Asymmetric Shocks and Co-movement of Price Indices

Rao, Nasir Hamid and Bukhari, Syed Kalim Hyder
State Bank of Pakistan

04. November 2010

Asymmetric Shocks and Co-movement of Price Indices

Nasir Hamid Rao
Analyst,
Monetary Policy Department,

Syed Kalim Hyder Bukhari
Economist,
Monetary Policy Department,

Abstract
This paper is an attempt to gauge the relationship between the long run paths of consumer price index and wholesale price index of Pakistan. For the empirical analysis the Johansen co-integration technique has been applied on monthly data (1978 to 2010) of WPI and CPI. This paper found that both the indices are co-integrated in the long run. Thus the deviations in movements of WPI and CPI in the short run are transitory and both the indices will converge to their coherent path in the long run. Therefore, inflation computed from CPI can be used as official measure of inflation without worrying for short run movements of WPI.

JEL Classification: E31, C32, E52
Keywords: Price Level, Time Series Models, Monetary Policy.

Acknowledgment
We would like to thank Riaz Riazuddin, Hamza Ali Malik, Abdul Jalil, Saghir Pervaiz Ghauri, Javed Iqbal and Khurram Ashfaque for guidance and helpful comments. The views expressed are of the authors and do not reflect views of the State Bank of Pakistan.

Contact for correspondence
Nasir Hamid Rao
Analyst, Monetary Policy Department,
State Bank of Pakistan,
I.I.Chundrigar Road,
Karachi- 7400, Pakistan.
Nasir.Rao@sbp.org.pk

1. Introduction

Price stability is now generally accepted as a primary responsibility of central banks (Moreno 2009). Literature[1] has a consensus that price stability should be the primary focus of monetary policy as the economic well being of the general population is best served by keeping inflation low and stable[2]. In recent times, Central Banks have been provided enough level of autonomy with the mandate of price stability and they should be held responsible and accountable[3], if they fail to achieve[4]. Central banks can achieve the goal of price stability by using the tools of monetary policy. Day to day implementation of price stability mandate, as well as accountability, has to be based on data. Whether central bank succeeded in achieving the price stability goal or not, can only be judged by the level of measured inflation. Although we all speak about inflation, measurement of inflation is not a simple exercise. The measurement is immediately confronted by the problem of calculating a price index. No single approach to index calculation yields the optimal index. Inflation is not only the judgment criteria of achieving the goal but its measurement is also fundamental to the conduct and performance of monetary policy. Inflation is calculated by using the measures of general price level such as consumer and wholesale price indices which form the foundation of central bank policy frameworks around the world. These indices serve as guides to decision making, as well as providing the primary mechanism for holding independent policymakers accountable.

There are a variety of price indices available in every country. National statistical offices in most countries produce survey based consumer price indices as well as indices used in the construction of national income and product account measures (Cecchetti 2009). These indices differ based on their scope, coverage and weighting scheme. Although the variety of available price indices in the country helps accurate conversion of different sectors of the economy from nominal terms to real terms. But at the same time it makes the life of central banks much difficult, as they have to take a decision by selecting the most appropriated index as target. And the wrong selection will raise questions about the policies of the central bank

1 Moreno (2009); Cecchetti (2009), Gasper and Smets (2002)
2 A rising price level (inflation) creates uncertainty in the economy, and that uncertainty might hamper economic growth.
3 Although central banks cannot achieve this famous goal without monetary-fiscal co-ordination but the main responsibility regarding price stability still pertains to the central banks.
4 Coats and Schiffman (1995); De Sousa (2001) and Walsh (1995)

and may hamper its credibility. There are three broad reasons on the basis of which variety of price indices should exist in any economy. The first is to transform nominal quantities into real quantities. This role is played by implicit deflators and chained indices assembled in the course of computing real gross domestic product and its components. The second motivation for computing a price index is to compensate individuals for price changes in arrangement to maintain their utility invariant in the face of aggregate inflation. For this purpose consumer price indices are computed. Third, and last, price indices are computed for the conduct of monetary policy. At the abstract level of macroeconomic modeling, it is straightforward to say that price index used for the conduct of monetary policy should be the aggregate price level of the economy.

Different measures of general price level, available in Pakistan, are Consumer Price Index (CPI), Wholesale Price Index (WPI), GDP deflator (PI) and Sensitive Price Indicator (SPI). SPI is available on highest frequency among all but it only covers 53 items and it is a subset of CPI whereas the PI is only available on the annual basis. So WPI and CPI can be treated as the only high frequency (monthly) broad measures of price level available in Pakistan. WPI measures the price of goods at the first commercial transaction in the economy whereas CPI measures the price of goods and services at the retail level. In conventional wisdom, WPI is considered to be the leading indicator for the CPI. The dynamics of transmission mechanism amongst consumer prices and wholesale prices move from the supply side, production processes, to demand side i.e. consumption behavior.

The conception is that the retail sector adds value with a lag to existing production and uses it as an input. Therefore, demand side dynamics depend on the producer prices of the domestic goods, the prices of the imported goods, the nominal exchange rate, the level of indirect taxes, the marginal cost of retail production and interest rates. Hence, this mechanism provides a theoretical foundation for causal relationship running from wholesale prices to consumer prices in any small open economy.

On micro level, the intuition behind the co-movement of prices has its foundation in the theory of consumer behavior. The substitutability and complementarity of the commodities may result in the co-movement of prices. But in case of exogenous shocks, prices at different stages react with variable degree of magnitude and with different time lag. The possible reason for such differences may be the weight assigned to a commodity in index. And it will result in a deviation of both indices from long run co-movement path.

Due to deviations in the short run, the selection of price index becomes highly important and critical to achieve the inflation or price level targeting policy goal. This is due to the fact that different indices can yield different inflation rates in short run. Hence, central banks, which pursue this popular policy goal, need to be very careful in choosing the relevant price index to be targeted, by identifying the deviations and the reasons. The effects of central bank policies on prices can vary depending both on the price index chosen and the policy instruments used. The exchange rate policies are more likely to have higher affect on the prices of tradable than non-tradable goods. On the other hand the interest rate polices have more effect on the prices of goods than services. Persistent deviation among the prices may lead to a situation that the central bank may achieve the target of inflation represented by one index but fail to spot for the other[5]. This situation may hit the credibility of the central bank.

Life of the central bank becomes a lot easier if the price indices are closely moving together in the long run. As the goals of monetary policy are of long run in nature so despite missing the target of inflation from one index will not hamper the credibility of central bank (Mishkin 2004). As in the long run both the indices will converge to long run co-movement path, so the achievement of inflation goal for one index means automatic achievement of the same goal for the other index.

