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Money and Price in Bhutan: Relationship Augmented with Indian Inflation

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Errors or misinterpretations and all viewpoints expressed are the sole responsibility of the author, not NSB or its authority.

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Abstract

The main objective of the study was to examine the behavior of inflation in Bhutan and the extent to which it was affected by money supply and Indian inflation.

The study used secondary data available in published sources to examine the functional relationship between dependent and explanatory variables. Multiple linear regression analysis was used to test the hypotheses. Granger causality test was conducted to determine the direction of causality between variables. Coefficients of correlation were calculated to see the degree of relationship between variables.

Though economic theory suggests that money supply has immediate effect on price, the study found out that money supply in Bhutan was significantly impacting price only after two lags. Likewise, Indian inflation was also impacting on Bhutanese price only after 1 and 3 lags.

The study found out that in Bhutan broad money (M2) had stronger relationship with price compared to M1. It also showed that Indian inflation was causing Bhutanese inflation and not the other way round. However, there wasn’t any causal relationship between money supply and price in Bhutan. The degree of relationship was found significant between Bhutanese price and Indian inflation.

Various diagnostic tests were performed on the model to validate its adequacy for policy formulation and forecasting. These tests showed the absence of autocorrelation, heteroskedasticity, multicollinearity and specification errors. The regression parameters were found to be stable and residuals were normally distributed.

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Introduction

In financial markets throughout the globe, central banks play a major role in shaping monetary policy. The central banks' role covers the interest rates, the amount of credit, and the money supply, all of which directly affect not only the financial markets, but also aggregate output of the economy and inflation.

The primary monetary policy objective of many central banks is price stability. So is the objective of the central bank of Bhutan, the Royal Monetary Authority (RMA), which was established in 1982. The fundamental goal while designing monetary policy is to figure out the factors that drive inflation. This would include the type of shocks that cause inflationary impulse and the nature of propagation mechanisms. Seeking price stability as the ultimate objective of central bank would be futile if the empirical link between monetary variables and price is weak.

Friedman (1963) posited that inflation is always and everywhere a monetary phenomenon. However, this theory has been criticized by the Structuralist School of thoughts on the ground that supply constraints have wider repercussions on the overall price level. In Bhutan, inflation is tracked to the movements of Indian inflation and as such, the query whether inflation is a monetary phenomenon or influenced by the Indian inflation is not merely educational, but will have profound implications for policy formulation.

To better understand inflation processes, the paper developed an empirical model based on the "quantity theory of money". It is expected to help explain the causes of inflation in Bhutan. Available evidence suggested that in the current market basket of 363 commodities used in measuring consumer price index (CPI), around 70 percent of the items were imported from India. Such a situation led to the expectation that imports from India would play a significant role in determining inflation in Bhutan, and that there would be similar movements of inflation in the two countries.

Given these assumptions, there was a need to find out the implication of Indian inflation on the Bhutanese inflation other than money supply.

Theoretical Framework

Bronfenbrenner (1990, p.142) in his book on Macroeconomics has defined inflation "as the significant and sustained increase in the general price level". Though inflation does not directly cost on the growth of an economy, it indirectly punctures the wheels of economy like investment, resource allocation, and balance of payments and so on.

The study is anchored on the "Quantity Theory of Money" which assumes that the "movements in the price level results solely from changes in the quantity of money". The equation of exchange, which relates nominal income to the quantity of money and velocity, is:

$$MV=PY$$

Where M is the money supply, V is the velocity of money, P is the price level and Y is the aggregate output (income). Fisher viewed that velocity of money (V) was fairly constant in the short run. Moreover, the classical economists thought that wages and prices were completely flexible and they believed that the level of aggregate output (Y) would remain at the full employment level, so Y in the equation of exchange could also be treated as constant in the short run.

As V and Y were assumed to be constant in the short run, the equation converts to:

$$P = f(M)$$

Hypothesis

The following hypotheses were tested in the study:

1. The inflation in Bhutan has no significant relationship with the money supply and Indian inflation.

2. The inflation in Bhutan as measured by price level is not significantly affected by the behavior of money supply and Indian inflation.

3. There is no significant evidence to show that money supply and Indian inflation collectively affect the inflation in Bhutan.

4. Inflation in Bhutan is not a stable function of money supply and Indian inflation.

5. Inflation in Bhutan is not caused by the individual behavior of money supply and Indian inflation.

Scope and the Limitation

The study encompasses the macroeconomic approaches to determine the causes of inflation in Bhutan in relation to ‘quantity theory of money ‘and determinants of price and inflation in India. The analysis is done in the macroeconomic context; the process involved investigating the relationship between explanatory variables with the dependent variable at the macro level and not on a particular sector.

The study was aimed at determining the causes of inflation. Beside the factors already described; other factors that could cause inflation were not considered.

The base year of Price Index in Bhutan and Price Index in India were different. So, the components were rebased to 2003 (second half of the year) in line with the base year of Bhutan CPI.

Methodology

Since the purpose of this study was to determine whether the causes of inflation in Bhutan were explained by the determinants like money supply and Indian inflation over a period of time, a descriptive causal approach was chosen to present the procedures and for the conduct of study. The empirical data were reviewed and regression analysis was used to validate the functional relationship between the dependent and explanatory variables. It also looked into the direction of causation between the variables.

Sources of Data

The study used secondary data available in published sources. The time series data for inflation was obtained from the quarterly CPI reports published by National Statistical Bureau (NSB) of Bhutan. The data on Indian inflation was compiled from the Reserve Bank of India website and Office of the economic advisor to the government of India, the Ministry of commerce and industry web site. The data on money supply was compiled from the annual reports published by RMA.

Functional forms of estimating equation

To examine the functional relationship between dependent variable and the explanatory variables, first the data's were converted into their natural logarithms. This was done because time series variables have overall trends of exponential growth. Then multiple linear regression analysis was used to test the hypothesis.

The specification of the model in natural log form:

$$D(lnCPI) = b_0 + b_1 D(lnM) + b_2 D(lnIWPI) + u$$

Where, b_0, b_1, b_2 are the regression coefficients, $\ln CPI$ is the natural log of consumer price index, $\ln M$ is the natural log of money supply, $\ln IWPI$ is the natural log of wholesale price index of India and u is the error term.

Though the functional form of the relationship was developed from the quantity theory of money, the impact of money supply on inflation may not be instantaneous. In order to capture delayed effect of money supply, the distributed lag model was constructed. Since Bhutan and India has porous borders, it was deemed necessary to use Indian prices as well to build the relationship. However, to see the impact of whether it was immediate or after certain lags, distributed lag model was developed. The final equation for the relationship in their natural logs can be written as:

$$D(lnCPI) = D(lnM) + D(lnM(-1)) + D(lnM(-n)) + D(lnIWPI) + D(lnIWPI(-1)) + D(lnIWPI(-n)) + u$$

The natural log of price served as the dependent variable with natural log of money supply and natural log of price in India as the explanatory variables.

Modeling Strategy

Since it is necessary to conduct unit root test before the interpretation to avoid spurious regression, a unit root test was performed on all the variables.

Unit Root Test

Augmented Dickey Fuller Test

To test the presence of unit root or to see if the regression model was stationary or non-stationary, Augmented Dickey-Fuller test was conducted. The test for the presence of unit root was conducted on every individual variable, as the data used were time series data and the possibility of non-stationary variables were highly likely which could lead to spurious regression. The Augmented Dickey-Fuller test equation is as follows:

$$\Delta P_t = b_0 + b_1 t + \delta P_{t-1} + \alpha_1 \sum_{i-1}^{m} \Delta P_{t-1}$$

Where, t is time trend and $\alpha_1 \sum_{i-1}^{m} \Delta P_{t-1}$ is difference lagged terms.

The Tau value and Dickey-Fuller or Mackinnon value were compared at 1 percent level of significance. The null hypothesis was rejected or accepted in accordance to the result and considered the series stationary or non stationary.

In case of those variables where Tau value of δ was insignificant, the non-stationary time series was transformed into a stationary series. Those series, which had unit root and are non-stationary at levels, their first difference became stationary.

Table 1 is the summary of the unit root test conducted on the variables using Augmented Dickey Fuller (ADF) Test. The result clearly showed (see also Appendix: 1 and 2) that all the variables have unit root in their levels I (O) indicating that the levels were non-stationary.

Table 1: Unit Root Test

Variables	**ADF Test statistics**	**MacKinnon critical values.**		
		1%	**5%**	**10%**
LNCPI with C	-3.1327	-3.5625	-2.9190	-2.5970
LNCPI with C and Trend	-1.2982	-4.1458	-3.4987	-3.1782
D(LNCPI) with C	**-4.4161**	-3.5653	-2.9202	-2.5977
D(LNCPI) with C and Trend	**-4.9614**	-4.1498	-3.5005	-3.1793
LNIWPI with C	-1.8375	-3.5625	-2.9190	-2.5970
LNIWPI with C and Trend	-1.4439	-4.1458	-3.4987	-3.1782
D(LNIWPI) with C	**-6.1973**	-3.5653	-2.9202	-2.5977
D(LNIWPI) with C and Trend	**-6.4264**	-4.1498	-3.5005	-3.1793
LNM1 with C	-0.2666	-3.5625	-2.9190	-2.5970
LNM1 with C and Trend	-4.3632	-4.1458	-3.4987	-3.1782
D(LNM1) with C	**-11.8178**	-3.5653	-2.9202	-2.5977
D(LNM1) with C and Trend	**-11.6944**	-4.1498	-3.5005	-3.1793
LNM2 with C	-0.9413	-3.5625	-2.9190	-2.5970
LNM2 with C and Trend	-2.3069	-4.1458	-3.4987	-3.1782
D(LNM2) with C	**-11.7241**	-3.5653	-2.9202	-2.5977
D(LNM2) with C and Trend	**-11.7997**	-4.1498	-3.5005	-3.1793

At first difference it was found that all the series rejected the null hypothesis at 1 percent MacKinnon critical values. So, the series were found to be stationary at first difference.

Based on the findings, the preferred equation for the money price relationship augmented with Indian price was:

$$D(lnCPI) = b_0 + b_1 D(lnM) + b_2 D(lnIWPI)$$

Co-integration

It is a known fact that two variables are co-integrated if they individually follow a unit root process, but jointly move together in the long run. If

$$Y_t = Y_{t-1} + e_{Yt}$$

and

$$X_t = X_{t-1} + e_{Xt}$$

we see that, Y and X have a unit root. However, if there is no unit root in the error term from the regression,

$$Y_t = b_0 + b_1 X_t + u_t$$

Then Y and X are co-integrated. (Salvatore, 2002, p 247)

In order to establish a co-integrating relationship among variables, it was necessary to test the residual of the equation at levels for unit root. So, residuals were obtained (see Appendix: 3) and tested for unit root at levels I (O) without intercept and trend. The result obtained indicated that residuals were not stationary at levels. However, with the residuals obtained from first difference of the variables showed stationarity which means the variables were co-integrated of order I(1).

Table 2: Unit Root Test on Residuals

Variable				ADF Test statistics	MacKinnon critical values.		
Dependent	**Independent**	**Cons.**	**Trend**		**1%**	**5%**	**10%**
LNCPI	LNIWPI	NO	NO	-2.0536	-2.6081	-1.9471	-1.6191
D(LNCPI)	D(LNIWPI)	NO	NO	**-7.4858**	-2.6090	-1.9473	-1.6192
LNCPI	LNM1	NO	NO	-1.7591	-2.6081	-1.9471	-1.6191
D(LNCPI)	D(LNM1)	NO	NO	**-9.6285**	-2.6090	-1.9473	-1.6192
LNCPI	LNM2	NO	NO	-2.1052	-2.6081	-1.9471	-1.6191
D(LNCPI)	D(LNM2)	NO	NO	**-9.3673**	-2.6090	-1.9473	-1.6192

The result indicated the presence of long-term relationship between the variables and the regression, and thus, would not be spurious.

Selection of Lag Lengths

In order to determine the number of lag effects and since the Granger test is sensitive to number of lags, a sequential procedure was adopted to determine the lag length. The current dependent variable was regressed on current explanatory variables. Then the further regression was carried out whereby explanatory variables were lagged by one period, two periods and so on. In order to determine the optimal lag length, adjusted R^2 approach was used. When the regression generated the highest adjusted R^2 and that point forward if the adjusted R^2 diminished that was a criterion for the optimal lag length.

