < 1)$ ,  $(0 < \beta < 1)$ , and  $h = 1, 2, ..$

The output associated with the exponential smoothing is featured in Box 1 of Appendix B. In the model, the smoothing parameter Alpha is equal to 0.96, and the other two parameters, Beta and Lambda, equal zero. The model suggests that there are trend and seasonal components associated with CPI. CPI values for quarters 1 and 2 were generally below trend, and those for quarters 3 and 4 were above trend.

Based on current trends, and using data up to the end of 1996, annual inflation in Belize is projected to decrease from 6.4% in 1996 to about 2% in 1997. The forecasts are depicted in Figure 4 on page 15 and in Tables 1 and 2 of Appendix A. The forecast values generated by the exponential smoothing method appear to be realistic, and the residuals associated with the model appeared to be white noise.

Pindyck and Rubinfeld (1991, p. 430) point to a possible weakness in forecasting with exponential smoothing models due to the ad hoc way of selecting the parameter values.

## **8.2. Forecasts Based On Econometric Approach**

Econometric models have the advantage of evaluating the interaction of CPI inflation with other economic variables. The past values of CPI and those of other variables are specified into a forecasting model. The other variables considered, all discussed earlier in this paper, are the US inflation, money supply and the fiscal balance. The quarterly data on fiscal balance was only available for the second quarter of 1989 and onwards; hence, this approach was limited to using a data set with only 31 data points.

$$\Pi_t^{BZ} = \beta_0 + \beta_1 \Pi_{t-1}^{BZ} + \beta_2 M2_{t-1} + \beta_3 F_{t-1} + \beta_4 \Pi_{t-1}^{US} + \varepsilon_t$$

where

$$\Pi^{BZ} = \text{Belize CPI};$$

$$M_2 = \text{Broad measure of money supply};$$

$$F = \text{Total fiscal balance};$$

$$\Pi^{US} = \text{US CPI} \quad \text{and} \quad \varepsilon_t = \text{a disturbance term.}$$

The model fitted with past values of Belize CPI and past values of US CPI included as explanatory variables had an R\_squared value of 0.99 and a Durbin Watson (DW) statistic of 1.94. The model, however, exhibited heteroscedasticity or lack of a constant variance in the disturbance terms. The model was, therefore, deemed to be inappropriate. One reason for the lack of fit is that the impact of the US economy was already feeding through via the exchange rate. Readers with a passion for econometrics will find the output of this discarded model in Box 2 of Appendix B.

The model regarded as acceptable and was used for forecasting was the following:

$$\hat{\Pi}_t^{BZ} = 70.3232 + 0.0791 M_{2,t-1} + 0.0764 F_{t-1}$$

(93.086)                      (48.688)                      (4.378)

The t-value for each coefficient is shown below the coefficient in brackets, and all the values suggest that the coefficients are significantly different from zero. The model has an R\_squared value of 0.989 and a DW statistic of 1.75.

Data up to the fourth quarter of 1996 were used to fit the model. The forecast values estimated by the model are featured in Figure 5 on page 15 and in Tables 1 and 2 of Appendix A. The forecasts