In order to formulate optimal monetary policy, robust assessment of the causal relationship between wholesale prices and consumer prices is of central importance. Observance of long run co-movement among CPI and WPI will close the debate of selection of index in case of Pakistan, as we may miss the target or overlook WPI movements in the short run[6] but due to convergence in the long run the goal of price stability will either be achieved or missed for both the indices. This issue has been extensively discussed in the literature for different countries but very little work has been done in case of Pakistan. Studies by Hatanaka and Wallace (1980); Engle (1978); Silver and Wallace (1980); Guthrie (1981); Colclough and Lange (1982); Cushing and McGarvey (1990) attempted to explore this empirical relationship but found conflicting results on causality hypothesis among different price indices. A recent study by Caporale *et al* (2002) tried to explain long-run causal dynamics using G-7 countries

---

[5] YoY CPI inflation in August 2009 was 10.69% but at the same time WPI YoY inflation was only 0.26%. CPI inflation indicates the inflationary pressures and demands for tight monetary stance but at the same time WPI apparently seems to indicate the threat of deflation and demands for loose monetary stance.

[6] CPI is being used as official index to calculate the inflation in Pakistan.

data, and came up with the results that wholesale prices impact the consumer prices and there is no reverse causality.

In the literature a variety of econometric techniques has been used to explore the relationship of different price indices. Different studies have found different results; as such there is no consensus in the literature about the establishment of co-integration. Studies by Hatanaka and Wallace (1980); Engle (1978) and Guthrie (1981) estimated the parameters of the lag distribution and found significant results. Silver and Wallace (1980) and Colclough and Lange (1982) utilized different approaches in investigating causal relationship by attempting Sims causality tests and came up with mixed results. Colclough and Lange (1982) used both Granger and Sims tests based on the U.S. data and concluded that causal relationship between wholesale prices and consumer prices moved in the opposite direction or might be bi-directional. Later on, Cushing and McGarvey (1990) attempted this causal relationship and provided strong justification for this transmission mechanism. Akdi *et al* (2006) used conventional tests of co-integration, Engle-Granger and Johansen, along with seasonally robust periodogram based test and found mixed results for CPI and WPI on Turkish data.

Shahbaz *et al*. (2010) have examined the causal relationship between wholesale prices and consumer prices in Pakistan by using the ARDL bound co-integration test. Results based on ARDL bounds testing framework and Johansen test for co-integration, show that there exists a long run relationship between WPI and CPI in Pakistan. The autoregressive distributed lag (ARDL) deals with single cointegration and is introduced originally by Pesaran and Shin (1999) and further extended by Pesaran *et al.* (2001). ARDL method has certain econometric advantages, infact, all other co-integration techniques require that the variables in a time-series regression equation are integrated of order one, i.e., the variables are I(1), only ARDL could be implemented regardless of whether the underlying variables are I(0), I(1), or fractionally integrated. The assumption of ARDL restricts consideration to cases where there exists at most one cointegration equation between the variables. This is the major disadvantage of the ARDL approach to cointegration since ARDL estimation is valid only in the case of a single cointegrating relation. In the event of more than one cointegration relation, ARDL estimation will not be valid. ARDL bound co-integration is recommended when we are not sure about the degree of Integration of variables. If all the variables are integrated of degree one then we should opt for Johansen rather than opting for ARDL so imposing no restrictions on the number of co-integrating relationship amongst the variables under consideration.

This paper explores the long run relationship between wholesale and consumer prices in Pakistan by using the Johansen technique. Johansen technique for testing the existence of co-integration and causality can only be carried out, once the time series properties of the data have been established. Tests for co-integration require the variables to be integrated of same order, typically I(1), prior to estimation. As all the variables used in this study are integrated of order one, Johansen could be ranked as the best econometric technique available for testing the presence of co-integration. Application of Johansen will allow the system to choose from the all possible co-integrating relationships rather than imposing the restriction that there is at most one co-integrating vector. This study is different from the earlier work by Shahbaz *et al*. (2010) on the ground that; 1) in this study unbounded econometric technique has been used to investigate the existence of co-integration, it will provide the more robust results which will be less sensitive to the sample size as compare to the results provided by ARDL bounded test, 2) analysis have been carried out on aggregated indices of CPI and WPI as well as on disaggregated form and 3) Shahbaz *et al*. (2010) have used monthly data from 1992-2007 whereas the sample of this study is from 1978-2010, which is almost double.

Kremers *et al* (1992) provide empirical evidence that, in the case of small sample size, no cointegration can be established among the variables if they are integrated of order one i.e. I(1). Additionally, Hakkio and Rush (1991) prove that increasing the number of observations by using the quarterly and monthly data will not improve the robustness of the result in the co-integration analysis. The results can be improved only by the increasing the length of the time period to an appropriate level (around thirty years). Results of this paper could be preferred over Shahbaz *et al*. (2010) on the basis of coverage of time span. Section 2 of the paper consists of data and methodology, section 3 provides the empirical investigation and section 4 concludes the debate.

2. Data and Methodology

In this paper, data of aggregate and disaggregated CPI and WPI with a base year 2000-01 has been used. For aggregated index the sample has been selected from January 1978 to September 2010. For disaggregated form such as food and non food groups of CPI and WPI, the sample has been selected from July 1991 to May 2010. Source of the data is different issues of Statistical Bulletin of SBP, Publications of Federal Bureau of Statistics and different issues of Economic Survey. The WPI index includes 425 commodities divided into 5 main groups. Prices of these commodities are collected from 18 markets which covers 18 major cities. The CPI index, on the other hand, includes 374 commodities divided into 10 main groups. Prices of these commodities are collected from 71 markets which covers 35 major cities. Both the indices are calculated by employing fixed-weight Laspeyres formulation.

The assumptions of the classical regression model necessitate all the variables to be used in econometric analysis should be stationary and that the errors have a zero mean and a finite variance. In the presence of non stationary variables, there might be a spurious regression[7]. But in the case where the non stationary sequences are integrated of the same order and the residual sequence is stationary, the variables are known to be co-integrated. The econometric technique used in this paper, Johansson co-integration technique, is based on the assumption that all the series should be non stationary and the order of integration for all the series should be one. For identification of possibilities of unit root in level and first differences of the series, Augmented Dickey Fuller (ADF) test has been chosen. Johansen co-integration technique can only be used once the result of the ADF confirms that all the series are I (1)[8]. Johansson technique has been preferred to Engle and Granger's method. Although Engle and Granger's method is simple but it is subject to the following criticisms[9]: 1) little is known about the asymptotic distribution of the Engle-Granger test, 2) Engle and Granger examine only the dominant co-integrating vector rather than all possible co-integrating vectors whereas Johansen provides the maximum likelihood method to investigate co-integration among variables. The Johansen test should be preferred to the Engle-Granger test since it is robust to various departures from normality, it does not suffer from problems associated with normalization, and more is known about its asymptotic behavior.