Table 3: Selection of Lags

Variable		Adjusted R square
Dependent	**Independent**	
D(LNCPI)	D(LNIWPI)	0.16569
D(LNCPI)	D(LNIWPI), D(LNIWPI(-1))	0.31959
D(LNCPI)	D(LNIWPI), D(LNIWPI(-1)), D(LNIWPI(-2))	0.32676
D(LNCPI)	D(LNIWPI), D(LNIWPI(-1)), D(LNIWPI(-2)), D(LNIWPI(-3))	**0.40194**
D(LNCPI)	D(LNIWPI), D(LNIWPI(-1)), D(LNIWPI(-2)), D(LNIWPI(-3)), D(LNIWPI(-4))	0.39978
D(LNCPI)	D(LNM2)	-0.01748
D(LNCPI)	D(LNM2), D(LNM2(-1)),	-0.03965
D(LNCPI)	D(LNM2), D(LNM2(-1)), D(LNM2(-2))	**0.03793**
D(LNCPI)	D(LNM2), D(LNM2(-1)), D(LNM2(-2)), D(LNM2(-3))	0.02776
D(LNCPI)	D(LNM1)	-0.01348
D(LNCPI)	D(LNM1), D(LNM1(-1)),	-0.03269
D(LNCPI)	D(LNM1), D(LNM1(-1)), D(LNM1(-2))	-0.04032
D(LNCPI)	D(LNM1), D(LNM1(-1)), D(LNM1(-2)), D(LNM1(-3))	-0.05680
D(LNCPI)	D(LNM1), D(LNM1(-1)), D(LNM1(-2)), D(LNM1(-3)), D(LNM1(-4))	-0.07769
D(LNCPI)	D(LNM1), D(LNM1(-1)), D(LNM1(-2)), D(LNM1(-3)), D(LNM1(-4)), D(LNM1(-5))	-0.07732
D(LNCPI)	D(LNM1), D(LNM1(-1)), D(LNM1(-2)), D(LNM1(-3)), D(LNM1(-4)), D(LNM1(-5)), D(LNM1(-6))	-0.10441

The result indicated that the optimal lag length in the model was 3 for Indian wholesale price index and 2 for broad money supply. At 3 lags and 2 lags respectively, the adjusted R^2 was at the highest and after that point it began to diminish. For money supply (M1), the adjusted R^2 wasn't improving even after 5 lags. So, the use of M1 was ruled out from the equation.

Multiple Regression Analysis

The final model after differencing and lag estimation, the variables were as follows,

$$D(lnCPI) = D(lnM2) + D(lnM2(-1)) + D(lnM2(-2)) + D(lnIWPI) + D(lnIWPI(-1)) + D(lnIWPI(-2)) + D(lnIWPI(-3)) + u$$

Regression Results

Regressing Bhutan's inflation on the chosen variables generated the results as presented below.

$$D(lnCPI)=-0.0094 -0.0050D(lnM2)+ 0.0212D(lnM2(-1))+ 0.0905D(lnM2(-2)+ 0.2099D(lnIWPI)+ 0.1050D(lnIWPI(-1))+0.1059D(lnIWPI(-2))+0.3079D(lnIWPI(-3))$$

(-1.2085) (-0.1844) (0.7588) (3.3770)

(2.0510) (3.9476) (0.5500) (2.9821)

R^2 =0.5747 Adjusted R^2 =0.5003

D-W = 1.6800 *F-ratio* =7.7227

However, money supply (M2) without lags depicted unusual characteristic as it was found to have negative relation with Inflation in Bhutan. Though such relationship could be possible, it did not agree with the theory. Moreover, money supply (M2) at one lag and Indian wholesale price index at two lags showed statistically insignificant t-statistics. Since, the coefficient of the M2 without lags, M2 with one lag and Indian wholesale price index at two lags was found insignificant and its presence in the model hindered the conduct of structural stability test, it was deemed necessary to subject the three variables for redundant variable test.

Redundant Variable Test

Redundant variables test allowed testing for the statistical significance of a subset of the included variables. More formally, the test was for whether subsets of variables in an equation all have zero coefficients and might thus be deleted from the equation.

In order to have sufficient justification to eliminate *D(lnM2)*, *D(lnM2(-1))* and *D(lnIWPI(-2))* from the model, the redundant variable test was applied. It can be seen from Table 4 (see also Appendix: 8), that the variable proved to be redundant in the model.

Table 4: Redundant Variable Test

Redundant Variables: D(LNM2) D(LNM2(-1)) D(LNIWPI(-2))

F-statistic	0.273018	Probability	0.844487
Log likelihood ratio	0.972936	Probability	0.807800

The F-statistics obtained, which is 0.273018 was lower than the critical F-statistics value of 2.80 at $\propto = 0.05$ with (3, 48) degrees of freedom. The variables in the test emerged to be redundant.

Thus, the final preferred equation for the study is presented below.

$$D(lnCPI) = c + D(lnM(-2)) + D(lnIWPI) + D(lnIWPI(-1)) + D(lnIWPI(-3)) + u$$

Pearson's Correlation Coefficient (r)

Pearson's correlation coefficient was used in order to find out the degree of relationship between price in Bhutan and the chosen explanatory variables.

$$r = \frac{\sum x_i y_i}{\sqrt{\left(\sum x_i^2\right)\left(\sum y_i^2\right)}}$$

The computed value was compared with the critical value to determine the extent of relationship.

To find out if there were relationships among the variables, Pearson's coefficient of correlation was calculated. The results are presented in Table 5.

Table 5: Correlation Matrix

		D(LNCPI)	D(LNM2(-2))	D(LNIWPI)	D(LNIWPI(-1))	D(LNIWPI(-3))
D(LNCPI)	Pearson Correlation	1	.233	.400**	.503**	.365**
	Sig. (1-tailed)		.056	.002	.000	.005
	N	48	48	48	48	48
D(LNM2(-2))	Pearson Correlation	.233	1	.242*	-.232	-.291*
	Sig. (1-tailed)	.056		.049	.057	.022
	N	48	48	48	48	48
D(LNIWPI)	Pearson Correlation	.400**	.242*	1	.152	.028
	Sig. (1-tailed)	.002	.049		.152	.425
	N	48	48	48	48	48
D(LNIWPI(-1))	Pearson Correlation	.503**	-.232	.152	1	.195
	Sig. (1-tailed)	.000	.057	.152		.092
	N	48	48	48	48	48
D(LNIWPI(-3))	Pearson Correlation	.365**	-.291*	.028	.195	1
	Sig. (1-tailed)	.005	.022	.425	.092	
	N	48	48	48	48	48

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

The relationship between price in Bhutan and Indian wholesale price without lags and with 1 and 3 lags respectively, the relationship was found significant at 1 percent level of significance. However, the relationship between money supply and price was not significant at any level of significance though the relationship was in accordance with the theory.

Therefore the hypothesis, *"The inflation in Bhutan has no significant relationship with the identified variables like money supply by 2 lag M2(-2), Indian wholesale price IWPI, Indian wholesale price by 1 lag IWPI(-1) and Indian wholesale price by 3 lags (IWPI(-3))"* could not be rejected in the case of money supply at various lags but in the case of Indian wholesale price the hypothesis was rejected meaning there is relationship between Bhutanese price and Indian wholesale price at various lags.

Interpretation of Results

(i) Analysis of Regression Results

Regressing price in Bhutan against money supply lagged by 2 period and Indian wholesale price without lag and with 1 and 3 lags respectively, generated the following result (see also appendix: 9)

Table 6: Regression Results

D(lnCPI)=--0.00678+0.0855D(lnM2(-2))+ 0.1972D(lnIWPI)+ 0.4387D(lnIWPI(-1))+

0.3388D (lnIWPI(-3))

(-1.1291) (3.6138) (2.0370) (4.5910)

(3.5863)

R^2*=0.5660Adjusted* R^2*=0.5257*

D-W=1.6999F-ratio=14.0212

a)Student's t-test (t)

The student's t-test is used to test the statistical significance of the parameter estimates of the regression.

$$t = \frac{\hat{b}}{se\hat{b}}$$

The computed "t" value was compared to the critical value at n-k degrees of freedom and the null hypothesis that coefficient 'b' was not significantly different from zero was rejected meaning the explanatory variable under consideration had significant effect on the dependent variable and vice versa. Where 'n' was number of observation and 'k' was the number of variables used in the model.

The estimated regression coefficients showed that one percent rise in money supply lag by 2 period (M2 (-2)) increased the rate of change of inflation in Bhutan by 0.0855 percent. Money supply lagged by 2 periods (M2 (-2)) was also in accordance with the theory and the study revealed that inflation in Bhutan was significantly affected by increase in money supply lagged by 2 periods. The effect was also found significant because the computed t-value of 3.6138 was higher than the critical t-value of 2.017 at $\propto = 0.05$ with 43 degrees of freedom. It was found significant even at $\propto = 0.01$ which had a critical t-value of 2.695 with 43 degrees of freedom.

The Indian inflation without lag was also in accordance to the theory. The estimated regression coefficient showed that one percent rise in Indian inflation without lag increased the rate of change of Inflation in Bhutan by 0.1972 percent. The effect was found significant at $\propto = 0.05$. The computed t-value of 2.0370 was higher than critical t-value of 2.017 with 43 degrees of freedom.

The Indian inflation after certain lags not only confirmed empirical suspicion about its effect but was also found significantly affecting inflation in Bhutan. The findings indicated that a one percent increase in the rate of change of Indian inflation with 1 lag lead to increase the rate of change of inflation in Bhutan by 0.4387 percent. The computed t-value of 4.5910 was greater than the critical t-value of 2.017 at $\propto = 0.05$ with 43 degrees of freedom. It was found significant even at $\propto = 0.01$.

The Indian inflation lagged by 3 periods showed that, one percent increase in the rate of change of Indian inflation increased the rate of change of Bhutan's inflation by 0.3388 percent. It was also found significant because the computed t-value of 3.5863 was higher than the critical t-value of 2.017 with 43 degrees of freedom. It was also found significant at $\propto = 0.01$

Therefore, the null hypothesis stating, *Inflation in Bhutan as measured by price level is not significantly affected by the behavior of money supply, and Indian inflation"* was rejected meaning all the variables had significant effect on Bhutanese Inflation.

b)The Adjusted Coefficient of Determination

The coefficient of determination was used to determine whether the variation in inflation was explained by the variation in the explanatory variables.

$$R^2 = 1 - \frac{\sum \hat{y}_i^{\,2}}{\sum y_i^{\,2}} = 1 - \frac{\sum \hat{e}^2}{\sum y^2}$$

A high adjusted R^2 explained that variation in inflation was indeed explained by the explanatory variables.

The adjusted R^2 was measured at 0.525658. The adjusted R^2 indicated that 52.57 percent of the variation in the rate of change of inflation was explained by the behavior of rate of change of money supply lagged by certain periods and rate of change of Indian inflation and its lagged terms. In other words, it showed that 47.43 percent of the variation in the rate of change of inflation in Bhutan was attributed to factors other than those included in the model. The measure of goodness of fit for the equation was not highly satisfactory but it was deemed okey. The low adjusted R^2 could have been due to the omission of other variables, whose data were not available in Bhutan's statistical system and also due to insufficiency of time series observations for this study.

c)Test of the Overall Significance of the Regression (F)

Test of overall significance was used to determine the ratio of the explained to the unexplained or residual variance. It followed the F-distribution with k-1 and n-k degrees of freedom, where 'n' was the number of observations and 'k' was number of parameters estimated.

$$F_{k-1,n-k} = \frac{R^2/(k-1)}{(1-R^2)/(n-k)} = \frac{ESS/df}{RSS/df}$$

The computed F ratio was compared to the critical F ratio and the result was determined accordingly whether the model was statistically significant or not.

The test of overall significance of the regression model (F), otherwise also known as analysis of variance (ANOVA), which determines the ratio of the explained to the unexplained variance, showed that the calculated F-statistics = 14.02118 was greater than the critical F-ratio of 2.59 at $\alpha = 0.05$ and (4, 43) degrees of freedom. It showed that coefficients of explanatory variables were not equal to zero and the regression model is therefore statistically significant. The model was found significant even at $\propto$ = 0.01 where the critical F-value was measured at 3.79.

The null hypothesis stating, "*There is no significant evidence to show that money supply lagged by certain periods and Indian inflation and its lagged periods taken collectively affect the inflation in Bhutan"* was rejected and it signified that there was enough evidence to show that the explanatory variables collectively affected the inflation in Bhutan.

Supplementary Diagnostic Tests

a)Jarque-Bera (JB) test for normality of residuals

The JB test was used to determine if residuals were normal.

$$JB = n\left[\frac{S^2}{6} + \frac{(k+3)^2}{24}\right]$$

Where, n was the number of observations, S was the skewness of residual and K was the kurtosis.

The JB test followed the chi square distribution at 2 degrees of freedom. If the J – B was less then the critical Chi square value at 2 degrees of freedom, then the residuals were considered normally distributed.

However, if the residuals were not normally distributed, the test of parameters and overall significance of the model would be invalid.

