CAUSALITY ANALYSIS BETWEEN CPI INFLATION AND WPI INFLATION: THE PAKISTAN EXPERIENCE

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ABSTRACT*: In this paper we examine the causality between CPI inflation and WPI inflation. Granger causality test is employed to check that WPI inflation causes CPI inflation or CPI inflation rates reflected by the WPI inflation rates. The result demonstrates that there is no visible causality between both types of inflation up to lag 10 (5% level of significance). However there is causality between the series at lag 1 (10% level of significance) and at lag 12 (5% level of significance) whereas this causality runs from WPI inflation to CPI inflation. Hence we conclude that the WPI inflation is influenced by the CPI inflation. The results are useful to predict the early inflating through WPI inflation*.

Keywords: *CPI inflation, WPI inflation, Unit root, Correlogram, Granger causality.*

1. INTRODUCTION

As a community we are currently facing significant inflationary pressures due to record high increases in essential commodity prices. The surge in inflation rates has become a major challenge that threatens price stability in many countries. It is now a crystal clear that average inflation throughout the world has been rising rapidly. Inflation in developed countries has reached its highest level in the last two decades. For the first time in many years, inflation figures of the developing countries are crossing physiological two digit levels.

Targeting of inflation is the prime objective of every central bank whether it is of a developed country or underdeveloped. Central bank usually uses monetary policy to curtail the inflation and they are very careful about their monetary policies. Any unrealistic decision pushes the economy into troubled water. Central Banks always set their monetary policies by the movement of inflation. Hence bankers, policy makers and researchers have been long concerned about finding early indicators of inflation. This study is being used to explore such indicators; one of these indicators is the Wholesales Price Index (WPI).

It is a fact that if costs of production i.e. producer's prices are high then these are ultimately shifted to wholesalers and wholesalers shift this increment to consumers [1]. For cost of production, wholesalers and consumers/retailers use Producers Price Index (PPI), Wholesale Price Index (WPI) and Consumer Price Index (CPI) respectively. PPI is not computed in Pakistan so we use the second shift. In this study our aim is to analyze whether consumer inflation rates are reflected by the WPI inflation rates. In this regard, we check the causality between CPI inflation rates and WPI inflation rates.

Most of the researchers have analyzed the causality among money, price and output not only in Pakistan but also around the world. Researchers like Sims [2], Barth and Bennett [3], Williams *et al* [4], Beltas and Jones [5], Darrat [6], Jones and Khilji [7] Brillembourg and Khan [8] and some others have checked causality. In the context of Pakistan, many researchers such as Khan and Siddiqui [9], Abbas [10], Bangali, Khan and Saddaqat [11], have attempted causality in respect of money, price and output. Many other areas are also available in which causality tests have been performed.

To the best of our knowledge non has attempted to check the causality between WPI inflation and CPI inflation in the economy of Pakistan. This study is the first attempt in this regard. We make the hypothesis as: WPI inflation is influenced by the CPI inflation.

The rest of the paper is organized as section 2 consists of data description and methodology. The results and analysis are presented in section 3. Section 4 concludes the paper.

2. MATERIALS AND METHODS:

In this study we used monthly data from July 1992 to June 2008 for both CPI inflation and WPI inflation with base 2000-01. The data have been collected from Federal Bureau of Statistics (FBS).

The first variable is the Consumer Price Index (CPI) inflation. CPI covers the retail prices of 374 items in 35 major cities and reflects roughly the cost of living in the urban areas of the country. Prices of 374 consumer items (both tradable and non-tradable) are taken for computation of this index on monthly basis. The second variable is the Wholesale Price Index (WPI) inflation. WPI measures the directional movements of prices for a set of selected items (tradable) in the primary and wholesale markets. Items covered in the series are those which could be precisely defined and are offered in lots by producers/manufacturers. Prices used in this index are generally those, which conform to the primary sellers realization at ex-mandi, ex-factory or at an organized wholesale level. The current series of WPI being computed are based on prices of 425 items which are sold in 18 main markets of the country.

In this study the monthly point to point inflation (seasonally unadjusted) is computed using the formula:

$(P_{n,1}- P_{n,0})/P_{n,0}*100$, someone can also use :

$Ln\ (P_{n,1}/P_{n,0})*100$, where $P_{n,1}$ is the index number (WPI or CPI) in current month and $P_{n,0}$ is the index number in the same month last year.