Figure 4: CPI, Actual and Exponential Forecasts, 1983-1997

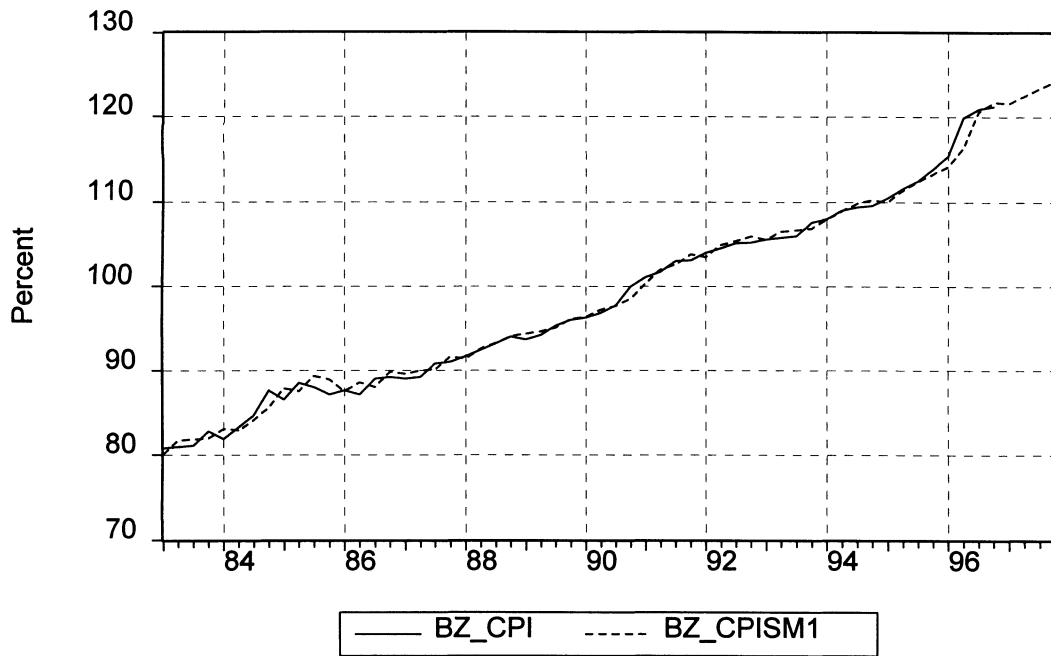
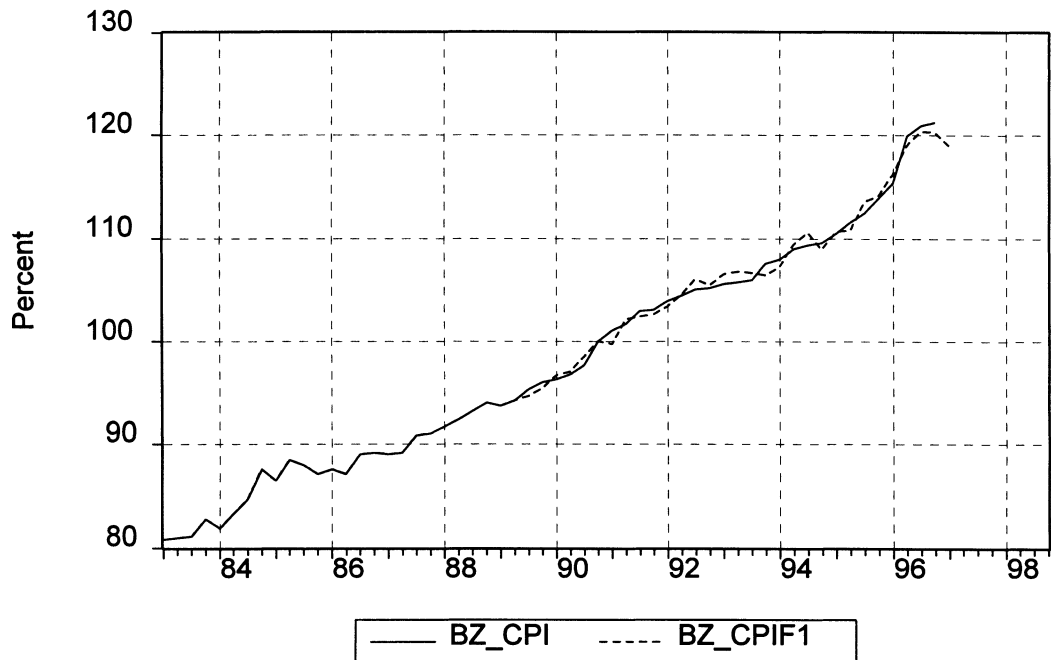


Figure 5: CPI, Actual and Econometric Forecasts, 1983-1997



appear to track the forecasts well, and they indicate that inflation would rise to at least 2% for the second and third quarters of 1997. The CPI forecasts for the second and third quarters of 1997 are within two points of the actual CPI.