Therefore, the normality of the residuals was tested using JB test and found out that the residuals were normally distributed. The JB value obtained was 0.281335 (Refer 11) and it was lower than the chi-square value of 5.99 at 2 degrees of freedom and 5 percent level of significance. Therefore, the t-test and F-test on the regression model were valid.

b)Auxiliary Regression

Auxiliary regression was used to detect the presence or absence of multicollinearity. The technique included regressing each of the explanatory variable with the remaining variable to determine which variables were collinear, using OLS as follows:

M2(-2) = f(CPI), IWPI, IWPI(-1) IWPI(-3))

IWPI = f(CPI), M2(-2), IWPI(-1) IWPI(-3))

IWPI(-1) = f(CPI, M2(-2), IWPI, IWPI(-3))

IWPI(-3) = f(CPI, M2(-2), IWPI, IWPI(-1))

For each auxiliary regression, the coefficient of determination R^2 was obtained and was used to detect the presence or absence of multicollinearity. Klein's rule of thumb suggested, "Multicollinearity is troublesome if the R^2 obtained from an auxiliary regression is greater than the overall R^2 obtained from the regressing dependent variable to explanatory variable".

The results of auxiliary regressions for each explanatory variable against the other explanatory variable are presented in the table 7.

Table 7 : Auxiliary Regression

Variable		**Adjusted R square**
Dependent	**Independent**	
D(LNM2(-2))	D(LNCPI), D(LNIWPI) D(LNIWPI(-1)), D(LNIWPI(-3))	0.32482
D(LNIWPI)	D(LNCPI), D(LNM2(-2)), D(LNIWPI(-1)), D(LNIWPI(-3)	0.11227
D(LNIWPI(-1))	D(LNCPI), D(LNM2(-2)), D(LNIWPI), D(LNIWPI(-3)	0.34851
D(LNIWPI(-3))	D(LNCPI), D(LNM2(-2)), D(LNIWPI), D(LNIWPI(-2)	0.24902

Based on the Klein's rule of thumb, the presence of multicollinearity was ruled out because the obtained overall R^2 of 0.525658 was greater than any of the R^2 obtained from the auxiliary regression.

c)The Durbin Watson Test (DW)

The DW was used to detect the presence or absence of autocorrelation.

$$DW = \frac{\sum (e_t - e_{t-1})^2}{\sum e^2 t}$$

To determine the critical DW value, the degrees of freedom used was k' and n. Where k' was the number of explanatory variables and n was the number of observation. So, computed and critical DW values were compared to see if there existed autocorrelation.

The DW for the current study was computed at d = 1.699991 (Refer Appendix 9). The critical value of d_u = 1.67076 and d_L = 1.40640 at $\alpha = 0.05$ with 48 observations and 4 explanatory variables. The condition to be satisfied for absence of autocorrelation was $d_U < d < 4 - d_U$, and since the value satisfied the condition as given by $1.67076 < 1.699991 < 2.32924$, there was no evidence of autocorrelation at 5 percent level of significance.

d)White's Heteroskedasticity Test

White's heteroskedasticity test was used to check if the variance of error term was constant for all the values of the explanatory variables. The procedure included regressing the squared residuals, u^2 on all explanatory variables. The coefficient of regression, R^2 was then obtained from the auxiliary regression and multiplied to the sample size, $n \times R^2$, giving the computed chi-square value. The obtained value was then compared to the chi-squared distribution. Under the current study, the auxiliary regression expanded to:

$$\hat{u}_i^2 = \alpha_0 + \alpha_1 M2(-2) + \alpha_2 IWPI + \alpha_3 IWPI(-1) + \alpha_4 IWPI(-3) \\ + \alpha_5 M2(-2)^2 + \alpha_6 IWPI^2 + \alpha_7 IWPI(-1)^2 + \alpha IWPI_8(-3)^2 + u$$

If the computed chi square value did not exceed the critical chi-square value at n – m degrees of freedom, the presence of heteroskedasticity was ruled out. Where n was number of observation and m was total number of coefficients.

The White's Heteroskedasticity test generated a coefficient of multiple determination equivalent to R^2= 0.092190 (See Appendix 14). When multiplied by the number of observations, n = 48, the computed chi-square value was χ^2 = 4.25132. Since it did not exceed the tabulated chi-square value χ^2 = 55.76 at $\alpha = 0.05$ and 40 degrees of freedom, the presence of heteroskedasticity was also ruled out in the model, again indicating that the ultimate parameters were unbiased.

e)Ramsey's Regression Specification Error Test (RESET)

The test was used to determine the possible misspecification of the model. RESET proceeded by obtaining OLS fitted values $\hat{P}$ from the original regression and introduced regressors of different powers of $\hat{P}$ (upto the sixth power). The expanded equation become

$$CPI_t = b_0 + b_1 M2(-2) + b_2 IWPI + b_3 IWPI(-1) + b_4 IWPI(-3) + \delta_1 C\hat{P}I^2 + \delta_2 C\hat{P}I^3 + \delta_3 C\hat{P}I^4 + \\ \delta_4 C\hat{P}I^5 + \delta_5 C\hat{P}I^6 + u$$

After obtaining the RSS, general F-test was applied as follows:

$$F = \frac{RSS_R - RSS_{UR}/k}{RSS_{UR}/n-k}$$

Where, RSS was the Residual Sum of Squares, R was restricted, UR was unrestricted and K was number of explanatory variables.

If calculated F ratio was less than the critical value of F at (k, n – k) degrees of freedom, there was no specification error.

The computed F-statistics, which is 0.202329, is lower than the tabulated F – statistics, which is 2.13 at $\alpha = 0.05$ and (9,39) degrees of freedom. Therefore, there was no evidence of specification error in the model.

f)Chow Breakpoint Test

The test was used to determine the structural stability of the model. The breakpoint was established at the mid year period and splited the data into two groups, then the model became:

$$P_t = a_1 + b_1 M2(-2) + c_1 IWPI + d_1 IWPI(-1) + e_1 IWPI(-3) + u$$

and

$$P_t = a_2 + b_2 M2(-2) + c_2 IWPI + d_2 IWPI(-1) + e_2 IWPI(-3) + u$$

The chow test followed the F distribution:

$$F = \frac{(RSS_C - (RSS_1 + RSS_2))/k}{(RSS_1 + RSS_2)/(n_1 + n_2 - 2k)}$$

Where, RSS_C was the Residual Sum of Squares from the combined data; RSS_1 was the Residual Sum of Squares from the first group, RSS_2 was the Residual Sum of Squares from the second group, n_1 *and* n_2 were the no. of observations in each group and *K* was the total no. of parameters.

If the computed F value was lower than the critical F value at (k, $n_1 + n_2 - 2k$) degrees of freedom, the model was deemed structurally stability.

The test for structural stability of the model using the Chow breakpoint test was performed at the midyear observation 1998 second half. The test revealed an F – ratio of 0.988030 (Refer Appendix 13). The corresponding critical value of F ratio at 4, 44 degrees of freedom and at 5 percent level of significance is 2.58. Since the computed F ratio is much lower than the tabulated F ratio, it signified that there was no structural change in parameters of the model.

Therefore, the hypothesis "*Inflation in Bhutan is not a stable function of money supply and Indian inflation"* was rejected.

Granger Causality test

Regression analysis only provided statistical relationship between dependent and explanatory variables. But the statistical relationship obtained did not imply causation of the variables. Therefore, the direction of causality was established using Granger Causality test.

The Granger (1969) approach to the question of whether x causes y was to see how much of the current y could be explained by past values of y and then to see whether adding lagged values of x could improve the explanation. y was said to be Granger-caused by x if x helped in the prediction of y, or equivalently if the coefficients on the lagged x's were statistically significant. The regression for Granger causality test was:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \dots\dots\dots + \alpha_i y_{t-i} + \beta_1 x_{t-1} + \dots\dots\dots + \beta_i x_{t-1}$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \dots\dots\dots + \alpha_i x_{t-i} + \beta_1 y_{t-1} + \dots\dots\dots + \beta_i y_{t-1}$$

For all possible pairs of (x,y) series in the group. The reported F-statistics were Wald statistics for the joint hypothesis:

$$\beta_1 = \dots\dots\dots = \beta_i = 0$$

For each equation, the null hypothesis was therefore that x does not Granger-cause y in the first regression and that y does not Granger-cause x in the second regression.

It followed F – distribution at (m, n-k) degrees of freedom. Where, m was the number of lagged terms, n was the number of observation and k was the number of parameters in unrestricted model.

$$F = \frac{RSS_R - RSS_{UR}/m}{RSS_{UR}/n-k}$$

Where, RSSwas the Residual Sum of Squares, R was restricted, UR was unrestricted. The computed F-statistics was compared with the critical F-statistics in order to reject or accept the null hypothesis.

The result from the Granger causality test (see also Appendix: 16) is presented in Table 8.

Table 8: Granger Causality Test

Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Probability
D(LNM2) does not Granger Cause D(LNCPI)	50	0.06355	0.80207
D(LNCPI) does not Granger Cause D(LNM2)		0.48249	0.49072
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Probability
D(LNM2) does not Granger Cause D(LNCPI)	49	2.65892	0.08126
D(LNCPI) does not Granger Cause D(LNM2)		0.32949	0.72105
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Probability
D(LNIWPI) does not Granger Cause D(LNCPI)	50	5.77894	0.02022
D(LNCPI) does not Granger Cause D(LNIWPI)		0.2971	0.58829
Lags: 2			

Null Hypothesis:	Obs	F-Statistic	Probability
D(LNIWPI) does not Granger Cause D(LNCPI)	49	4.1317	0.02268
D(LNCPI) does not Granger Cause D(LNIWPI)		0.0044	0.99561
Lags: 3			
Null Hypothesis:	Obs	F-Statistic	Probability
D(LNIWPI) does not Granger Cause D(LNCPI)	48	3.7297	0.01848
D(LNCPI) does not Granger Cause D(LNIWPI)		1.69358	0.18335

There was no bi-directional causality between Bhutanese inflation and money supply at 1 lag. The F-statistics was measured at 0.06355 in case of money supply Granger causing inflation in Bhutan and 0.48249 in case of inflation in Bhutan causing money supply. Since the critical F-statistics value at (1, 45) degrees of freedom was 4.06, the null hypothesis of the test could not be rejected. It was same in case of 2 lags also. The F-statistics measured at 2.65892 in case of money supply Granger causing inflation in Bhutan and 0.32949 in case of inflation in Bhutan causing money supply could not be rejected because the critical F-statistics value at (2, 44) degrees of freedom was 3.21.

At $\alpha = 0.05$, Indian inflation after one lag did Granger cause Bhutanese inflation because computed F-statistics of 5.77894 was higher than the critical F-statistics of 4.06 with (1, 45) degrees of freedom. But there wasn’t opposite causation because computed F-statistics of 0.2971 was lower than the critical F-statistics of 4.06. Even after 2 lags, Indian inflation did Granger cause Bhutanese inflation because the computed F-statistics of 4.1317 was higher than the critical F-statistics of 3.21 with (2, 44) degrees of freedom. Similarly there was no opposite causation. After 3 lags also, Indian inflation did Granger cause Bhutanese inflation because the computed F-statistics of 3.7297 was higher than the critical F-statistics of 2.82 at (3, 43) degrees of freedom. There was no opposite causation. Since, Indian inflation did Granger cause inflation in Bhutan at $\alpha = 0.05$, it signified that Indian inflation had precedence over Bhutanese inflation at various lags.

Therefore, the null hypothesis, *"Inflation in Bhutan is not caused by the individual behavior of Money supply and Indian inflation"* was rejected in case of Indian inflation. However, the hypothesis could not be rejected in case of money supply.

Conclusion

Based on the findings of the study, the following conclusions were drawn:

1. Inflation in Bhutan had been influenced by Indian inflation and to certain extent by broad money supply.

2. The functional relationship between money supply and inflation was found to be strong only in case of money supply with 2 lags. Therefore, such behavior in the monetary variables signified that inflation in Bhutan was not sensitive to fluctuations in money supply immediately but it had effect only after a year. Functional relationship between Indian inflation and Bhutanese inflation was established and it was found that there was immediate impact of Indian inflation on Bhutanese inflation. The impact was also highly significant after one and three lags. So, it can be concluded that Indian inflation does not take time to reach Bhutan and its effect continues for 1.5 years.

3. The causality test described significant causation between the Indian inflation and Bhutanese inflation. Indian inflation did Granger cause Bhutanese inflation but not the other way around. It signified that Indian inflation had precedence over Bhutanese inflation.

4. There was no bi-directional causality between money supply and Bhutanese inflation. The possible reason for such a situation could be due to Indian inflation. First it is the Indian inflation that effects the Bhutanese inflation and then only it is the money supply that fuels further the inflation in Bhutan.

Recommendations

1. It is highly recommended that Bhutan government now encourage building a strong domestic manufacturing base in order to curve imports from India. Building a strong manufacturing base will not only lessen the burden of imported inflation but it will lead to a more rapid economic growth and industrialization.

2. However, since developing manufacturing base will take considerable time, it is recommended that the immediate action from the government should be to reduce imports from India, basically through gradually imposing import taxes and quotas. Though such an action would likely be retaliated by the Indian government, the adverse effect would probably not significantly damage the Bhutanese economy. Such initiatives would not only control adverse affect of business cycles, it would generate more revenues for the Bhutan government.