Another key difference between Johansen estimate of long-run equilibrium relationship and those from the Engle-Granger test is that standard inference can be performed on the coefficients of the co-integrating vector whereas in Engle-Granger it is not possible to

7 It is well known that many economic time series are difference stationary. In general, a regression involving the levels of these I(1) series will produce misleading results, with conventional Wald tests for coefficient significance spuriously showing a significant relationship between unrelated series (Phillips 1986).

8 In case of I(2) series two step procedure is adopted whereas concerned variables should not be I(0).

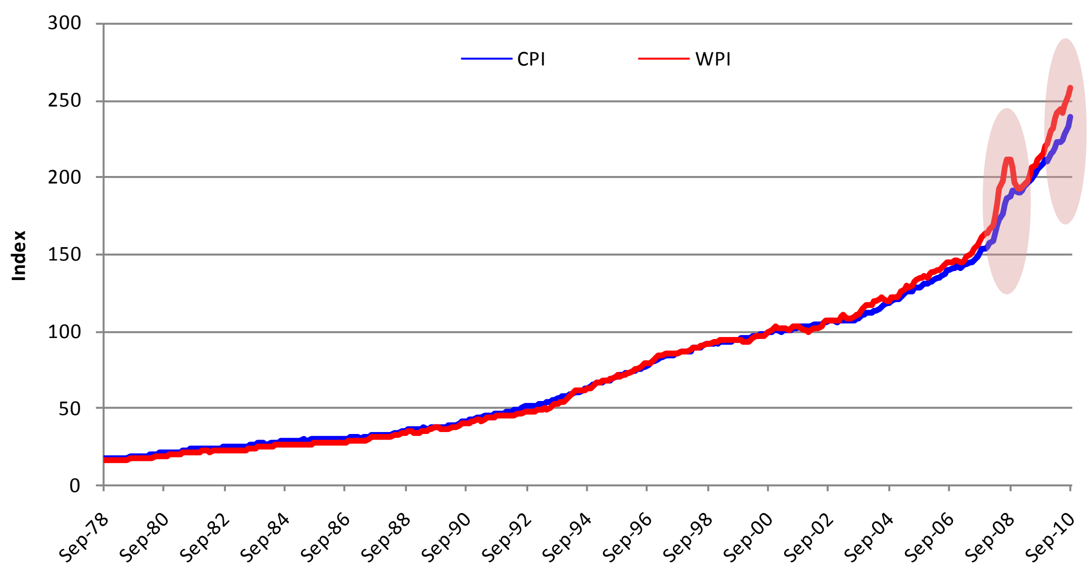
9 Sephton and Larsen (1991) cited by Wu- Jyh-Lin (1996) "The empirical Investigation of Long Run Purchasing Power Parity: The case of Taiwan Exchange Rate"

conduct inference of these co-integrating vectors unless we use the fully modified least squares procedures developed by Phillips and Hansen[10]. Johansen provides a unique relationship between two variables but the Granger may result in two relationships between two variables.

3. Empirical Investigation

Figure 1 reports the time series plots of the CPI and WPI. Both the series are similar regarding persistency and both have increasing trends. Figure 2 reports the time series plots of Food groups of CPI and WPI and figure 3 reports the time series plots of non food groups of CPI and WPI. The graphs of the calculated values of Autocorrelation and Partial Autocorrelation functions were analyzed and it was found that graph of autocorrelation functions decay very slowly, which may suggest a possible unit root for each series. Therefore the unit root tests were warranted.

Figure 1: Behavior of Whole sale and Consumer Price indices in Pakistan



[10] Enders, W. (2010) Applied Econometric Time Series, 3rd Edition, Co-integration and Error Correction models, pp 409-427

Figure 2: Behavior CPIF and WPIF in Pakistan

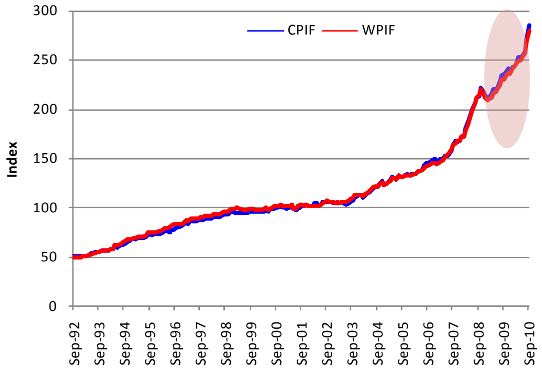


Figure 3: Behavior CPIN and WPIN in Pakistan

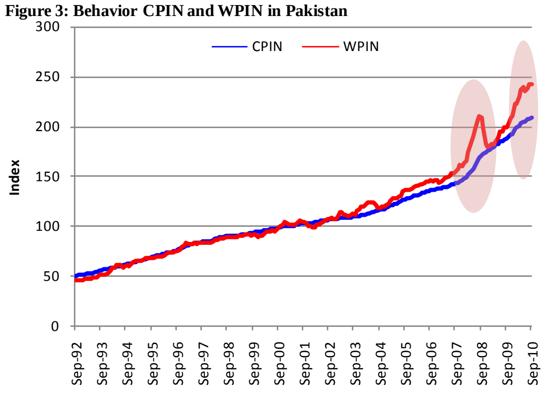


Figure 4: Behavior of CPIF and WPIN in Pakistan

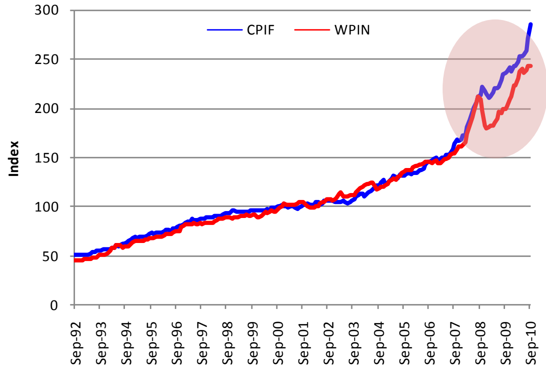
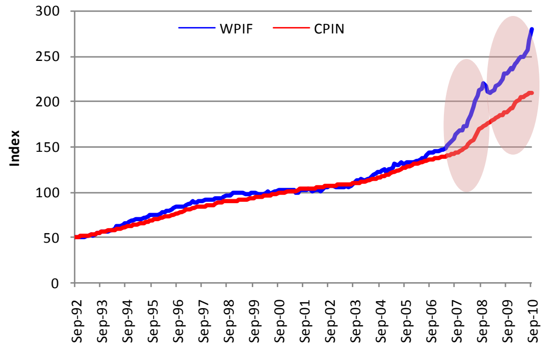


Figure 5: Behavior WPIF and CPIN in Pakistan



Shaded area in figure 1 indicates the period where the integrated relationship between CPI and WPI was broken. If we look at figure 2 to figure 5 for the same period of time, we could end up with a conclusion that this deviation from coherent path was due to non food components of CPI and WPI. As figure 2 reports that CPIF and WPIF continued their co-movement path in the period of may 2008 onward. But at the same time CPIN and WPIN behaved differently, CPIN was increasing with a much lesser speed as compared to a rapid growth in WPIN. This deviation may be due to external shocks, especially oil shocks.