### **9. Policy Implications of Results**

Inflation relates to a state of increasing prices, and such a state is of great interest to policy-makers, investors and the general public. Inflation in Belize has been fairly steady and at a moderate level, and such a situation would be consistent with the view advocated by Meir (1989, p. 526) who said that some level of inflation is inevitable. The problem would be if the inflation were increasing at a rapid and unanticipated pace. The GDP deflator is only available on an annual basis in Belize; therefore, the CPI will continue to be the most popular measure of inflation in Belize. The following observations are worthy of mention:

- A. The CPI relies on quarterly pricing of a basket of goods, and periodic surveys of household expenditure are necessary for the selection of the goods and services in the CPI basket. The last survey was in 1990, and in order to maintain the representativeness of the basket, consideration should now be given to another survey.
- B. Following a sharp increase in the CPI in the second quarter of 1996, the forecast is for the index to stabilize, albeit at a higher level. The forecast is for inflation to fall to between 2-3% in 1997.
- C. Given the fixed exchange rate regime against the US dollar, and given the apparent effect that this exchange rate regime has had on the level of prices in Belize, the continued

commitment to the exchange rate is of paramount importance. Appropriate measures to stabilize the real exchange rate would, therefore, be desirable.

D. Economic variables such as the money supply and the fiscal balance have an impact on the CPI. Given the openness of the Belizean economy, the targeting of money supply would not be a viable proposition. It seems, therefore, that continued efforts at fiscal restraint will be of importance.

## **10. Conclusion**

Inflation can bring about a number of distortions in the economy. The real rate of interest on bank deposits can become unattractive to consumers due to inflation. Also, long-term investments may be adversely affected because investors may experience difficulty in establishing a real rate of return on investments in a climate of high and unpredictable inflation. A number of empirical findings have been examined in this paper. The conceptual issues relating to the measurement and ways of measuring inflation were raised. The CPI is available on a quarterly basis from the CSO, and it is the most sought after measure of inflation in Belize. Other measures of inflation have their advantages, and one would need to be cognizant of this in order to use the most appropriate measure in a given situation.

An exponential smoothing model was fitted to the quarterly CPI data, and the model is not restricted in the number of future periods it can provide forecasts for. The econometric model has two features to it; it provides a framework relating the CPI to money supply and the fiscal balance, and secondly, it has the ability of providing one period ahead forecasts. The model needs to be interpreted with caution, however, because of the limited number of data points associated with fiscal balance. The

stability of both the exponential model and the econometric model will be tested in the future as more data becomes available.

The data series on unemployment and wage rates were very limited; consequently, the impact of these variables on inflation could not be explored in this paper. Those are some of the issues that could be explored in future studies.

### **11. Acknowledgments**

The author wishes to express a debt of gratitude to Ms. Patricia Mendoza, Mr. Manuel Vasquez and Mr. Sidney Campbell of the Central Bank of Belize, and Mr. Glenford Avilez of the Central Statistical Office for the instructive suggestions offered during the course of writing and for the valuable comments made on an earlier draft of the paper. The author accepts full responsibility for all remaining errors in the paper.