3. For further enhancement of the result, it is recommended that future studies along this area may consider other variables like, real output, interest rates, exchange rates, employment, balance of payment, budget deficit, etc. and increased observations to have more in-depth analysis on the causes of inflation in Bhutan. The increased observation and additional variables will not only increase the "goodness of fit" of model but generate more reliable results.

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Appendix 1: Unit root test at levels

(i). ADF Test on LNCPI with constant

ADF Test Statistic	-3.132671	1% Critical Value*	-3.5625
		5% Critical Value	-2.9190
		10% Critical Value	-2.5970

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 06/21/12 Time: 10:44
Sample(adjusted): 1986:2 2011:2
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPI(-1)	-0.014992	0.004786	-3.132671	0.0029
C	0.099557	0.020598	4.833359	0.0000

R-squared	0.166860	Mean dependent var	0.035490
Adjusted R-squared	0.149857	S.D. dependent var	0.019007
S.E. of regression	0.017525	Akaike info criterion	-5.211974
Sum squared resid	0.015049	Schwarz criterion	-5.136216
Log likelihood	134.9053	F-statistic	9.813630
Durbin-Watson stat	1.377325	Prob(F-statistic)	0.002922

(ii). ADF Test on LNCPI with constant and trend

ADF Test Statistic	-1.298150	1% Critical Value*	-4.1458
		5% Critical Value	-3.4987
		10% Critical Value	-3.1782

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 06/21/12 Time: 11:41
Sample(adjusted): 1986:2 2011:2
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPI(-1)	-0.032503	0.025038	-1.298150	0.2004
C	0.158226	0.084889	1.863925	0.0685
@TREND(1986:1)	0.000622	0.000872	0.712643	0.4795

R-squared	0.175582	Mean dependent var	0.035490

Adjusted R-squared	0.141232	S.D. dependent var	0.019007
S.E. of regression	0.017613	Akaike info criterion	-5.183283
Sum squared resid	0.014891	Schwarz criterion	-5.069647
Log likelihood	135.1737	F-statistic	5.111462
Durbin-Watson stat	1.368394	Prob(F-statistic)	0.009717

(iii). ADF Test on LNIWPI with constant

ADF Test Statistic	-1.837530	1% Critical Value*	-3.5625
		5% Critical Value	-2.9190
		10% Critical Value	-2.5970

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNIWPI)
Method: Least Squares
Date: 06/21/12 Time: 11:49
Sample(adjusted): 1986:2 2011:2
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIWPI(-1)	-0.010601	0.005769	-1.837530	0.0722
C	0.080398	0.024926	3.225510	0.0022

R-squared	0.064466	Mean dependent var	0.034902
Adjusted R-squared	0.045374	S.D. dependent var	0.021012
S.E. of regression	0.020529	Akaike info criterion	-4.895487
Sum squared resid	0.020651	Schwarz criterion	-4.819729
Log likelihood	126.8349	F-statistic	3.376515
Durbin-Watson stat	1.878499	Prob(F-statistic)	0.072199

(iv). ADF Test on LNIWPI with constant and trend.

ADF Test Statistic	-1.443882	1% Critical Value*	-4.1458
		5% Critical Value	-3.4987
		10% Critical Value	-3.1782

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNIWPI)
Method: Least Squares
Date: 06/21/12 Time: 11:52
Sample(adjusted): 1986:2 2011:2

Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIWPI(-1)	-0.053944	0.037360	-1.443882	0.1553
C	0.227807	0.127981	1.780003	0.0814
@TREND(1986:1)	0.001485	0.001265	1.174111	0.2461

R-squared	0.090584	Mean dependent var	0.034902
Adjusted R-squared	0.052692	S.D. dependent var	0.021012
S.E. of regression	0.020451	Akaike info criterion	-4.884586
Sum squared resid	0.020075	Schwarz criterion	-4.770949
Log likelihood	127.5569	F-statistic	2.390568
Durbin-Watson stat	1.850930	Prob(F-statistic)	0.102400

(v). ADF Test on LNM2 with constant

ADF Test Statistic	-0.941259	1% Critical Value*	-3.5625
		5% Critical Value	-2.9190
		10% Critical Value	-2.5970

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNM2)
Method: Least Squares
Date: 06/21/12 Time: 11:54
Sample(adjusted): 1986:2 2011:2
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNM2(-1)	-0.008296	0.008814	-0.941259	0.3512
C	0.165209	0.076560	2.157907	0.0359

R-squared	0.017760	Mean dependent var	0.094118
Adjusted R-squared	-0.002286	S.D. dependent var	0.089357
S.E. of regression	0.089459	Akaike info criterion	-1.951641
Sum squared resid	0.392145	Schwarz criterion	-1.875883
Log likelihood	51.76685	F-statistic	0.885969
Durbin-Watson stat	2.981949	Prob(F-statistic)	0.351190

(vi). ADF Test on LNM2 with constant and trend.

ADF Test Statistic	-2.306896	1% Critical Value*	-4.1458

		5% Critical Value	-3.4987
		10% Critical Value	-3.1782

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNM2)
Method: Least Squares
Date: 06/21/12 Time: 11:55
Sample(adjusted): 1986:2 2011:2
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNM2(-1)	-0.212454	0.092095	-2.306896	0.0254
C	1.400000	0.559514	2.502173	0.0158
@TREND(1986:1)	0.019797	0.008892	2.226269	0.0307

R-squared	0.109689	Mean dependent var	0.094118
Adjusted R-squared	0.072593	S.D. dependent var	0.089357
S.E. of regression	0.086053	Akaike info criterion	-2.010691
Sum squared resid	0.355443	Schwarz criterion	-1.897054
Log likelihood	54.27262	F-statistic	2.956887
Durbin-Watson stat	2.663491	Prob(F-statistic)	0.061517

(vii) ADF Test on LNM1 with constant

ADF Test Statistic	-0.266608	1% Critical Value*	-3.5625
		5% Critical Value	-2.9190
		10% Critical Value	-2.5970

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNM1)
Method: Least Squares
Date: 06/21/12 Time: 11:57
Sample(adjusted): 1986:2 2011:2
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNM1(-1)	-0.003204	0.012018	-0.266608	0.7909
C	0.123023	0.095990	1.281633	0.2060

R-squared	0.001449	Mean dependent var	0.097843
Adjusted R-squared	-0.018930	S.D. dependent var	0.121265
S.E. of regression	0.122408	Akaike info criterion	-1.324494

Sum squared resid	0.734198	Schwarz criterion	-1.248736
Log likelihood	35.77460	F-statistic	0.071080
Durbin-Watson stat	2.958948	Prob(F-statistic)	0.790890

(viii). ADF Test on LNM1 with constant and trend

ADF Test Statistic	-4.363204	1% Critical Value*	-4.1458
		5% Critical Value	-3.4987
		10% Critical Value	-3.1782

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNM1)
Method: Least Squares
Date: 06/21/12 Time: 11:57
Sample(adjusted): 1986:2 2011:2
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNM1(-1)	-0.568653	0.130329	-4.363204	0.0001
C	3.137903	0.697579	4.498277	0.0000
@TREND(1986:1)	0.054961	0.012628	4.352185	0.0001

R-squared	0.283995	Mean dependent var	0.097843
Adjusted R-squared	0.254161	S.D. dependent var	0.121265
S.E. of regression	0.104727	Akaike info criterion	-1.617897
Sum squared resid	0.526452	Schwarz criterion	-1.504260
Log likelihood	44.25637	F-statistic	9.519311
Durbin-Watson stat	2.232578	Prob(F-statistic)	0.000330

Appendix 2: Unit root test at 1st difference
(i). ADF Test on LNCPI with constant

ADF Test Statistic	-4.416070	1% Critical Value*	-3.5653
		5% Critical Value	-2.9202
		10% Critical Value	-2.5977

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPI,2)
Method: Least Squares
Date: 06/21/12 Time: 12:00
Sample(adjusted): 1987:1 2011:2
Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPI(-1))	-0.582922	0.132000	-4.416070	0.0001
C	0.020919	0.005273	3.966860	0.0002

R-squared	0.288906	Mean dependent var	0.000400
Adjusted R-squared	0.274092	S.D. dependent var	0.020698
S.E. of regression	0.017635	Akaike info criterion	-5.198711
Sum squared resid	0.014927	Schwarz criterion	-5.122230
Log likelihood	131.9678	F-statistic	19.50167
Durbin-Watson stat	2.291901	Prob(F-statistic)	0.000057

(ii). ADF Test on LNCPI with constant and trend.

ADF Test Statistic	-4.961392	1% Critical Value*	-4.1498
		5% Critical Value	-3.5005
		10% Critical Value	-3.1793

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPI,2)
Method: Least Squares
Date: 06/21/12 Time: 12:01
Sample(adjusted): 1987:1 2011:2
Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPI(-1))	-0.701958	0.141484	-4.961392	0.0000
C	0.034850	0.008688	4.010995	0.0002
@TREND(1986:1)	-0.000368	0.000185	-1.984333	0.0531

R-squared	0.343875	Mean dependent var	0.000400
Adjusted R-squared	0.315955	S.D. dependent var	0.020698
S.E. of regression	0.017119	Akaike info criterion	-5.239165
Sum squared resid	0.013773	Schwarz criterion	-5.124443
Log likelihood	133.9791	F-statistic	12.31637
Durbin-Watson stat	2.156159	Prob(F-statistic)	0.000050

(iii). ADF Test on LNIWPI with constant.

ADF Test Statistic	-6.197279	1% Critical Value*	-3.5653
		5% Critical Value	-2.9202
		10% Critical Value	-2.5977

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNIWPI,2)
Method: Least Squares
Date: 06/21/12 Time: 12:02
Sample(adjusted): 1987:1 2011:2
Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNIWPI(-1))	-0.888970	0.143445	-6.197279	0.0000
C	0.030936	0.005830	5.306098	0.0000

R-squared	0.444485	Mean dependent var	0.000000
Adjusted R-squared	0.432912	S.D. dependent var	0.028284
S.E. of regression	0.021300	Akaike info criterion	-4.821084
Sum squared resid	0.021776	Schwarz criterion	-4.744603
Log likelihood	122.5271	F-statistic	38.40627
Durbin-Watson stat	1.998141	Prob(F-statistic)	0.000000

(iv). ADF Test on LNIWPI with constant and trend.

ADF Test Statistic	-6.426372	1% Critical Value*	-4.1498
		5% Critical Value	-3.5005
		10% Critical Value	-3.1793

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNIWPI,2)
Method: Least Squares

Date: 06/21/12 Time: 12:03
Sample(adjusted): 1987:1 2011:2
Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNIWPI(-1))	-0.939653	0.146218	-6.426372	0.0000
C	0.040791	0.008968	4.548595	0.0000
@TREND(1986:1)	-0.000305	0.000213	-1.434976	0.1579

R-squared	0.467801	Mean dependent var	0.000000
Adjusted R-squared	0.445155	S.D. dependent var	0.028284
S.E. of regression	0.021068	Akaike info criterion	-4.823963
Sum squared resid	0.020862	Schwarz criterion	-4.709242
Log likelihood	123.5991	F-statistic	20.65644
Durbin-Watson stat	1.966989	Prob(F-statistic)	0.000000

(v). ADF Test on LNM2 with constant

ADF Test Statistic	-11.72408	1% Critical Value*	-3.5653
		5% Critical Value	-2.9202
		10% Critical Value	-2.5977

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNM2,2)
Method: Least Squares
Date: 06/21/12 Time: 12:04
Sample(adjusted): 1987:1 2011:2
Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNM2(-1))	-1.483197	0.126509	-11.72408	0.0000
C	0.139304	0.016480	8.452823	0.0000

R-squared	0.741176	Mean dependent var	-0.001600
Adjusted R-squared	0.735784	S.D. dependent var	0.155122
S.E. of regression	0.079736	Akaike info criterion	-2.181025
Sum squared resid	0.305172	Schwarz criterion	-2.104544
Log likelihood	56.52562	F-statistic	137.4541
Durbin-Watson stat	1.768638	Prob(F-statistic)	0.000000

(vi). ADF Test on LNM2 with constant and trend

ADF Test Statistic	-11.79972	1% Critical Value*	-4.1498
		5% Critical Value	-3.5005
		10% Critical Value	-3.1793

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNM2,2)
Method: Least Squares
Date: 06/21/12 Time: 12:05
Sample(adjusted): 1987:1 2011:2
Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNM2(-1))	-1.495805	0.126766	-11.79972	0.0000
C	0.163249	0.027341	5.970863	0.0000
@TREND(1986:1)	-0.000858	0.000783	-1.096298	0.2785

R-squared	0.747629	Mean dependent var	-0.001600
Adjusted R-squared	0.736890	S.D. dependent var	0.155122
S.E. of regression	0.079568	Akaike info criterion	-2.166275
Sum squared resid	0.297563	Schwarz criterion	-2.051553
Log likelihood	57.15687	F-statistic	69.61701
Durbin-Watson stat	1.783442	Prob(F-statistic)	0.000000

(vii). ADF Test on LNM1 with constant

ADF Test Statistic	-11.81783	1% Critical Value*	-3.5653
		5% Critical Value	-2.9202
		10% Critical Value	-2.5977

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNM1,2)
Method: Least Squares
Date: 06/21/12 Time: 12:07
Sample(adjusted): 1987:1 2011:2
Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNM1(-1))	-1.485283	0.125681	-11.81783	0.0000
C	0.146758	0.019595	7.489538	0.0000

R-squared	0.744220	Mean dependent var	0.001200
Adjusted R-squared	0.738891	S.D. dependent var	0.210894
S.E. of regression	0.107764	Akaike info criterion	-1.578567
Sum squared resid	0.557429	Schwarz criterion	-1.502086
Log likelihood	41.46416	F-statistic	139.6612
Durbin-Watson stat	1.959171	Prob(F-statistic)	0.000000

(viii). ADF Test on LNM1 with constant and trend.