To investigate the dynamic relationship between CPI and WPI, econometric analyses have been carried out on aggregate indexes as well as disaggregated form of CPI and WPI. After initial analysis on aggregate indexes, both the indexes were disaggregated on the basis of food and non food items and were checked for the same inference.

1. **Identification of Level of Integration**

All the series used in this paper were tested for the hypothesis of unit root by using the Augmented Dickey Fuller (ADF) test. The following hypothesis was tested for all the series at level and first difference with options like with constant, with constant & trend and without constant & trend.

$$H_0 : Series\ under\ discussion\ has\ a\ unit\ root$$

Results of ADF test are placed at Annexure-I. Results of the test suggest that we cannot reject the null of a unit root in either series in levels (with and without time trend). However, we could reject the null of a unit root in the difference of the series. Thus, we claim that all the series are I (1). The results validates that all the series are non stationary at level and stationary at first difference. Hence the variables fulfill the necessary condition of co-integration approach i.e. all the variables should be integrated of order (1).

2. **Aggregate Analysis**

In the previous section, it was established that the two series are integrated of same order so they may have a common trend. In such cases, fair chances of a possible co-integrating relationship between CPI and WPI cannot be overlooked. If a set of non-stationary multivariate time series has a stationary linear combination, such series is considered to be a co-integrated one.

a) **Long run relationship**

To investigate the nature and magnitude of long run relationship between the aggregate indices of CPI and WPI, we performed the Johansson co-integration test. Unrestricted vector autoregressive (VAR) model at the log levels of CPI and WPI was estimated. All available Lag Length Criteria were used to identify the optimal lag length to be included in the co-integration analysis. Sequential modified LR test statistic (LR) suggested for twelve lags, Final Prediction Error (FPE) and Akaike Information Criterion (AIC) suggested for four lags as optimal lag length. The remaining criterions, Schwarz Information Criterion (SIC) and Hannan-Quinn information criterion, suggested for 2 lags as an optimal. We have relied on AIC, the most common criterion being used for identification of optimal lag length, and imposed four lags as optimal.

After the selection of optimal lag length, both the variables were tested for existence of co-integration. Intercept but no trend was used as co-integration test specification for long run and short run. Table 1 reports the results for testing the number of cointegrating relations. Two types of test statistics are reported. The first block reports the trace statistics and the second block reports the maximum eigenvalue statistics. For each block, the first column is the number of cointegrating relations under the null hypothesis, the second column is the ordered eigenvalues of the matrix, the third column is the test statistic, and the last two columns are the 5% critical values and the probabilities of acceptance and rejection of the occurrence of co-integration vectors. The (nonstandard distribution) critical values are taken from MacKinnon-Haug-Michelis (1999) so they differ slightly from those reported in Johansen and Juselius (1990). Trace and Eigenvalue test indicates for existence of one co-integrating equation at 0.05 levels.

Table 1: Cointegration Rant Test (Trace and Eigenvalue)

Series: Ln(CPI) Ln(WPI) Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE*(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.***
None **	0.077494	31.83579	15.49471	0.0001
At most 1	0.001389	0.539149	3.841466	0.4628

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.****
None **	0.077494	31.29664	14.26460	0.0000
At most 1	0.001389	0.539149	3.841466	0.4628

*Cointegration equations
** denotes rejection of the hypothesis at the 0.05 level
***MacKinnon-Haug-Michelis (1999) p-values

Relying on the results of Trace and Maximum Eigenvalue tests, Vector Error Correction (VECM) was estimated with rank of co-integration vector as (1) and allowing for linear trend in data (Intercept in CE and VAR but no trend). The normalized form of the significant symmetric relation is as under:

$$\mathrm{Ln}(\mathrm{CPI}_{t-1}) = 0.232 + \underset{\substack{(30.75)\\ [0.00]}}{0.947} * \left(\mathrm{Ln}(\,\mathrm{WPI}_{t-1}\,)\right) + \varepsilon_{t-1} \qquad (1)$$

χ^2 is in () and probability in []. Relation defined in equation (1) is found to be statistically significant and reports that in the long run 10% change in WPI will cause 9.5% change in CPI, in the absence of any exogenous shock. Results are consistent with the theory that WPI has a one to one impact on CPI. The elasticity of CPI with respect to WPI, which is 0.947, is tested by using Wald Test against the hypothesis of unit elasticity but we fail to accept the null hypothesis.

b) Short run relationship

Cointegration describes the long-run equilibrium association amongst the variables. An error correction mechanism forces the short-run deviation from equilibrium towards their equilibrium level in the coming periods. It is very important for policy purpose to explore the dynamics of the short run and to identify how variables behave after an exogenous shock and how the equilibrium path is restored. Our long run analysis suggests that CPI and WPI are co-integrated and exhibits a stable long-run equilibrium relationship. But these variables may deviate in the short run which makes the exploration of speed and dynamics of restoration of equilibrium path a much important one.

From long run normalized relationship, the short run reduced form equations of CPI and WPI were estimated. Table 2 explains the behavior of CPI. CPI is found to be endogenous[11] the Error Correction Term (EC) is statistically significant which validates our argument. CPI is being adjusted towards the long run co-integrated path at a rate of 10% per month. It indicates that any exogenous shock that diverge either CPI or WPI from long run equilibrium path is gradually adjusted in almost 10 months by equilibrium relationship. The diagnostics were performed to the equation regarding problems such as autocorrelation and hetroskedesticity.

[11] A variable is called endogenous if it is explained within the model in which it appears.

Diagnostics are necessary to establish the power of the results in terms robustness, biasness and efficiency of the estimates. Presence of autocorrelation was tested by using the correlogram of residuals (Q-Statistics) and serial correlation LM test. Normal Durbin Watson (DW) cannot be used[12] due to the presence of dependent variable's own lags on right hand side of the equation. For hetroskedesticity White and Breusch-Pagan-Godfrey test were used. All the tests suggests that the error term of the equation is white noise as all the residual test and stability test applied on the equation suggest for non occurrence of econometric problem (Results of the diagnostic tests are reported at Annex-III).