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**APPENDIX A**

**TABLES**

**Table 1: CPI and Inflation - Actual, Econometric Forecast and Exponential Forecast, 1983 - 1997**

| Period | Actual CPI | Inflation | Econometric Forecast | Econ. Inflation | Exponential Forecast | Exp. Inflation |
|--------|------------|-----------|----------------------|-----------------|----------------------|----------------|
| 1983:2 | 81.0       | 0.2       | 81.0                 | 0.2             | 81.7                 | 2.0            |
| 1983:3 | 81.1       | 0.2       | 81.1                 | 0.2             | 81.8                 | 0.2            |
| 1983:4 | 82.8       | 2.1       | 82.8                 | 2.1             | 82.0                 | 0.2            |
| 1984:1 | 81.9       | -1.1      | 81.9                 | -1.1            | 83.1                 | 1.4            |
| 1984:2 | 83.3       | 1.7       | 83.3                 | 1.7             | 82.9                 | -0.3           |
| 1984:3 | 84.7       | 1.7       | 84.7                 | 1.7             | 84.1                 | 1.5            |
| 1984:4 | 87.6       | 3.4       | 87.6                 | 3.4             | 85.5                 | 1.6            |
| 1985:1 | 86.5       | -1.3      | 86.5                 | -1.3            | 87.8                 | 2.7            |
| 1985:2 | 88.5       | 2.3       | 88.5                 | 2.3             | 87.5                 | -0.4           |
| 1985:3 | 88.0       | -0.6      | 88.0                 | -0.6            | 89.3                 | 2.1            |
| 1985:4 | 87.1       | -1.0      | 87.1                 | -1.0            | 88.9                 | -0.5           |
| 1986:1 | 87.6       | 0.6       | 87.6                 | 0.6             | 87.5                 | -1.5           |
| 1986:2 | 87.1       | -0.6      | 87.1                 | -0.6            | 88.5                 | 1.2            |
| 1986:3 | 89.0       | 2.2       | 89.0                 | 2.2             | 88.0                 | -0.6           |
| 1986:4 | 89.2       | 0.2       | 89.2                 | 0.2             | 89.8                 | 2.0            |
| 1987:1 | 89.0       | -0.2      | 89.0                 | -0.2            | 89.6                 | -0.3           |
| 1987:2 | 89.2       | 0.2       | 89.2                 | 0.2             | 89.9                 | 0.4            |
| 1987:3 | 90.8       | 1.8       | 90.8                 | 1.8             | 90.1                 | 0.1            |
| 1987:4 | 91.0       | 0.2       | 91.0                 | 0.2             | 91.6                 | 1.7            |
| 1988:1 | 91.7       | 0.8       | 91.7                 | 0.8             | 91.4                 | -0.3           |
| 1988:2 | 92.4       | 0.8       | 92.4                 | 0.8             | 92.6                 | 1.4            |
| 1988:3 | 93.2       | 0.9       | 93.2                 | 0.9             | 93.2                 | 0.7            |
| 1988:4 | 94.0       | 0.9       | 94.0                 | 0.9             | 94.0                 | 0.8            |
| 1989:1 | 93.7       | -0.3      | 93.7                 | -0.3            | 94.3                 | 0.3            |
| 1989:2 | 94.2       | 0.5       | 94.2                 | 0.5             | 94.6                 | 0.3            |
| 1989:3 | 95.3       | 1.2       | 94.7                 | 0.5             | 95.1                 | 0.4            |
| 1989:4 | 96.0       | 0.7       | 95.4                 | 0.8             | 96.1                 | 1.1            |
| 1990:1 | 96.3       | 0.3       | 96.7                 | 1.4             | 96.3                 | 0.2            |