ADF Test Statistic	-11.69443	1% Critical Value*	-4.1498
		5% Critical Value	-3.5005
		10% Critical Value	-3.1793

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNM1,2)
Method: Least Squares
Date: 06/21/12 Time: 12:08
Sample(adjusted): 1987:1 2011:2
Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNM1(-1))	-1.485203	0.127001	-11.69443	0.0000
C	0.149545	0.034457	4.340007	0.0001
@TREND(1986:1)	-0.000105	0.001067	-0.098839	0.9217

R-squared	0.744273	Mean dependent var	0.001200
Adjusted R-squared	0.733391	S.D. dependent var	0.210894
S.E. of regression	0.108893	Akaike info criterion	-1.538774
Sum squared resid	0.557313	Schwarz criterion	-1.424053
Log likelihood	41.46936	F-statistic	68.39489
Durbin-Watson stat	1.959711	Prob(F-statistic)	0.000000

Appendix 3: Residual table

(i). LNCPI AND LNIWPI

```
Actual     Fitted     Residual    Residual Plot
 3.28000   3.30853   -0.02853    |       .*  |   .       |
 3.31000   3.34948   -0.03948    |        *  |   .       |
 3.33000   3.35971   -0.02971    |       .*  |   .       |
 3.39000   3.42113   -0.03113    |        *  |   .       |
 3.43000   3.46208   -0.03208    |        *  |   .       |
 3.48000   3.49278   -0.01278    |       .  *|   .       |
 3.51000   3.51326   -0.00326    |       .   *   .       |
 3.56000   3.57467   -0.01467    |       . * |   .       |
 3.61000   3.60538    0.00462    |       .   |*  .       |
 3.65000   3.66680   -0.01680    |       . * |   .       |
 3.72000   3.72822   -0.00822    |       .  *|   .       |
 3.78000   3.81010   -0.03010    |       .*  |   .       |
 3.87000   3.85105    0.01895    |       .   | * .       |
 3.93000   3.90223    0.02777    |       .   |  *.       |
 4.00000   3.92270    0.07730    |       .   |   .   *   |
 4.01000   3.98412    0.02588    |       .   |  *.       |
 4.05000   4.05577   -0.00577    |       .  *|   .       |
 4.09000   4.13766   -0.04766    |      *.   |   .       |
 4.13000   4.18884   -0.05884    |     * .   |   .       |
 4.19000   4.21955   -0.02955    |       .*  |   .       |
 4.22000   4.22979   -0.00979    |       .  *|   .       |
 4.27000   4.27073   -0.00073    |       .   *   .       |
 4.29000   4.28097    0.00903    |       .   |*  .       |
 4.33000   4.31168    0.01832    |       .   | * .       |
 4.38000   4.33215    0.04785    |       .   |   . *     |
 4.44000   4.37309    0.06691    |       .   |   .  *    |
 4.47000   4.37309    0.09691    |       .   |   .      *|
 4.48000   4.40380    0.07620    |       .   |   .   *   |
 4.50000   4.43451    0.06549    |       .   |   .  *    |
 4.53000   4.47545    0.05455    |       .   |   . *     |
 4.54000   4.49593    0.04407    |       .   |   .*      |
 4.56000   4.50616    0.05384    |       .   |   . *     |
 4.56000   4.51640    0.04360    |       .   |   .*      |
 4.58000   4.54711    0.03289    |       .   |   *       |
 4.58000   4.56758    0.01242    |       .   |*  .       |
 4.61000   4.59829    0.01171    |       .   |*  .       |
 4.63000   4.62900    0.00100    |       .   *   .       |
 4.65000   4.66994   -0.01994    |       . * |   .       |
 4.68000   4.68018   -0.00018    |       .   *   .       |
 4.70000   4.72112   -0.02112    |       . * |   .       |
 4.73000   4.74159   -0.01159    |       .  *|   .       |
 4.75000   4.79278   -0.04278    |      *.   |   .       |
 4.78000   4.80301   -0.02301    |       .*  |   .       |
 4.80000   4.82348   -0.02348    |       .*  |   .       |
 4.85000   4.87466   -0.02466    |       .*  |   .       |
 4.89000   4.92585   -0.03585    |        *  |   .       |
 4.90000   4.89514    0.00486    |       .   |*  .       |
```

<table>
<tr><td>4.92000</td><td>4.94632</td><td>-0.02632</td><td>| .* | . |</td></tr>
<tr><td>4.96000</td><td>4.99750</td><td>-0.03750</td><td>| * | . |</td></tr>
<tr><td>5.00000</td><td>5.03844</td><td>-0.03844</td><td>| * | . |</td></tr>
<tr><td>5.04000</td><td>5.08962</td><td>-0.04962</td><td>| * . | . |</td></tr>
<tr><td>5.09000</td><td>5.13057</td><td>-0.04057</td><td>| *. | . |</td></tr>
</table>

(ii). LNCPI AND LNM2

<table>
<tr><th>Actual</th><th>Fitted</th><th>Residual</th><th>Residual Plot</th></tr>
<tr><td>3.28000</td><td>3.38542</td><td>-0.10542</td><td>| *. | . |</td></tr>
<tr><td>3.31000</td><td>3.43178</td><td>-0.12178</td><td>| * . | . |</td></tr>
<tr><td>3.33000</td><td>3.43891</td><td>-0.10891</td><td>| * . | . |</td></tr>
<tr><td>3.39000</td><td>3.46744</td><td>-0.07744</td><td>| * | . |</td></tr>
<tr><td>3.43000</td><td>3.52450</td><td>-0.09450</td><td>| *. | . |</td></tr>
<tr><td>3.48000</td><td>3.56373</td><td>-0.08373</td><td>| * | . |</td></tr>
<tr><td>3.51000</td><td>3.61366</td><td>-0.10366</td><td>| *. | . |</td></tr>
<tr><td>3.56000</td><td>3.67071</td><td>-0.11071</td><td>| * . | . |</td></tr>
<tr><td>3.61000</td><td>3.67428</td><td>-0.06428</td><td>| .* | . |</td></tr>
<tr><td>3.65000</td><td>3.70638</td><td>-0.05638</td><td>| . * | . |</td></tr>
<tr><td>3.72000</td><td>3.74204</td><td>-0.02204</td><td>| .   *| . |</td></tr>
<tr><td>3.78000</td><td>3.78840</td><td>-0.00840</td><td>| .   *| . |</td></tr>
<tr><td>3.87000</td><td>3.79197</td><td>0.07803</td><td>| . | * |</td></tr>
<tr><td>3.93000</td><td>3.84546</td><td>0.08454</td><td>| . | * |</td></tr>
<tr><td>4.00000</td><td>3.84546</td><td>0.15454</td><td>| . | .   *|</td></tr>
<tr><td>4.01000</td><td>3.92035</td><td>0.08965</td><td>| . | * |</td></tr>
<tr><td>4.05000</td><td>3.91678</td><td>0.13322</td><td>| . | . * |</td></tr>
<tr><td>4.09000</td><td>3.99167</td><td>0.09833</td><td>| . | .* |</td></tr>
<tr><td>4.13000</td><td>4.00950</td><td>0.12050</td><td>| . | . * |</td></tr>
<tr><td>4.19000</td><td>4.10222</td><td>0.08778</td><td>| . | * |</td></tr>
<tr><td>4.22000</td><td>4.10222</td><td>0.11778</td><td>| . | . * |</td></tr>
<tr><td>4.27000</td><td>4.13432</td><td>0.13568</td><td>| . | .   *|</td></tr>
<tr><td>4.29000</td><td>4.19851</td><td>0.09149</td><td>| . | .* |</td></tr>
<tr><td>4.33000</td><td>4.29837</td><td>0.03163</td><td>| . |*   . |</td></tr>
<tr><td>4.38000</td><td>4.32333</td><td>0.05667</td><td>| . | * . |</td></tr>
<tr><td>4.44000</td><td>4.35186</td><td>0.08814</td><td>| . | * |</td></tr>
<tr><td>4.47000</td><td>4.39109</td><td>0.07891</td><td>| . | * |</td></tr>
<tr><td>4.48000</td><td>4.44815</td><td>0.03185</td><td>| . |*   . |</td></tr>
<tr><td>4.50000</td><td>4.46241</td><td>0.03759</td><td>| . | * . |</td></tr>
<tr><td>4.53000</td><td>4.50164</td><td>0.02836</td><td>| . |*   . |</td></tr>
<tr><td>4.54000</td><td>4.48024</td><td>0.05976</td><td>| . | * . |</td></tr>
<tr><td>4.56000</td><td>4.53017</td><td>0.02983</td><td>| . |*   . |</td></tr>
<tr><td>4.56000</td><td>4.53730</td><td>0.02270</td><td>| . |*   . |</td></tr>
<tr><td>4.58000</td><td>4.61932</td><td>-0.03932</td><td>| . * | . |</td></tr>
<tr><td>4.58000</td><td>4.63002</td><td>-0.05002</td><td>| . * | . |</td></tr>
<tr><td>4.61000</td><td>4.61932</td><td>-0.00932</td><td>| .   *| . |</td></tr>
</table>

<table>
<tr><td>4.63000</td><td>4.64072</td><td>-0.01072</td><td>| .   *| . |</td></tr>
<tr><td>4.65000</td><td>4.68351</td><td>-0.03351</td><td>| .   * | . |</td></tr>
<tr><td>4.68000</td><td>4.67995</td><td>5.1E-05</td><td>| .   *   . |</td></tr>
<tr><td>4.70000</td><td>4.72274</td><td>-0.02274</td><td>| .   * | . |</td></tr>
<tr><td>4.73000</td><td>4.75841</td><td>-0.02841</td><td>| .   * | . |</td></tr>
<tr><td>4.75000</td><td>4.82260</td><td>-0.07260</td><td>| .* | . |</td></tr>
<tr><td>4.78000</td><td>4.82973</td><td>-0.04973</td><td>| . * | . |</td></tr>
<tr><td>4.80000</td><td>4.86539</td><td>-0.06539</td><td>| .* | . |</td></tr>
<tr><td>4.85000</td><td>4.84043</td><td>0.00957</td><td>| . |*   . |</td></tr>
<tr><td>4.89000</td><td>4.90819</td><td>-0.01819</td><td>| .   *| . |</td></tr>
<tr><td>4.90000</td><td>4.91888</td><td>-0.01888</td><td>| .   *| . |</td></tr>
<tr><td>4.92000</td><td>5.02944</td><td>-0.10944</td><td>| * . | . |</td></tr>
<tr><td>4.96000</td><td>5.01161</td><td>-0.05161</td><td>| . * | . |</td></tr>
<tr><td>5.00000</td><td>5.08293</td><td>-0.08293</td><td>| * | . |</td></tr>
<tr><td>5.04000</td><td>5.07936</td><td>-0.03936</td><td>| . * | . |</td></tr>
<tr><td>5.09000</td><td>5.09719</td><td>-0.00719</td><td>| .   *   . |</td></tr>
</table>

(iii). LNCPI AND LNM1.