Table 2.1 in annexure-II explains the behavior of WPI in the short run. WPI is found to be weakly [13] exogenous in the system as the Error Correction Term (ECT) is statistically insignificant. It means that the disequilibrium in the long run has no impact on WPI. When the short run equation of WPI was evaluated for diagnostics it was found that the error term doesn't have a constant variance which violates the condition of homoskedasticity, which suggests for the presence of hetroskedesticity. In the presence of hetroskedesticity although the coefficients are unbiased but OLS underestimates true variance and overestimates t-statistics, which may result in a wrong inference of hypothesis. As the data was already in log form so Weighted Least square (WLS) was the only option available to tackle hetroskedesticity. WPI includes Fuel, Lighting and Lubricant group (which is mainly driven by oil prices) with a weight of 19.29% in WPI whereas the same products have lesser weight in CPI. So there is possibility that the WPI short run equation may have a strong relation with volatility in oil prices and such volatility doesn't have that much strong impact on CPI. This difference in weights to specific commodities may be the reason of variable variance or the hetroskedesticity problem may be due to some missing variables.

As the main focus of the paper is identification of the long run association amongst both the variables. So to avoid the problem of hetroskedesticity and to make the variance and co-variance of the regression coefficients unbiased, the equation was estimated by using

---

[12] Literature suggests that conventional DW test breaks down if lags of dependent variable are used as explanatory variables.

[13] In a co-integrated system, if a variable does not respond to the discrepancy from the long run equilibrium relationship, it is weakly exogenous. Engle, Hendry and Richard (1983) provides a comprehensive analysis of various types of Exogeneity, In general a variable x_{it} is weakly exogenous for the parameter set P if the marginal distribution of x_{it} contains no useful information for conducting inference on P. Hence, x_{it} can be exogenous in one econometric model but not another.

Ordinary Least Squares approach with hetroskedestic consistent coefficient covariance[14] rather than specifying the missing variables to curb the hetroskedesticity.

Table 2: Short Run Equation of CPI in Log form at first difference

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.005516	0.000713	7.737024	0.0000
EC	-0.099415	0.021304	-4.666411	0.0000
$(cpi_{t-1}-cpi_{t-2})$	0.083503	0.060424	1.381943	0.1678
$(cpi_{t-2}-cpi_{t-3})$	-0.096435	0.048536	-1.986886	0.0477
$(cpi_{t-3}-cpi_{t-4})$	0.185323	0.049580	3.737872	0.0002
$(wpi_{t-1}-wpi_{t-2})$	0.120895	0.050189	2.408799	0.0165
$(wpi_{t-4}-wpi_{t-5})$	-0.087038	0.042441	-2.050797	0.0410
R-square	0.150729	Durbin-Watson stat		1.980373
Adjusted R-square	0.137355	F-statistic		11.27000
Prob(F-statistic)	0.000000	Akaike info criterion		-6.692198

Lower case letter represents logarithmic form of the variable
Residuals are white noise.

3. Disaggregated Analysis

Aggregate analysis suggests that the two series are co-integrated in the long run. WPI was found to be weakly exogenous in the system. To further investigate the behaviors of both the series, analysis was carried out on the disaggregated form. Indices were disaggregated in Food and Non Food categories. Weights of both the groups in the indices are almost the same.

[14] If hetroskedesticity among the stochastic disturbance terms in a regression model is ignored and the OLS procedure is used to estimate the parameters, then the following properties hold:

- The estimators and forecasts based on them will still be unbiased and consistent.
- The OLS estimators are no longer BLUE and will be inefficient. Forecasts will also be inefficient.
- The estimated variance and covariance of the regression coefficients will be biased and inconsistent, and hence tests of hypothesis (that is t and F tests) are invalid.
- If however, consistent estimates can be obtained for the variances of the estimates, then valid inferences are possible for large samples. White (1980) proposed a method of obtaining consistent estimators of the variances and covariances of the OLS estimator, which he called the hetroskedesticity consistent covariance matrix (HCCM) estimator.

a) Long run relationship

To identify the presence of long run relationship amongst the variables, Trace and Eigenvalue tests were used. Trace and Eigenvalue test indicates for existence of two co-integrating equations at 0.05 levels. In the presence of two co-integrating equations, we have to rely on theoretical concepts to normalize the results through identification of the co-integrating matrices by using the restrictions. Those restrictions should be based on some theoretical justification. And restrictions should have to be statistically valid. After making the co-integrating matrices identified, we can solve the matrices to get full range of statistically significant relationships among the variables.

Table 3: Cointegration Rant Test (Trace and Eigenvalue)

Series: Ln(CPIF) Ln(CPIN) Ln(WPIF) Ln(WPIN) Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.159	89.269	63.876	0.0001
At most 1 *	0.125	50.841	42.915	0.0067
At most 2	0.071	21.245	25.872	0.1693
At most 3	0.022	4.8687	12.517	0.6153

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.159	38.428	32.118	0.0074
At most 1 *	0.125	29.595	25.823	0.0152
At most 2	0.071	16.377	19.387	0.1298
At most 3	0.022	4.8687	12.517	0.6153

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Relying on the results of Trace and Maximum Eigenvalue tests, Vector Error Correction (VECM) was estimated with rank of co-integration vector as (2) and allowing for linear trend in data (Intercept and trend in CE but no trend in VAR). The normalized form of the significant symmetric relations is as under:

Table 4: Vector Error Correction Estimates Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	CointEq2
($cpif_{t-1}$)	1.000	0.000
($cpin_{t-1}$)	0.000	1.000
($wpif_{t-1}$)	-1.357 (0.062) [-21.99]	-0.607 (0.034) [-17.80]
($wpin_{t-1}$)	0.726 (0.084) [8.61]	0.000
Trend	-0.003 (0.000) [-8.54]	-0.002 (0.00) [-8.55]
Constant	-1.371	-1.551

Cointegration Restrictions: B(1,1)=1, B(2,1)=0, B(2,2)=1, B(1,2)=0, B(2,4)=0
Convergence achieved after 5 iterations. Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 2):

Chi-square(1)	6.52E-05
Probability	0.993559

Lower case letter represents logarithmic form of the variable

Long run relationships derived from the above mentioned co-integrating equations are as follows:-

$$\Delta Ln(CPI_{t-1}^{F}) = 2.23 * \left(\Delta Ln(CPI_{t-1}^{N})\right) + 1.36 * \left(\Delta Ln(WPI_{t-1}^{F})\right) - 0.73 * \left(\Delta Ln(WPI_{t-1}^{N})\right) + 0.003 * (Trend) + 1.37 + \varepsilon_{t-1}^{CPIF} \quad (2)$$

$$\Delta Ln(CPI_{t-1}^{N}) = 0.45 * \left(\Delta Ln(CPI_{t-1}^{F})\right) + 0.61 * \left(\Delta Ln(WPI_{t-1}^{F})\right) + 0.32 * \left(\Delta Ln(WPI_{t-1}^{N})\right) + 0.002 * (Trend) + 1.55 + \varepsilon_{t-1}^{CPIN} \quad (3)$$

$$\Delta Ln(WPI_{t-1}^{F}) = 0.74 * \left(\Delta Ln(CPI_{t-1}^{F})\right) + 1.65 * \left(\Delta Ln(CPI_{t-1}^{N})\right) + 0.53 * \left(\Delta Ln(WPI_{t-1}^{N})\right) + 0.002 * (Trend) + 1.01 + \varepsilon_{t-1}^{WPIF} \quad (4)$$

$$\Delta Ln(WPI_{t-1}^{N}) = -1.38 * \left(\Delta Ln(CPI_{t-1}^{F})\right) + 3.08 * \left(\Delta Ln(CPI_{t-1}^{N})\right) + 1.87 * \left(\Delta Ln(WPI_{t-1}^{F})\right) + 0.004 * (Trend) + 1.89 + \varepsilon_{t-1}^{WPIN} \quad (5)$$