| 1990:2 | 96.8       | 0.5       | 97.1                 | 0.4             | 97.2                 | 0.9            |
| 1990:3 | 97.7       | 0.9       | 98.5                 | 1.5             | 97.7                 | 0.4            |
| 1990:4 | 100.0      | 2.4       | 100.0                | 1.5             | 98.5                 | 0.9            |
| 1991:1 | 101.1      | 1.1       | 99.7                 | -0.3            | 100.3                | 1.8            |
| 1991:2 | 101.7      | 0.6       | 102.2                | 2.5             | 102.0                | 1.7            |
| 1991:3 | 103.0      | 1.3       | 102.4                | 0.2             | 102.6                | 0.6            |
| 1991:4 | 103.1      | 0.1       | 102.7                | 0.2             | 103.8                | 1.2            |
| 1992:1 | 104.0      | 0.9       | 103.4                | 0.7             | 103.5                | -0.3           |
| 1992:2 | 104.5      | 0.5       | 104.6                | 1.1             | 104.9                | 1.4            |
| 1992:3 | 105.1      | 0.6       | 106.1                | 1.4             | 105.4                | 0.4            |
| 1992:4 | 105.2      | 0.1       | 105.5                | -0.6            | 105.9                | 0.6            |
| 1993:1 | 105.6      | 0.4       | 106.5                | 1.0             | 105.6                | -0.4           |
| 1993:2 | 105.8      | 0.2       | 106.8                | 0.2             | 106.5                | 0.9            |
| 1993:3 | 106.0      | 0.2       | 106.7                | -0.1            | 106.7                | 0.1            |
| 1993:4 | 107.6      | 1.5       | 106.4                | -0.2            | 106.9                | 0.2            |
| 1994:1 | 108.0      | 0.4       | 107.2                | 0.8             | 107.9                | 1.0            |
| 1994:2 | 109.0      | 0.9       | 109.5                | 2.1             | 108.9                | 0.9            |
| 1994:3 | 109.4      | 0.4       | 110.6                | 1.0             | 109.8                | 0.8            |
| 1994:4 | 109.6      | 0.2       | 108.9                | -1.5            | 110.2                | 0.4            |
| 1995:1 | 110.5      | 0.8       | 110.7                | 1.6             | 110.0                | -0.3           |
| 1995:2 | 111.6      | 1.0       | 110.8                | 0.1             | 111.4                | 1.3            |
| 1995:3 | 112.5      | 0.8       | 113.6                | 2.5             | 112.4                | 0.9            |
| 1995:4 | 113.9      | 1.2       | 114.1                | 0.5             | 113.3                | 0.8            |
| 1996:1 | 115.4      | 1.3       | 116.2                | 1.8             | 114.2                | 0.8            |
| 1996:2 | 119.9      | 3.9       | 119.0                | 2.4             | 116.3                | 1.8            |
| 1996:3 | 120.9      | 0.8       | 120.3                | 1.1             | 120.6                | 3.7            |
| 1996:4 | 121.2      | 0.2       | 120.3                | -0.1            | 121.7                | 0.9            |
| 1997:1 | 121.0      | -0.2      | 119.0                | -1.0            | 121.6                | -0.1           |
| 1997:2 | 120.4      | -0.5      | 121.7                | 2.3             | 122.5                | 0.8            |
| 1997:3 |            |           | 124.3                | 2.1             | 123.3                | 0.7            |
| 1997:4 |            |           |                      |                 | 124.1                | 0.7            |