<table>
<tr><th>Actual</th><th>Fitted</th><th>Residual</th><th>Residual Plot</th></tr>
<tr><td>3.28000</td><td>3.41996</td><td>-0.13996</td><td>| * . | . |</td></tr>
<tr><td>3.31000</td><td>3.43044</td><td>-0.12044</td><td>| *. | . |</td></tr>
<tr><td>3.33000</td><td>3.49331</td><td>-0.16331</td><td>| * . | . |</td></tr>
<tr><td>3.39000</td><td>3.53872</td><td>-0.14872</td><td>| * . | . |</td></tr>
<tr><td>3.43000</td><td>3.59461</td><td>-0.16461</td><td>| * . | . |</td></tr>
<tr><td>3.48000</td><td>3.62954</td><td>-0.14954</td><td>| * . | . |</td></tr>
<tr><td>3.51000</td><td>3.68193</td><td>-0.17193</td><td>| * . | . |</td></tr>
<tr><td>3.56000</td><td>3.72734</td><td>-0.16734</td><td>| * . | . |</td></tr>
<tr><td>3.61000</td><td>3.70988</td><td>-0.09988</td><td>| * | . |</td></tr>
<tr><td>3.65000</td><td>3.72385</td><td>-0.07385</td><td>| . * | . |</td></tr>
<tr><td>3.72000</td><td>3.77974</td><td>-0.05974</td><td>| . * | . |</td></tr>
<tr><td>3.78000</td><td>3.83912</td><td>-0.05912</td><td>| . * | . |</td></tr>
<tr><td>3.87000</td><td>3.82864</td><td>0.04136</td><td>| . |*   . |</td></tr>
<tr><td>3.93000</td><td>3.87754</td><td>0.05246</td><td>| . | * . |</td></tr>
<tr><td>4.00000</td><td>3.83213</td><td>0.16787</td><td>| . | . * |</td></tr>
<tr><td>4.01000</td><td>3.87754</td><td>0.13246</td><td>| . | .* |</td></tr>
<tr><td>4.05000</td><td>3.84960</td><td>0.20040</td><td>| . | .   *|</td></tr>
<tr><td>4.09000</td><td>3.95438</td><td>0.13562</td><td>| . | .* |</td></tr>
<tr><td>4.13000</td><td>3.97185</td><td>0.15815</td><td>| . | . * |</td></tr>
<tr><td>4.19000</td><td>4.03822</td><td>0.15178</td><td>| . | . * |</td></tr>
<tr><td>4.22000</td><td>4.03472</td><td>0.18528</td><td>| . | . * |</td></tr>
<tr><td>4.27000</td><td>4.19889</td><td>0.07111</td><td>| . | * . |</td></tr>
<tr><td>4.29000</td><td>4.17793</td><td>0.11207</td><td>| . | * |</td></tr>
<tr><td>4.33000</td><td>4.21286</td><td>0.11714</td><td>| . | * |</td></tr>
<tr><td>4.38000</td><td>4.25827</td><td>0.12173</td><td>| . | .* |</td></tr>
<tr><td>4.44000</td><td>4.29670</td><td>0.14330</td><td>| . | . * |</td></tr>
<tr><td>4.47000</td><td>4.30718</td><td>0.16282</td><td>| . | . * |</td></tr>
<tr><td>4.48000</td><td>4.37005</td><td>0.10995</td><td>| . | * |</td></tr>
</table>