All the relationships are assumed to be statistically significant as they have been derived by solving statistically significant co-integrating equations.

b) Short run relationship

From long run normalized relationship, reduced form equations for the short run for disaggregated data of CPI and WPI were estimated. Table 5 explains the behavior of CPIF in the short run. CPIF is found to be endogenous in the short run as the Error Correction Terms are jointly statistically significant. For CPIF, deviation in food prices from the first long run equilibrium relationship (EC1) is being adjusted by 7.93%. Whereas the second long run equilibrium relationship (EC2) has no significant impact on food prices. It means that the disequilibrium generated in non-food prices has no impact on the food prices, which is also exhibited by the figure 2.

Table 5: Short Run Equation of CPIF in Log form at first difference

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.001930	0.001805	1.069133	0.2862
EC1	-0.079377	0.052917	-1.500036	0.1351
EC2	-0.025719	0.044684	-0.575576	0.5655
$(cpif_{t-2}-cpif_{t-3})$	-0.241727	0.091432	-2.643798	0.0088
$(cpin_{t-3}-cpin_{t-4})$	0.496875	0.200956	2.472550	0.0142
$(wpif_{t-2}-wpif_{t-4})$	0.183662	0.068404	2.684950	0.0078
$(wpin_{t-1}-wpin_{t-3})$	0.161228	0.037702	4.276417	0.0000
$(wpin_{t-4}-wpin_{t-5})$	-0.110420	0.065556	-1.684366	0.0936

R-squared	0.214610	Durbin-Watson stat	2.032370
Adjusted R-squared	0.188799	F-statistic	8.314697
Prob(F-statistic)	0.000000	Akaike info criterion	-5.958064

Lower case letter represents logarithmic form of the variable
Residuals are white noise.

Table 6 explains the behavior of CPIN in the short run. CPIN is found to be endogenous in the short run as the Error Correction Terms are jointly statistically significant. For CPIN, deviation in non-food prices from the first long run equilibrium relationship (EC1) has no significant impact on non-food prices. Whereas the second long run equilibrium relationship (EC2) is being adjusted by 8.8%. As the first error correction term (EC1) is the deviation of food prices from the long run path, therefore it significantly adjusts the short run movements of CPIF. And the second error correction term (EC2) is the deviation of non-food prices from the long run path so therefore it is impacting the short run movement of CPIN.

Table 6: Short Run Equation of CPIN in Log form at first difference

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.004939	0.000764	6.463642	0.0000
EC1	0.002744	0.014843	0.184865	0.8535
EC2	-0.088036	0.013629	-6.459364	0.0000
$(cpif_{t-1}-cpif_{t-2})$	-0.039664	0.022233	-1.784028	0.0759
$(cpif_{t-4}-cpif_{t-5})$	0.056169	0.043164	1.301287	0.1946
$(cpin_{t-1}-cpin_{t-2})$	0.165501	0.058232	2.842115	0.0049
$(cpin_{t-3}-cpin_{t-4})$	0.162007	0.070358	2.302598	0.0223
$(wpif_{t-2}-wpif_{t-4})$	-0.039390	0.034472	-1.142680	0.2545
$(wpif_{t-4}-wpif_{t-5})$	-0.093920	0.040338	-2.328355	0.0208
$(wpin_{t-2}-wpin_{t-3})$	0.052892	0.018635	2.838298	0.0050
R-squared	0.422717	Durbin-Watson stat		1.990621
Adjusted R-squared	0.398094	F-statistic		17.16728
Prob(F-statistic)	0.000000	Akaike info criterion		-8.287185

Lower case letter represents logarithmic form of the variable
Residuals are white noise.

For WPIF, deviation in food prices from the first long run equilibrium relationship (EC1) has no significant impact on food prices. Whereas the second long run equilibrium relationship (EC2) is being adjusted by 13.3%. For WPIN, deviation in non-food prices from the first long run equilibrium relationship (EC1) is being adjusted by 23%. Whereas the second long run equilibrium relationship (EC2) has no significant impact on non-food prices. WPIN has been found weakly exogenous.

Short run results of disaggregated indices show that the second round impact of food prices is relatively higher (23%) whereas the second round impact of non-food prices is 13%. (For detailed results of WPIN and WPIF, please see annex-II)

4. Conclusion

Different type of indices are always present in any economy, which makes the life of a central bank much more difficult as different indices could yield different inflation rates for the same period. And it may happen that central bank may achieve the inflation target for one index but misses for the other one. This situation may hit the credibility of the central bank and may force some inconsistent policies on part of central bank. But if the indices are co-integrated and follow a coherent path then the task of the central bank becomes much easier as any index can be chosen to calculate the inflation.

In this paper we have found that both the indices (CPI and WPI) are co-integrated in the long run and follow a coherent path. WPI was found weakly exogenous in the system and the in depth analysis (in disaggregated form) validates the results of aggregate analysis. Recent deviation of both the indices from their coherent path is due to the external shocks in the near past, as the near past period has witnessed high global food inflation and a highly volatile international oil prices. The speed of adjustment of the shock in non food prices of WPI is relatively slow and it takes some time for full adjustment.

Normalized results of Johansen co-integration technique indicate that WPI has significant impact on CPI. This implies that WPI is determined by market forces and that is also a leading indicator of consumer prices in Pakistan. Our overall findings include robust evidence that, for Pakistan, there is a strong bidirectional causality running amongst wholesale and consumer prices.

On the basis of results of this paper, we may conclude that the central bank should focus on CPI without worrying about the patterns of WPI. As both may deviate in the short run but will converge to the equilibrium path in the long run, and the policy goals of central banks are primarily of long term in nature. So the short run deviations of the behaviors of the indices will not cause any distortion to the long term policy goals of the central bank. In short run central bank may have a situation where inflation target for one index will be met but will miss for the other but in long run as both the indices will be on their coherent path so either the bank will achieve the target for both the indices or will miss for both.

References

Akdi, Y., Berument, H. and Cilasun, S. M. (2006). “The Relationship between Different Price Indices: Evidence from Turkey”, *Physica A* 360, 483-492.