**Table 2: Belize CPI - Actual and Forecast, US CPI, M2 and Fiscal Balance, 1983 - 1997**

| Period | BZ CPI | Econometric Forecast | Exponential Forecast | US CPI | M2 (Bz\$ mn.) | Fiscal Balance (Bz\$ mn.) |
|--------|--------|----------------------|----------------------|--------|---------------|---------------------------|
| 1983:1 | 80.8   | 80.8                 | 80.1                 | 75.0   | 148.0         |                           |
| 1983:2 | 81.0   | 81.0                 | 81.7                 | 75.9   | 157.4         |                           |
| 1983:3 | 81.1   | 81.1                 | 81.8                 | 76.8   | 160.2         |                           |
| 1983:4 | 82.8   | 82.8                 | 82.0                 | 77.5   | 160.3         |                           |
| 1984:1 | 81.9   | 81.9                 | 83.1                 | 78.3   | 164.8         |                           |
| 1984:2 | 83.3   | 83.3                 | 82.9                 | 79.2   | 164.1         |                           |
| 1984:3 | 84.7   | 84.7                 | 84.1                 | 80.1   | 166.4         |                           |
| 1984:4 | 87.6   | 87.6                 | 85.5                 | 80.7   | 165.7         |                           |
| 1985:1 | 86.5   | 86.5                 | 87.8                 | 81.2   | 169.1         |                           |
| 1985:2 | 88.5   | 88.5                 | 87.5                 | 82.2   | 168.5         |                           |
| 1985:3 | 88.0   | 88.0                 | 89.3                 | 82.7   | 166.8         |                           |
| 1985:4 | 87.1   | 87.1                 | 88.9                 | 83.5   | 172.7         |                           |
| 1986:1 | 87.6   | 87.6                 | 87.5                 | 83.7   | 186.5         |                           |
| 1986:2 | 87.1   | 87.1                 | 88.5                 | 83.4   | 193.0         |                           |
| 1986:3 | 89.0   | 89.0                 | 88.0                 | 84.1   | 190.9         |                           |
| 1986:4 | 89.2   | 89.2                 | 89.8                 | 84.5   | 199.4         |                           |
| 1987:1 | 89.0   | 89.0                 | 89.6                 | 85.5   | 208.6         |                           |
| 1987:2 | 89.2   | 89.2                 | 89.9                 | 86.6   | 218.6         |                           |
| 1987:3 | 90.8   | 90.8                 | 90.1                 | 87.6   | 225.4         |                           |
| 1987:4 | 91.0   | 91.0                 | 91.6                 | 88.3   | 241.2         |                           |
| 1988:1 | 91.7   | 91.7                 | 91.4                 | 88.9   | 255.6         |                           |
| 1988:2 | 92.4   | 92.4                 | 92.6                 | 89.9   | 265.2         |                           |
| 1988:3 | 93.2   | 93.2                 | 93.2                 | 91.2   | 262.4         |                           |
| 1988:4 | 94.0   | 94.0                 | 94.0                 | 92.1   | 280.2         |                           |
| 1989:1 | 93.7   | 93.7                 | 94.3                 | 93.2   | 294.4         |                           |
| 1989:2 | 94.2   | 94.2                 | 94.6                 | 94.6   | 310.3         | -2.8                      |
| 1989:3 | 95.3   | 94.7                 | 95.1                 | 95.5   | 316.7         | 0.7                       |
| 1989:4 | 96.0   | 95.4                 | 96.1                 | 96.4   | 324.1         | 9.9                       |
| 1990:1 | 96.3   | 96.7                 | 96.3                 | 98.0   | 344.2         | -6.2                      |
| 1990:2 | 96.8   | 97.1                 | 97.2                 | 99.0   | 357.8         | -1.0                      |
| 1990:3 | 97.7   | 98.5                 | 97.7                 | 100.7  | 369.1         | 6.4                       |
| 1990:4 | 100.0  | 100.0                | 98.5                 | 102.4  | 377.0         | -5.3                      |
| 1991:1 | 101.1  | 99.7                 | 100.3                | 103.2  | 401.4         | 1.6                       |
| 1991:2 | 101.7  | 102.2                | 102.0                | 103.8  | 416.2         | -10.5                     |
| 1991:3 | 103.0  | 102.4                | 102.6                | 104.6  | 423.6         | -15.1                     |
| 1991:4 | 103.1  | 102.7                | 103.8                | 105.4  | 429.1         | -10.8                     |
| 1992:1 | 104.0  | 103.4                | 103.5                | 106.1  | 433.7         | -0.6                      |
| 1992:2 | 104.5  | 104.6                | 104.9                | 107.0  | 463.4         | -11.7                     |
| 1992:3 | 105.1  | 106.1                | 105.4                | 107.8  | 469.6         | -26.3                     |
| 1992:4 | 105.2  | 105.5                | 105.9                | 108.6  | 469.2         | -11.6                     |
| 1993:1 | 105.6  | 106.5                | 105.6                | 109.5  | 468.5         | -7.6                      |
| 1993:2 | 105.8  | 106.8                | 106.5                | 110.4  | 482.3         | -23.7                     |
| 1993:3 | 106.0  | 106.7                | 106.7                | 110.8  | 470.4         | -14.5                     |
| 1993:4 | 107.6  | 106.4                | 106.9                | 111.6  | 473.6         | -7.1                      |
| 1994:1 | 108.0  | 107.2                | 107.9                | 112.3  | 500.8         | -6.3                      |
| 1994:2 | 109.0  | 109.5                | 108.9                | 113.0  | 513.1         | -4.2                      |
| 1994:3 | 109.4  | 110.6                | 109.8                | 114.0  | 504.9         | -17.2                     |
| 1994:4 | 109.6  | 108.9                | 110.2                | 114.5  | 507.2         | 2.8                       |
| 1995:1 | 110.5  | 110.7                | 110.0                | 115.5  | 526.3         | -15.2                     |
| 1995:2 | 111.6  | 110.8                | 111.4                | 116.5  | 551.6         | -4.7                      |
| 1995:3 | 112.5  | 113.6                | 112.4                | 117.0  | 565.2         | -11.5                     |
| 1995:4 | 113.9  | 114.1                | 113.3                | 117.6  | 589.3         | -9.3                      |
| 1996:1 | 115.4  | 116.2                | 114.2                | 118.6  | 622.9         | -7.5                      |
| 1996:2 | 119.9  | 119.0                | 116.3                | 119.8  | 628.3         | 4.1                       |
| 1996:3 | 120.9  | 120.3                | 120.6                | 120.4  | 627.2         | 4.2                       |
| 1996:4 | 121.2  | 120.3                | 121.7                | 121.3  | 625.3         | -10.1                     |
| 1997:1 | 121.0  | 119.0                | 121.6                |        | 658.4         | -9.3                      |
| 1997:2 | 120.4  | 121.7                | 122.5                |        | 678.1         | 4.4                       |
| 1997:3 |        | 124.3                | 123.3                |        |               |                           |
| 1997:4 |        |                      | 124.1                |        |               |                           |