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4.50000    4.39450     0.10550   |    .    |    *    |
4.53000    4.42594     0.10406   |    .    |    *    |
4.54000    4.46436     0.07564   |    .    |  * .    |
4.56000    4.49580     0.06420   |    .    |  * .    |
4.56000    4.50278     0.05722   |    .    | *  .    |
4.58000    4.62504    -0.04504   |    .   *|    .    |
4.58000    4.61456    -0.03456   |    .   *|    .    |
4.61000    4.61106    -0.00106   |    .    *    .    |
4.63000    4.65298    -0.02298   |    .   *|    .    |
4.65000    4.66695    -0.01695   |    .   *|    .    |
4.68000    4.68442    -0.00442   |    .    *    .    |
4.70000    4.70537    -0.00537   |    .    *    .    |
4.73000    4.70887     0.02113   |    .    |*   .    |
4.75000    4.82414    -0.07414   |    . *  |    .    |
4.78000    4.84859    -0.06859   |    . *  |    .    |
4.80000    4.93940    -0.13940   |   * .   |    .    |
4.85000    4.86954    -0.01954   |    .   *|    .    |
4.89000    4.91495    -0.02495   |    .   *|    .    |
4.90000    4.95687    -0.05687   |    .  * |    .    |
4.92000    5.03022    -0.11022   |    *    |    .    |
4.96000    5.02673    -0.06673   |    . *  |    .    |
5.00000    5.11755    -0.11755   |    *    |    .    |
5.04000    5.13152    -0.09152   |    .*   |    .    |
5.09000    5.16295    -0.07295   |    . *  |    .    |
```

Appendix 4: Co-integration test on residual at levels

(i). ADF TEST ON RESIDUAL OF LNCPI AND LNIWPI. (no constant and trend)

ADF Test Statistic	-2.053615	1% Critical Value*	-2.6081
		5% Critical Value	-1.9471
		10% Critical Value	-1.6191

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESCPIWPI)
Method: Least Squares
Date: 06/21/12 Time: 13:27
Sample(adjusted): 1986:2 2011:2
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESCPIWPI(-1)	-0.161222	0.078506	-2.053615	0.0453

R-squared	0.077675	Mean dependent var	-0.000236
Adjusted R-squared	0.077675	S.D. dependent var	0.021788
S.E. of regression	0.020924	Akaike info criterion	-4.876390
Sum squared resid	0.021891	Schwarz criterion	-4.838511
Log likelihood	125.3480	Durbin-Watson stat	1.959121

(ii). ADF TEST ON RESIDUAL OF LNCPI AND LNM2. (no constant and trend).

ADF Test Statistic	-2.105215	1% Critical Value*	-2.6081
		5% Critical Value	-1.9471
		10% Critical Value	-1.6191

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESCPIM2)
Method: Least Squares
Date: 06/21/12 Time: 13:31
Sample(adjusted): 1986:2 2011:2
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESCPIM2(-1)	-0.141228	0.067085	-2.105215	0.0403

R-squared	0.079011	Mean dependent var	0.001926

Adjusted R-squared	0.079011	S.D. dependent var	0.037970
S.E. of regression	0.036439	Akaike info criterion	-3.766954
Sum squared resid	0.066389	Schwarz criterion	-3.729075
Log likelihood	97.05733	Durbin-Watson stat	2.408059

(iii). ADF TEST ON RESIDUAL OF LNCPI AND LNM1. (no constant and trend).

ADF Test Statistic	-1.759180	1% Critical Value*	-2.6081
		5% Critical Value	-1.9471
		10% Critical Value	-1.6191

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESCPIM1)
Method: Least Squares
Date: 06/21/12 Time: 13:33
Sample(adjusted): 1986:2 2011:2
Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESCPIM1(-1)	-0.103656	0.058923	-1.759180	0.0847

R-squared	0.057562	Mean dependent var	0.001314
Adjusted R-squared	0.057562	S.D. dependent var	0.047834
S.E. of regression	0.046437	Akaike info criterion	-3.282040
Sum squared resid	0.107818	Schwarz criterion	-3.244161
Log likelihood	84.69201	Durbin-Watson stat	2.494037

Appendix 5: Co-integration tests on residuals at 1st difference

(i). ADF TEST ON RESIDUAL OF LNCPI AND LNIWPI. (no constant and trend)

ADF Test Statistic	-7.485797	1% Critical Value*	-2.6090
		5% Critical Value	-1.9473
		10% Critical Value	-1.6192

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESCPIWPI,2)
Method: Least Squares
Date: 06/21/12 Time: 13:36
Sample(adjusted): 1987:1 2011:2
Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RESCPIWPI(-1))	-1.066193	0.142429	-7.485797	0.0000

R-squared	0.533424	Mean dependent var	0.000400
Adjusted R-squared	0.533424	S.D. dependent var	0.032071
S.E. of regression	0.021906	Akaike info criterion	-4.784288
Sum squared resid	0.023514	Schwarz criterion	-4.746047
Log likelihood	120.6072	Durbin-Watson stat	1.954086

(ii). ADF TEST ON RESIDUAL OF LNCPI AND LNM2. (no constant and trend).

ADF Test Statistic	-9.367287	1% Critical Value*	-2.6090
		5% Critical Value	-1.9473
		10% Critical Value	-1.6192

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESCPIM2,2)
Method: Least Squares
Date: 06/21/12 Time: 13:38
Sample(adjusted): 1987:1 2011:2
Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RESCPIM2(-1))	-1.288706	0.137575	-9.367287	0.0000

R-squared	0.641580	Mean dependent var	0.000971

Adjusted R-squared	0.641580	S.D. dependent var	0.061334
S.E. of regression	0.036720	Akaike info criterion	-3.751212
Sum squared resid	0.066068	Schwarz criterion	-3.712971
Log likelihood	94.78029	Durbin-Watson stat	1.849166

(iii). ADF TEST ON RESIDUAL OF LNCPI AND LNM1. (no constant and trend).

ADF Test Statistic	-9.628510	1% Critical Value*	-2.6090
		5% Critical Value	-1.9473
		10% Critical Value	-1.6192

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RESCPIM1,2)

Method: Least Squares

Date: 06/21/12 Time: 13:39

Sample(adjusted): 1987:1 2011:2

Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RESCPIM1(-1))	-1.308280	0.135876	-9.628510	0.0000

R-squared	0.654219	Mean dependent var	-1.90E-05
Adjusted R-squared	0.654219	S.D. dependent var	0.078068
S.E. of regression	0.045906	Akaike info criterion	-3.304626
Sum squared resid	0.103263	Schwarz criterion	-3.266385
Log likelihood	83.61564	Durbin-Watson stat	1.843962

Appendix 6: Ad-lag estimation

(i). D(LNCPI) C D(LNIWPI)

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:10

Sample(adjusted): 1986:2 2011:2

Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.022007	0.004748	4.635253	0.0000
D(LNIWPI)	0.386303	0.116849	3.305998	0.0018

R-squared	0.182374	Mean dependent var	0.035490
Adjusted R-squared	0.165688	S.D. dependent var	0.019007
S.E. of regression	0.017361	Akaike info criterion	-5.230772
Sum squared resid	0.014769	Schwarz criterion	-5.155014
Log likelihood	135.3847	F-statistic	10.92962
Durbin-Watson stat	1.519847	Prob(F-statistic)	0.001776

(ii). D(LNCPI) C D(LNIWPI) D(LNIWPI(-1))

Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 07/06/12 Time: 04:13

Sample(adjusted): 1987:1 2011:2

Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010722	0.005456	1.965211	0.0553
D(LNIWPI)	0.347242	0.107230	3.238284	0.0022
D(LNIWPI(-1))	0.367650	0.107230	3.428605	0.0013

R-squared	0.347365	Mean dependent var	0.035600
Adjusted R-squared	0.319593	S.D. dependent var	0.019183
S.E. of regression	0.015824	Akaike info criterion	-5.396490
Sum squared resid	0.011768	Schwarz criterion	-5.281769
Log likelihood	137.9122	F-statistic	12.50785

Durbin-Watson stat	1.592985	Prob(F-statistic)	0.000044

(iii). D(LNCPI) C D(LNIWPI) D(LNIWPI(-1)) D(LNIWPI(-2))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:15

Sample(adjusted): 1987:2 2011:2

Included observations: 49 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.007466	0.006139	1.216136	0.2303
D(LNIWPI)	0.308460	0.110596	2.789061	0.0077
D(LNIWPI(-1))	0.358349	0.107597	3.330476	0.0017
D(LNIWPI(-2))	0.148725	0.109463	1.358676	0.1810

R-squared	0.368836	Mean dependent var	0.035918
Adjusted R-squared	0.326758	S.D. dependent var	0.019248
S.E. of regression	0.015793	Akaike info criterion	-5.380342
Sum squared resid	0.011224	Schwarz criterion	-5.225907
Log likelihood	135.8184	F-statistic	8.765605
Durbin-Watson stat	1.615966	Prob(F-statistic)	0.000109

(iv). D(LNCPI) C D(LNIWPI) D(LNIWPI(-1)) D(LNIWPI(-2)) D(LNIWPI(-3))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:16

Sample(adjusted): 1988:1 2011:2

Included observations: 48 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001071	0.006314	0.169625	0.8661
D(LNIWPI)	0.278377	0.105460	2.639652	0.0115
D(LNIWPI(-1))	0.348076	0.104524	3.330121	0.0018
D(LNIWPI(-2))	0.124476	0.102917	1.209474	0.2331
D(LNIWPI(-3))	0.236403	0.102555	2.305138	0.0260

R-squared	0.452838	Mean dependent var	0.035417
Adjusted R-squared	0.401939	S.D. dependent var	0.019125
S.E. of regression	0.014790	Akaike info criterion	-5.491332
Sum squared resid	0.009407	Schwarz criterion	-5.296415
Log likelihood	136.7920	F-statistic	8.896839
Durbin-Watson stat	1.683699	Prob(F-statistic)	0.000025

(v). D(LNCPI) C D(LNIWPI) D(LNIWPI(-1)) D(LNIWPI(-2)) D(LNIWPI(-3)) D(LNIWPI(-4))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:18

Sample(adjusted): 1988:2 2011:2

Included observations: 47 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000793	0.006690	-0.118599	0.9062
D(LNIWPI)	0.248597	0.111679	2.226000	0.0316
D(LNIWPI(-1))	0.359049	0.107714	3.333372	0.0018
D(LNIWPI(-2))	0.105797	0.107120	0.987646	0.3291
D(LNIWPI(-3))	0.227707	0.104269	2.183835	0.0348
D(LNIWPI(-4))	0.104198	0.108903	0.956798	0.3443

R-squared	0.465017	Mean dependent var	0.035319
Adjusted R-squared	0.399775	S.D. dependent var	0.019320
S.E. of regression	0.014968	Akaike info criterion	-5.447050
Sum squared resid	0.009186	Schwarz criterion	-5.210861
Log likelihood	134.0057	F-statistic	7.127576
Durbin-Watson stat	1.614670	Prob(F-statistic)	0.000071

(vi). D(LNCPI) C D(LNM2)

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:19

Sample(adjusted): 1986:2 2011:2

Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.036564	0.003920	9.328550	0.0000
D(LNM2)	-0.011404	0.030343	-0.375845	0.7087

R-squared	0.002875	Mean dependent var	0.035490
Adjusted R-squared	-0.017475	S.D. dependent var	0.019007
S.E. of regression	0.019172	Akaike info criterion	-5.032300
Sum squared resid	0.018011	Schwarz criterion	-4.956542
Log likelihood	130.3236	F-statistic	0.141260
Durbin-Watson stat	1.150673	Prob(F-statistic)	0.708654

(vi). D(LNCPI) C D(LNM2) D(LNM2(-1))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:20

Sample(adjusted): 1987:1 2011:2

Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.037035	0.006377	5.807145	0.0000
D(LNM2)	-0.012361	0.035407	-0.349101	0.7286
D(LNM2(-1))	-0.002952	0.035437	-0.083300	0.9340

R-squared	0.002787	Mean dependent var	0.035600
Adjusted R-squared	-0.039648	S.D. dependent var	0.019183
S.E. of regression	0.019560	Akaike info criterion	-4.972544
Sum squared resid	0.017982	Schwarz criterion	-4.857823
Log likelihood	127.3136	F-statistic	0.065673
Durbin-Watson stat	1.137821	Prob(F-statistic)	0.936523

(vii). D(LNCPI) C D(LNM2) D(LNM2(-1)) D(LNM2(-2))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:21

Sample(adjusted): 1987:2 2011:2

Included observations: 49 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.028579	0.007491	3.814915	0.0004
D(LNM2)	-0.030168	0.035025	-0.861326	0.3936
D(LNM2(-1))	0.028448	0.037169	0.765368	0.4480
D(LNM2(-2))	0.077415	0.035836	2.160296	0.0361

R-squared	0.098057	Mean dependent var	0.035918
Adjusted R-squared	0.037928	S.D. dependent var	0.019248
S.E. of regression	0.018880	Akaike info criterion	-5.023357
Sum squared resid	0.016040	Schwarz criterion	-4.868923
Log likelihood	127.0722	F-statistic	1.630770
Durbin-Watson stat	1.036923	Prob(F-statistic)	0.195552

(viii). D (LNCPI) C D(LNM2) D(LNM2(-1)) D(LNM2(-2)) D(LNM2(-3))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:23

Sample(adjusted): 1988:1 2011:2

Included observations: 48 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.023062	0.009448	2.441023	0.0188
D(LNM2)	-0.017060	0.037268	-0.457759	0.6494
D(LNM2(-1))	0.032336	0.037609	0.859801	0.3947
D(LNM2(-2))	0.085539	0.037728	2.267271	0.0285
D(LNM2(-3))	0.027678	0.038322	0.722260	0.4740

R-squared	0.110505	Mean dependent var	0.035417
Adjusted R-squared	0.027761	S.D. dependent var	0.019125
S.E. of regression	0.018858	Akaike info criterion	-5.005423
Sum squared resid	0.015292	Schwarz criterion	-4.810506
Log likelihood	125.1301	F-statistic	1.335511
Durbin-Watson stat	1.114737	Prob(F-statistic)	0.272250

(ix) D(LNCPI) C D(LNM1)

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:23

Sample(adjusted): 1986:2 2011:2

Included observations: 51 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.036754	0.003456	10.63391	0.0000
D(LNM1)	-0.012915	0.022315	-0.578773	0.5654

R-squared	0.006790	Mean dependent var	0.035490
Adjusted R-squared	-0.013480	S.D. dependent var	0.019007
S.E. of regression	0.019134	Akaike info criterion	-5.036234
Sum squared resid	0.017940	Schwarz criterion	-4.960476
Log likelihood	130.4240	F-statistic	0.334979
Durbin-Watson stat	1.166637	Prob(F-statistic)	0.565393

(x) D(LNCPI) C D(LNM1) D(LNM1(-1))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:25

Sample(adjusted): 1987:1 2011:2

Included observations: 50 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.038132	0.005220	7.305020	0.0000
D(LNM1)	-0.017491	0.026110	-0.669875	0.5062
D(LNM1(-1))	-0.008134	0.026028	-0.312521	0.7560

R-squared	0.009462	Mean dependent var	0.035600
Adjusted R-squared	-0.032688	S.D. dependent var	0.019183
S.E. of regression	0.019494	Akaike info criterion	-4.979261

Sum squared resid	0.017861	Schwarz criterion	-4.864539
Log likelihood	127.4815	F-statistic	0.224487
Durbin-Watson stat	1.156631	Prob(F-statistic)	0.799778

(xi) D(LNCPI) C D(LNM1) D(LNM1(-1)) D(LNM1(-2))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:26

Sample(adjusted): 1987:2 2011:2

Included observations: 49 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.035079	0.006489	5.406235	0.0000
D(LNM1)	-0.016787	0.026360	-0.636852	0.5274
D(LNM1(-1))	0.002026	0.029076	0.069684	0.9448
D(LNM1(-2))	0.022942	0.026315	0.871826	0.3879

R-squared	0.024704	Mean dependent var	0.035918
Adjusted R-squared	-0.040316	S.D. dependent var	0.019248
S.E. of regression	0.019632	Akaike info criterion	-4.945167
Sum squared resid	0.017344	Schwarz criterion	-4.790732
Log likelihood	125.1566	F-statistic	0.379946
Durbin-Watson stat	1.074031	Prob(F-statistic)	0.767908

(xii) D(LNCPI) C D(LNM1) D(LNM1(-1)) D(LNM1(-2)) D(LNM1(-3))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:27