Bechter, D. M. and Pickett, M. S. (1973). "The Wholesale and Consumer Price Indexes: What's the Connection?" *Monthly Review, Federal Reserve Bank of Kansas City*, 3-9.

Cecchetti, S.G. (2009). “Monetary Policy and the Measurement of Inflation: Prices, Wages and Expectations”, BIS (49), *Bank for International Settlements.*

Clark, T.E. (1999). “The Responses of Prices at Different Stages of Production to Monetary Policy Shocks”, *The Review of Economics and Statistics* 81(3), 420-433.

Coats, W. and Schiffman, H. (1995). “Key Issues in the Reform of Central Bank Legislation”, Monetary and Exchange Affairs Department, *International Monetary Fund.*

Colclough, W.G. and Lange, M.D. (1982). “Empirical Evidence of Causality From Consumer to Wholesale Prices”, *Journal of Econometrics*19, 379-84.

Cushing, M.J. and McGarvey, M.G. (1990). “Feedback between Wholesale and Consumer Price Inflation: A Reexamination of the Evidence”, *Southern Economic Journal* 56, 1059-72.

De Sousa, P.A.B. (2001). “Independent and Accountable Central Banks and the European Central Bank”, *European Integration online Papers (EIoP)* 5(9).

Enders, W. (2010). “Cointegration and Error Correction Models”, *Applied Econometric Time Series*, 3rd Edition, 356-427.

Engle, R.F, Hendry, D.F and Richard, J. (1983). “Exogeneity”, *Econometrica* 51(2), 277-304.

Engle, R. F. (1978). “Testing Price Equations for Stability Across Spectral Frequency Bands”, *Econometrica* 46(4), 869-81.

Gasper, V. and Smets, F. (2002). “Monetary Policy, Price Stability and Output Gap Stabilization”, *International Finance* 5(2), 193-211, Blackwell Publisher Limited.

Granger, C. and Newbold, P. (1974). "Spurious Regressions in Econometrics", *Journal of Econometrics* 2, 111-120.

Guthrie, R. S. (1981). "The Relationship between Wholesale and Consumer Prices", *Southern Economic Journal* 47(4), 1046-1055.

Hakkio, C.S. and Rush, M. (1991). "Cointegration: How Short is the Long-run?" *Journal of International Money and Finance* 10, 571-581.

Hatanaka, M. and Tom D. Wallace, T.D. (1980). "Multicollinearity and the Estimation of Low Order Moments in Stable Lag Distributions in Evaluation of Econometric Models" *Evaluation of Econometric Models, Academic Press.*

Johansen, S. and Juselius, K. (1990). "Maximum Likelihood Estimation and Inferences on Cointegration-with Applications to the Demand for Money" *Oxford Bulletin of Economics and Statistics* 52, 169–210.

Kremers, J.J.M., Ericsson, N.L. and Dolado, J. (1992). "The Power of Cointegration Tests", *The Journal of Econometrics* 52, 389-402.

MacKinnon, J. G., Haug, A. A. and Leo Michelis, L. (1999). "Numerical Distribution Functions of Likelihood Ratio Tests for Cointegration" *Journal of Applied Econometrics* 14, 563-577

Maddala, G.S. and Lahiri, K. (2009). "Introduction to Econometrics", 4th Edition, *Wiley Publication*.

Mishkin, F.S. (2004). "The Economics of Money, Banking and Financial Institutions", *Monetary Policy Strategy* 21, 501-503.

Moreno, R. (2009). "Some Issues in Measuring and Tracking Prices in Emerging Market Economies", BIS (49), *Bank for International Settlements*.

Pesaran, M. H., Shin, Y. and Smith, R. J. (2001). "Bounds Testing Approaches to the Analysis of Long Run Relationships", *Journal of Applied Econometrics* 16, 289-326.

Pesaran M. H. and Shin Y. (1999). "An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis", Chapter 11 in Econometrics and Economic Theory in the 20th Century, The Ragnar Frisch Centennial Symposium Strom. *Cambridge University Press, Cambridge*.

Phillips, P. and Hansen, B. (1990). "Statistical Inference in Instrumental Variables Regression with *I(1)* Processes", *Review of Economic Studies* 57, 99-125.

Ramanathan, R. (2002). "Introductory Econometrics with Applications", 5th Edition.

Shabaz, M., Haider, A. and Wahid, A.N.M. (2010). "Empirical Psychology between Wholesale Price and Consumer Price Indices: The case of Pakistan", *The Singapore Economic Review, World Scientific Publishing Company*.

Silver, J. L. and Wallace, T. D. (1980). "The Lag Relationship between Wholesale and Consumer Prices-An Application of the Hatanaka-Wallace Procedure", *Journal of Econometrics* 12, 375-87.

Srour, G (2001). "Price-Level versus Inflation Targeting in a Small Open Economy", *Working Paper 24, Bank of Canada*.

Walsh, C.E. (1995). "Recent Central Bank Reforms and the Role of Price Stability as the Sole Objective of Monetary Policy", *NBER Macroeconomics Annual 10*, 237-252

White, H. (1980). "A Hetroskedesticiy Consistent Covariance Matrix and a Direct Test for Hetroskedesticiy", *Econometrica* 48, 817-838.

Wu- Jyh-Lin (1996). "The Empirical Investigation of Long Run Purchasing Power Parity: The Case of Taiwan Exchange Rate", *International Economic Journal* 10(4), 59-69.

Annexure-I

Table 1.1: Unit Root Test at Levels

Variable	Option included	t-ADF	5% Critical Value	prob*	Lag Length
Ln(CPI)	None	6.879	-1.942	0.999	3
	Intercept	0.326	-2.869	0.979	4
	Trend and Intercept	-1.405	-3.422	0.859	3
Ln(WPI)	None	7.520	-1.942	1.000	1
	Intercept	0.798	-2.869	0.994	1
	Trend and Intercept	-1.648	-3.421	0.772	1
Ln(CPIF)	None	8.772	-1.942	1.000	0
	Intercept	0.791	-2.874	0.994	0
	Trend and Intercept	-0.264	-3.430	0.991	0
Ln(CPIN)	None	3.772	-1.942	1.000	3
	Intercept	0.198	-2.874	0.972	3
	Trend and Intercept	-1.221	-3.430	0.903	3
Ln(WPIF)	None	9.583	-1.942	1.000	0
	Intercept	0.577	-2.874	0.989	0
	Trend and Intercept	-0.491	-3.430	0.983	1
Ln(WPIN)	None	4.178	-1.942	1.000	1
	Intercept	0.178	-2.874	0.971	1
	Trend and Intercept	-2.135	-3.430	0.523	1

*MacKinnon (1996) one-sided p-values.