**APPENDIX B****OUTPUT****Box 1: Exponential Smoothing**

Sample: 1983:1 1996:4  
 Included observations: 56  
 Method: Holt-Winters Additive Seasonal  
 Original Series: BZ\_CPI  
 Forecast Series: BZ\_CPISM1

|                          |            |                  |
|--------------------------|------------|------------------|
| Parameters:              | Alpha      | 0.9600           |
|                          | Beta       | 0.0000           |
|                          | Lambda     | 0.0000           |
| Sum of Squared Residuals |            | 44.93467         |
| Root Mean Squared Error  |            | 0.895771         |
| End of Period Levels:    | Mean       | 121.0445         |
|                          | Trend      | 0.729567         |
|                          | Seasonals: | 1996:1 -0.220828 |
|                          |            | 1996:2 -0.032538 |
|                          |            | 1996:3 0.077181  |
|                          |            | 1996:4 0.176185  |

**Box 2: Econometric Model Affected By Heteroscedasticity**

LS // Dependent Variable is BZ\_CPI  
 Sample(adjusted): 1989:3 1996:4  
 Included observations: 30 after adjusting endpoints

| Variable           | Coefficient | Std. Error            | t-Statistic | Prob.  |
|--------------------|-------------|-----------------------|-------------|--------|
| C                  | 41.07336    | 10.52775              | 3.901439    | 0.0006 |
| BZ_CPI(-1)         | 0.477002    | 0.143313              | 3.328386    | 0.0027 |
| US_CPI(-1)         | -0.062386   | 0.100719              | -0.619407   | 0.5413 |
| M2(-1)             | 0.047716    | 0.011638              | 4.099916    | 0.0004 |
| TFBAL(-1)          | 0.046919    | 0.017852              | 2.628131    | 0.0145 |
| R-squared          | 0.992302    | Mean dependent var    | 106.5567    |        |
| Adjusted R-squared | 0.991070    | S.D. dependent var    | 7.162146    |        |
| S.E. of regression | 0.676796    | Akaike info criterion | -0.629760   |        |
| Sum squared resid  | 11.45131    | Schwarz criterion     | -0.396227   |        |
| Log likelihood     | -28.12176   | F-statistic           | 805.6623    |        |
| Durbin-Watson stat | 1.940819    | Prob(F-statistic)     | 0.000000    |        |



**Box 3: Econometric Model Fitted**

LS // Dependent Variable is BZ\_CPI

Date: 09/15/97 Time: 08:04

Sample(adjusted): 1989:3 1996:4

Included observations: 30 after adjusting endpoints

| Variable           | Coefficient | Std. Error            | t-Statistic | Prob.  |
|--------------------|-------------|-----------------------|-------------|--------|
| C                  | 70.32320    | 0.755462              | 93.08640    | 0.0000 |
| M2(-1)             | 0.079095    | 0.001625              | 48.68761    | 0.0000 |
| TFBAL(-1)          | 0.076377    | 0.017444              | 4.378382    | 0.0002 |
| R-squared          | 0.988846    | Mean dependent var    | 106.5567    |        |
| Adjusted R-squared | 0.988020    | S.D. dependent var    | 7.162146    |        |
| S.E. of regression | 0.783920    | Akaike info criterion | -0.392257   |        |
| Sum squared resid  | 16.59233    | Schwarz criterion     | -0.252137   |        |
| Log likelihood     | -33.68430   | F-statistic           | 1196.849    |        |
| Durbin-Watson stat | 1.757369    | Prob(F-statistic)     | 0.000000    |        |

**Box 4: Forecast Characteristics of Fitted Model**

Actual: BZ\_CPI Forecast: BZ\_CPIF1

Sample: 1989:3 1997:1

Include observations: 30

|                                |          |
|--------------------------------|----------|
| Root Mean Squared Error        | 0.743692 |
| Mean Absolute Error            | 0.661259 |
| Mean Absolute Percentage Error | 0.618419 |
| Theil Inequality Coefficient   | 0.003482 |
| Bias Proportion                | 0.000000 |
| Variance Proportion            | 0.002804 |
| Covariance Proportion          | 0.997196 |