Sample(adjusted): 1988:1 2011:2

Included observations: 48 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.034160	0.008045	4.245955	0.0001

D(LNM1)	-0.019008	0.027315	-0.695889	0.4902
D(LNM1(-1))	-0.001484	0.029340	-0.050586	0.9599
D(LNM1(-2))	0.026985	0.029202	0.924088	0.3606
D(LNM1(-3))	0.005509	0.027589	0.199682	0.8427

R-squared	0.033144	Mean dependent var	0.035417
Adjusted R-squared	-0.056796	S.D. dependent var	0.019125
S.E. of regression	0.019661	Akaike info criterion	-4.922027
Sum squared resid	0.016622	Schwarz criterion	-4.727110
Log likelihood	123.1286	F-statistic	0.368509
Durbin-Watson stat	1.092038	Prob(F-statistic)	0.829726

(xiii) D(LNCPI) C D(LNM1) D(LNM1(-1)) D(LNM1(-2)) D(LNM1(-3)) D(LNM1(-4))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:28

Sample(adjusted): 1988:2 2011:2

Included observations: 47 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.031952	0.009317	3.429505	0.0014
D(LNM1)	-0.021073	0.028142	-0.748828	0.4582
D(LNM1(-1))	0.000560	0.030672	0.018271	0.9855
D(LNM1(-2))	0.027334	0.030023	0.910431	0.3679
D(LNM1(-3))	0.011893	0.030565	0.389105	0.6992
D(LNM1(-4))	0.014940	0.028335	0.527257	0.6009

R-squared	0.039454	Mean dependent var	0.035319
Adjusted R-squared	-0.077685	S.D. dependent var	0.019320
S.E. of regression	0.020056	Akaike info criterion	-4.861785
Sum squared resid	0.016493	Schwarz criterion	-4.625596
Log likelihood	120.2519	F-statistic	0.336816
Durbin-Watson stat	1.058386	Prob(F-statistic)	0.887668

(xiv) D(LNCPI) C D(LNM1) D(LNM1(-1)) D(LNM1(-2)) D(LNM1(-3)) D(LNM1(-4)) D(LNM1(-5))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:30

Sample(adjusted): 1989:1 2011:2

Included observations: 46 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.038548	0.010946	3.521546	0.0011
D(LNM1)	-0.030177	0.029204	-1.033326	0.3078
D(LNM1(-1))	-0.002169	0.031034	-0.069890	0.9446
D(LNM1(-2))	0.017644	0.031087	0.567551	0.5736
D(LNM1(-3))	0.005059	0.031176	0.162266	0.8719
D(LNM1(-4))	0.003267	0.030702	0.106399	0.9158
D(LNM1(-5))	-0.031392	0.029444	-1.066154	0.2929

R-squared	0.066322	Mean dependent var	0.035000
Adjusted R-squared	-0.077320	S.D. dependent var	0.019408
S.E. of regression	0.020144	Akaike info criterion	-4.832528
Sum squared resid	0.015826	Schwarz criterion	-4.554256
Log likelihood	118.1481	F-statistic	0.461717
Durbin-Watson stat	1.038872	Prob(F-statistic)	0.832220

(xv) D(LNCPI) C D(LNM1) D(LNM1(-1)) D(LNM1(-2)) D(LNM1(-3)) D(LNM1(-4)) D(LNM1(-5)) D(LNM1(-6))

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/06/12 Time: 04:32

Sample(adjusted): 1989:2 2011:2

Included observations: 45 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.040153	0.012644	3.175623	0.0030
D(LNM1)	-0.029092	0.029993	-0.969958	0.3384
D(LNM1(-1))	-0.003383	0.032632	-0.103666	0.9180
D(LNM1(-2))	0.019091	0.032087	0.594965	0.5555
D(LNM1(-3))	0.004214	0.033031	0.127563	0.8992
D(LNM1(-4))	0.003208	0.031899	0.100578	0.9204

D(LNM1(-5))	-0.035873	0.032471	-1.104794	0.2764
D(LNM1(-6))	-0.011101	0.030397	-0.365188	0.7171

R-squared	0.071295	Mean dependent var	0.035111
Adjusted R-squared	-0.104406	S.D. dependent var	0.019612
S.E. of regression	0.020611	Akaike info criterion	-4.766190
Sum squared resid	0.015718	Schwarz criterion	-4.445006
Log likelihood	115.2393	F-statistic	0.405774
Durbin-Watson stat	0.999452	Prob(F-statistic)	0.892579

Appendix 7: Proposed model for the relationship

Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 07/06/12 Time: 04:36
Sample(adjusted): 1988:1 2011:2
Included observations: 48 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.009349	0.007736	-1.208531	0.2339
D(LNM2)	-0.005039	0.027326	-0.184397	0.8546
D(LNM2(-1))	0.021146	0.027869	0.758779	0.4524
D(LNM2(-2))	0.090454	0.026785	3.377080	0.0016
D(LNIWPI)	0.209920	0.102350	2.051005	0.0469
D(LNIWPI(-1))	0.414653	0.105040	3.947574	0.0003
D(LNIWPI(-2))	0.058294	0.105985	0.550021	0.5854
D(LNIWPI(-3))	0.307998	0.103282	2.982113	0.0049

R-squared	0.574736	Mean dependent var	0.035417
Adjusted R-squared	0.500315	S.D. dependent var	0.019125
S.E. of regression	0.013519	Akaike info criterion	-5.618366
Sum squared resid	0.007311	Schwarz criterion	-5.306499
Log likelihood	142.8408	F-statistic	7.722740
Durbin-Watson stat	1.680074	Prob(F-statistic)	0.000007

Appendix 8: Redundant variable test on D(LNM2) D(LNM2(-1) and D(LNIWPI(-2))

Redundant Variables: D(LNM2) D(LNM2(-1)) D(LNIWPI(-2))

F-statistic	0.273018	Probability	0.844487
Log likelihood ratio	0.972936	Probability	0.807800

Test Equation:
Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 07/06/12 Time: 04:57
Sample: 1988:1 2011:2
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.006780	0.006005	-1.129084	0.2651
D(LNM2(-2))	0.085500	0.023659	3.613827	0.0008
D(LNIWPI)	0.197153	0.096787	2.036976	0.0478
D(LNIWPI(-1))	0.438650	0.095547	4.590955	0.0000
D(LNIWPI(-3))	0.338799	0.094469	3.586338	0.0009

R-squared	0.566028	Mean dependent var	0.035417
Adjusted R-squared	0.525658	S.D. dependent var	0.019125
S.E. of regression	0.013172	Akaike info criterion	-5.723096
Sum squared resid	0.007461	Schwarz criterion	-5.528180
Log likelihood	142.3543	F-statistic	14.02118
Durbin-Watson stat	1.699991	Prob(F-statistic)	0.000000

Appendix 9: Final model

Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 07/06/12 Time: 05:00
Sample(adjusted): 1988:1 2011:2
Included observations: 48 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.006780	0.006005	-1.129084	0.2651
D(LNM2(-2))	0.085500	0.023659	3.613827	0.0008
D(LNIWPI)	0.197153	0.096787	2.036976	0.0478
D(LNIWPI(-1))	0.438650	0.095547	4.590955	0.0000
D(LNIWPI(-3))	0.338799	0.094469	3.586338	0.0009

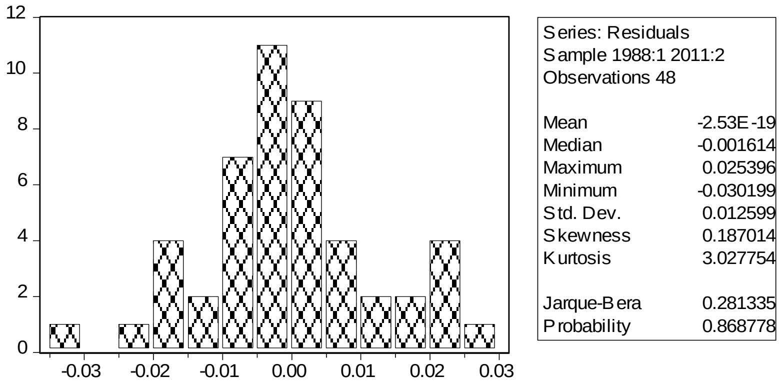
R-squared	0.566028	Mean dependent var	0.035417
Adjusted R-squared	0.525658	S.D. dependent var	0.019125
S.E. of regression	0.013172	Akaike info criterion	-5.723096
Sum squared resid	0.007461	Schwarz criterion	-5.528180
Log likelihood	142.3543	F-statistic	14.02118
Durbin-Watson stat	1.699991	Prob(F-statistic)	0.000000

Appendix 10: Correlation matrix

		D(LNCPI)	D(LNM2(-2))	D(LNIWPI)	D(LNIWPI(-1))	D(LNIWPI(-3))
D(LNCPI)	Pearson Correlation	1	0.233	.400**	.503**	.365**
	Sig. (1-tailed)		0.056	0.002	0	0.005
	N	48	48	48	48	48
D(LNM2(-2))	Pearson Correlation	0.233	1	.242*	-0.232	-.291*
	Sig. (1-tailed)	0.056		0.049	0.057	0.022
	N	48	48	48	48	48
D(LNIWPI)	Pearson Correlation	.400**	.242*	1	0.152	0.028
	Sig. (1-tailed)	0.002	0.049		0.152	0.425
	N	48	48	48	48	48
D(LNIWPI(-1))	Pearson Correlation	.503**	-0.232	0.152	1	0.195
	Sig. (1-tailed)	0	0.057	0.152		0.092
	N	48	48	48	48	48
D(LNIWPI(-3))	Pearson Correlation	.365**	-.291*	0.028	0.195	1
	Sig. (1-tailed)	0.005	0.022	0.425	0.092	
	N	48	48	48	48	48

**. Correlation is significant at the 0.01 level (1-tailed).
*. Correlation is significant at the 0.05 level (1-tailed).

Appendix 11: Jarque-Bera test for normality of the residuals



Appendix 12: Auxiliary regression to test for multicollinearity

D(LNM2(-2)) C D(LNCPI) D(LNIWPI) D(LNIWPI(-1)) D(LNIWPI(-3))

Dependent Variable: D(LNM2(-2))

Method: Least Squares

Date: 07/08/12 Time: 16:31

Sample(adjusted): 1988:1 2011:2

Included observations: 48 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.114025	0.029679	3.841925	0.0004
D(LNCPI)	2.724705	0.753967	3.613827	0.0008
D(LNIWPI)	0.396042	0.568938	0.696106	0.4901
D(LNIWPI(-1))	-1.926372	0.589262	-3.269128	0.0021
D(LNIWPI(-3))	-1.746081	0.546417	-3.195509	0.0026
R-squared	0.382283	Mean dependent var		0.096458
Adjusted R-squared	0.324821	S.D. dependent var		0.090495
S.E. of regression	0.074359	Akaike info criterion		-2.261492
Sum squared resid	0.237758	Schwarz criterion		-2.066576
Log likelihood	59.27582	F-statistic		6.652785
Durbin-Watson stat	2.423117	Prob(F-statistic)		0.000293

(i) D(LNIWPI) C D(LNM2(-2)) D(LNCPI) D(LNIWPI(-1)) D(LNIWPI(-3))

Dependent Variable: D(LNIWPI)

Method: Least Squares

Date: 07/08/12 Time: 16:34

Sample(adjusted): 1988:1 2011:2

Included observations: 48 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.019349	0.008681	2.229002	0.0311
D(LNM2(-2))	0.028137	0.040420	0.696106	0.4901
D(LNCPI)	0.446368	0.219133	2.036976	0.0478
D(LNIWPI(-1))	-0.007915	0.175496	-0.045103	0.9642

D(LNIWPI(-3))	-0.081511	0.161539	-0.504590	0.6164
R-squared	0.187825	Mean dependent var	0.034792	
Adjusted R-squared	0.112274	S.D. dependent var	0.021036	
S.E. of regression	0.019820	Akaike info criterion	-4.905932	
Sum squared resid	0.016892	Schwarz criterion	-4.711016	
Log likelihood	122.7424	F-statistic	2.486060	
Durbin-Watson stat	1.923009	Prob(F-statistic)	0.057511	

(ii) D(LNIWPI(-1)) C D(LNM2(-2)) D(LNCPI) D(LNIWPI) D(LNIWPI(-3))

Dependent Variable: D(LNIWPI(-1))

Method: Least Squares

Date: 07/08/12 Time: 16:36

Sample(adjusted): 1988:1 2011:2

Included observations: 48 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.024887	0.007005	3.552901	0.0009
D(LNM2(-2))	-0.103336	0.031610	-3.269128	0.0021
D(LNCPI)	0.749871	0.163337	4.590955	0.0000
D(LNIWPI)	-0.005977	0.132509	-0.045103	0.9642
D(LNIWPI(-3))	-0.176332	0.138190	-1.276005	0.2088
R-squared	0.403958	Mean dependent var	0.035208	
Adjusted R-squared	0.348513	S.D. dependent var	0.021337	
S.E. of regression	0.017222	Akaike info criterion	-5.186897	
Sum squared resid	0.012754	Schwarz criterion	-4.991980	
Log likelihood	129.4855	F-statistic	7.285653	
Durbin-Watson stat	1.969360	Prob(F-statistic)	0.000143	

(iii) D(LNIWPI(-3)) C D(LNM2(-2)) D(LNCPI) D(LNIWPI) D(LNIWPI(-1))

Dependent Variable: D(LNIWPI(-3))

Method: Least Squares

Date: 07/08/12 Time: 16:39

Sample(adjusted): 1988:1 2011:2

Included observations: 48 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.030705	0.007249	4.235591	0.0001
D(LNM2(-2))	-0.109904	0.034393	-3.195509	0.0026
D(LNCPI)	0.679587	0.189493	3.586338	0.0009
D(LNIWPI)	-0.072215	0.143117	-0.504590	0.6164
D(LNIWPI(-1))	-0.206902	0.162148	-1.276005	0.2088

R-squared	0.312932	Mean dependent var	0.034375
Adjusted R-squared	0.249018	S.D. dependent var	0.021527
S.E. of regression	0.018656	Akaike info criterion	-5.027018
Sum squared resid	0.014965	Schwarz criterion	-4.832101
Log likelihood	125.6484	F-statistic	4.896187
Durbin-Watson stat	1.669947	Prob(F-statistic)	0.002419

Appendix 13: Chow Break point test

Chow Breakpoint Test: 1998:2

F-statistic	0.988030	Probability	0.437841
Log likelihood ratio	5.866612	Probability	0.319415

Appendix 14: White's Heteroskedasticity test

White Heteroskedasticity Test:

F-statistic	0.495068	Probability	0.852205
Obs*R-squared	4.425132	Probability	0.816876

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/09/12 Time: 19:48
Sample: 1988:1 2011:2
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.14E-05	0.000145	0.355209	0.7243
D(LNM2(-2))	0.000581	0.000939	0.619117	0.5394
(D(LNM2(-2)))^2	-0.002564	0.004047	-0.633606	0.5300
D(LNIWPI)	0.001411	0.003918	0.360094	0.7207
(D(LNIWPI))^2	0.009315	0.054352	0.171377	0.8648
D(LNIWPI(-1))	-0.000186	0.003680	-0.050410	0.9601
(D(LNIWPI(-1)))^2	0.016955	0.051913	0.326609	0.7457
D(LNIWPI(-3))	-0.001297	0.004351	-0.298049	0.7672
(D(LNIWPI(-3)))^2	0.030867	0.057942	0.532731	0.5972

R-squared	0.092190	Mean dependent var	0.000155
Adjusted R-squared	-0.094027	S.D. dependent var	0.000224
S.E. of regression	0.000234	Akaike info criterion	-13.71553
Sum squared resid	2.13E-06	Schwarz criterion	-13.36468
Log likelihood	338.1727	F-statistic	0.495068
Durbin-Watson stat	2.161763	Prob(F-statistic)	0.852205

Appendix 15: Ramsey reset

Ramsey RESET Test:

F-statistic	0.202329	Probability	0.959514
Log likelihood ratio	1.261152	Probability	0.938878

Test Equation:

Dependent Variable: D(LNCPI)

Method: Least Squares

Date: 07/08/12 Time: 16:50

Sample: 1988:1 2011:2

Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.083110	0.426468	0.194879	0.8465
D(LNM2(-2))	-0.753226	3.336203	-0.225773	0.8226
D(LNIWPI)	-1.741007	7.703517	-0.226002	0.8224
D(LNIWPI(-1))	-3.847192	17.13290	-0.224550	0.8235
D(LNIWPI(-3))	-2.979767	13.24951	-0.224896	0.8233
FITTED^2	1225.674	3538.540	0.346378	0.7310
FITTED^3	-67421.55	157515.1	-0.428032	0.6710
FITTED^4	1823927.	3674521.	0.496372	0.6225
FITTED^5	-23759703	42964359	-0.553010	0.5835
FITTED^6	1.19E+08	1.98E+08	0.599566	0.5524

R-squared	0.577282	Mean dependent var	0.035417
Adjusted R-squared	0.477164	S.D. dependent var	0.019125
S.E. of regression	0.013829	Akaike info criterion	-5.541037
Sum squared resid	0.007267	Schwarz criterion	-5.151204
Log likelihood	142.9849	F-statistic	5.766042
Durbin-Watson stat	1.792883	Prob(F-statistic)	0.000050

Appendix 16: Granger causality test

D(LNCPI) AND D(LNM2) WITH 1 LAG

Pairwise Granger Causality Tests

Date: 07/08/12 Time: 17:11

Sample: 1986:1 2011:2

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
D(LNM2) does not Granger Cause D(LNCPI)	50	0.06355	0.80207
D(LNCPI) does not Granger Cause D(LNM2)		0.48249	0.49072

(i) D(LNCPI) AND D(LNM2) WITH 2 LAG.

Pairwise Granger Causality Tests

Date: 07/08/12 Time: 16:58

Sample: 1986:1 2011:2

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
D(LNM2) does not Granger Cause D(LNCPI)	49	2.65892	0.08126
D(LNCPI) does not Granger Cause D(LNM2)		0.32949	0.72105

(ii) D(LNCPI) AND D(LNIWPI) WITH 1 LAG

Pairwise Granger Causality Tests

Date: 07/08/12 Time: 17:06

Sample: 1986:1 2011:2

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability

D(LNIWPI) does not Granger Cause D(LNCPI)	50	5.77894	0.02022
D(LNCPI) does not Granger Cause D(LNIWPI)		0.29710	0.58829

(iii) D(LNCPI) AND D(LNIWPI) WITH 2 LAGS

Pairwise Granger Causality Tests

Date: 07/08/12 Time: 17:07

Sample: 1986:1 2011:2

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
D(LNIWPI) does not Granger Cause D(LNCPI)	49	4.13170	0.02268
D(LNCPI) does not Granger Cause D(LNIWPI)		0.00440	0.99561

(iv) D(LNCPI) AND D(LNIWPI) WITH 3 LAGS.

Pairwise Granger Causality Tests

Date: 07/08/12 Time: 17:00

Sample: 1986:1 2011:2

Lags: 3

Null Hypothesis:	Obs	F-Statistic	Probability
D(LNIWPI) does not Granger Cause D(LNCPI)	48	3.72970	0.01848
D(LNCPI) does not Granger Cause D(LNIWPI)		1.69358	0.18335