Table 1.2: Unit Root Test at First Difference

Variable	Option included	t-ADF	5% Critical Value	prob*	Lag Length
Ln(CPI)	None	-2.514	-1.942	0.012	8
	Intercept	-8.939	-2.869	0.000	3
	Trend and Intercept	-8.939	-3.422	0.000	3
Ln(WPI)	None	-3.217	-1.942	0.001	8
	Intercept	-14.055	-2.869	0.000	0
	Trend and Intercept	-14.086	-3.421	0.000	0
Ln(CPIF)	None	-5.006	-1.942	0.000	2
	Intercept	-13.258	-2.874	0.000	0
	Trend and Intercept	-13.278	-3.430	0.000	0
Ln(CPIN)	None	-1.980	-1.942	0.046	2
	Intercept	-4.302	-2.874	0.001	2
	Trend and Intercept	-4.302	-3.430	0.004	2
Ln(WPIF)	None	-4.462	-1.942	0.000	2
	Intercept	-12.722	-2.874	0.000	0
	Trend and Intercept	-12.721	-3.430	0.000	0
Ln(WPIN)	None	-8.633	-1.942	0.000	0
	Intercept	-9.875	-2.874	0.000	0
	Trend and Intercept	-9.873	-3.430	0.000	0

*MacKinnon (1996) one-sided p-values.

Annexure-II

Table 2.1: Short Run Equation of WPI in Log form at first difference
Method: Least Squares
White Heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.005431	0.000858	6.331271	0.0000
EC	0.022126	0.029360	0.753615	0.4515
$(cpi_{t-1}-cpi_{t-3})$	-0.115074	0.065275	-1.762902	0.0787
$(cpi_{t-3}-cpi_{t-4})$	0.054408	0.056980	0.954848	0.3403
$(wpi_{t-1}-wpi_{t-2})$	0.362786	0.070057	5.178444	0.0000
$(wpi_{t-2}-wpi_{t-3})$	0.094047	0.073464	1.280176	0.2013
$(wpi_{t-4}-wpi_{t-5})$	-0.027232	0.061273	-0.444438	0.6570
R-squared	0.117959	Durbin-Watson stat		1.967892
Adjusted R-squared	0.104069	F-statistic		8.492127
Prob(F-statistic)	0.000000	Akaike info criterion		-6.264631

Lower case letter represents logarithmic form of the variable

Table 2.2: Short Run Equation of WPIF in Log form at first difference

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.006414	0.001615	3.972646	0.0001
EC1	0.034230	0.043394	0.788812	0.4311
EC2	-0.132971	0.037004	-3.593431	0.0004
$(cpif_{t-1}-cpif_{t-3})$	-0.101235	0.045566	-2.221719	0.0273
$(cpin_{t-3}-cpin_{t-4})$	0.231555	0.166963	1.386862	0.1669
$(wpif_{t-4}-wpif_{t-5})$	-0.141219	0.070233	-2.010742	0.0456
$(wpin_{t-1}-wpin_{t-3})$	0.158851	0.032562	4.878491	0.0000
R-squared	0.234236	Durbin-Watson stat		1.994119
Adjusted R-squared	0.212766	F-statistic		10.90991
Prob(F-statistic)	0.000000	Akaike info criterion		-6.196646

Lower case letter represents logarithmic form of the variable

Table 2.3: Short Run Equation of WPIN in Log form at first difference

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.002402	0.002341	1.026404	0.3058
EC1	-0.229864	0.051819	-4.435905	0.0000
EC2	0.016176	0.045833	0.352938	0.7245
$(cpin_{t-2}-cpin_{t-3})$	0.674497	0.245393	2.748638	0.0065
$(cpin_{t-3}-cpin_{t-4})$	-0.429290	0.247657	-1.733407	0.0845
$(wpin_{t-1}-wpin_{t-2})$	0.479422	0.062955	7.615309	0.0000
R-squared	0.262142	Durbin-Watson stat		2.068864
Adjusted R-squared	0.245062	F-statistic		15.34789
Prob(F-statistic)	0.000000	Akaike info criterion		-5.642471

Lower case letter represents logarithmic form of the variable

Annexure-III

Diagnostics Tests	CPI	WPI	CPIF	CPIN	WPIF	WPIN
Autocorrelation test						
$Q_{(4)}$	0.2830 (0.991)	0.4102 (0.982)	0.2609 (0.992)	1.0377 (0.904)	1.4412 (0.837)	0.9034 (0.924)
$LM_{(4)}$	0.8772 (0.4776)	1.1620 (0.3272)	0.1275 (0.9723)	0.3492 (0.8444)	0.5468 (0.7016)	0.7980 (0.5277)
$Q^2_{(4)}$	4.025 (0.403)	26.00 (0.00)	2.5090 (0.643)	0.8719 (0.929)	1.9815 (0.739)	23.191 (0.000)
White Test						
F-statistic	0.4182 (0.8669)	5.55 (0.00)	1.3787 (0.2156)	4.8388 (0.000)	1.888 (0.084)	7.9513 (0.000)
Obs*R-squared	2.5387 (0.8641)	31.22 (0.00)	9.5795 (0.2137)	37.8095 (0.000)	11.1125 (0.085)	34.5092 (0.000)
Scaled explained SS	10.1764 (0.1174)	60.49 (0.00)	11.6076 (0.1142)	159.10 (0.000)	14.5516 (0.024)	65.8480 (0.000)
Stability Test: Quandt-Andrews unknown breakpoint test Number of breaks compared: 270 (for CPI and WPI) and 153 for CPIF, CPIN, WPIF and WPIN.						
Maximum LR F-statistic	1.7899 (1.00)	3.8670 (1.00)	2.0563 (1.00)	2.6859 (1.00)	2.5310 (1.00)	1.9838 (1.00)
Maximum Wald F-statistic	1.7899 (1.00)	3.8670 (1.00)	4.5196 (1.00)	0.0675 (1.00)	3.1842 (1.00)	1.9838 (1.00)
Exp LR F-statistic	0.4821 (1.00)	1.2095 (1.00)	0.5895 (1.00)	0.6580 (1.00)	0.6606 (1.00)	0.6641 (1.00)
Exp Wald F-statistic	0.4821 (1.00)	1.2095 (1.00)	0.1317 (1.00)	0.0011 (1.00)	0.1447 (1.00)	0.6641 (1.00)
Ave LR F-statistic	0.9392 (1.00)	2.3626 (0.9998)	1.1549 (1.00)	1.2156 (1.00)	1.2462 (1.00)	1.3072 (1.00)
Ave Wald F-statistic	0.9392 (1.00)	2.3626 (0.9998)	-0.2632 (1.00)	0.0019 (1.00)	-0.7951 (1.00)	1.3072 (1.00)
All the probabilities are given in parenthesis Note: probabilities calculated using Hansen's (1997) method for Stability tests						