To analyze the relationship between CPI inflation and the WPI inflation, this paper focuses on causality among these variables using the method adapted by Granger [12]. Granger developed an application of distributed lag models

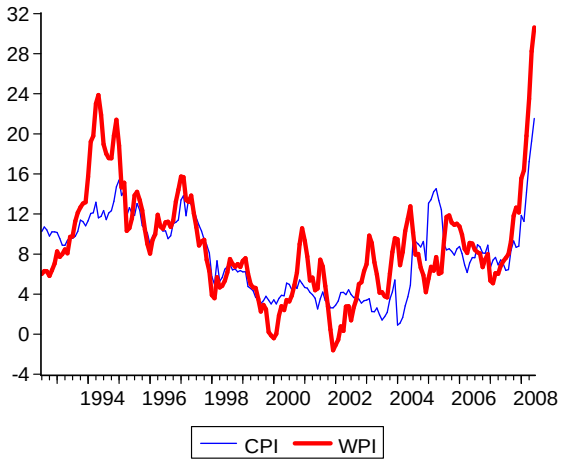


Figure: 1 combined graph of CPI inflation and WPI inflation

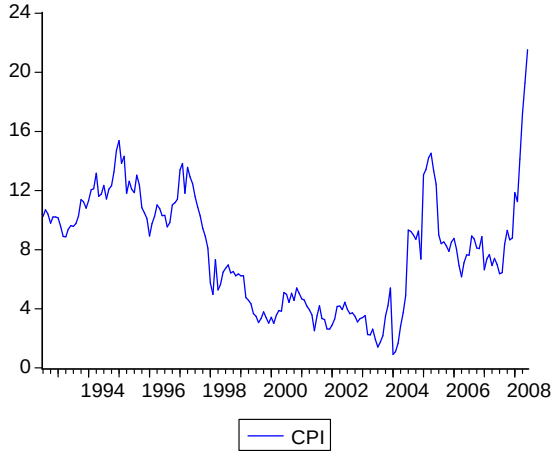


Figure 2 (a): Line graph and correlogram of CPI inflation

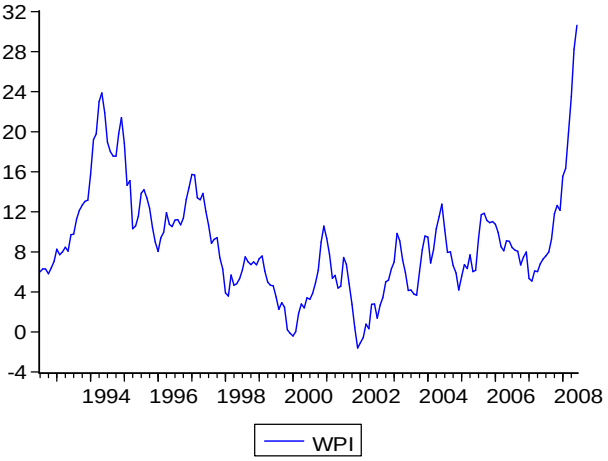
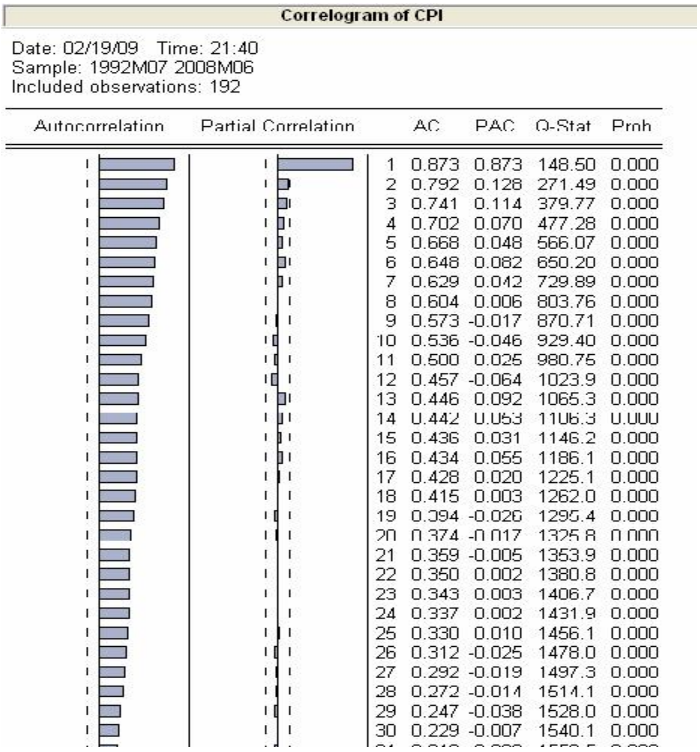


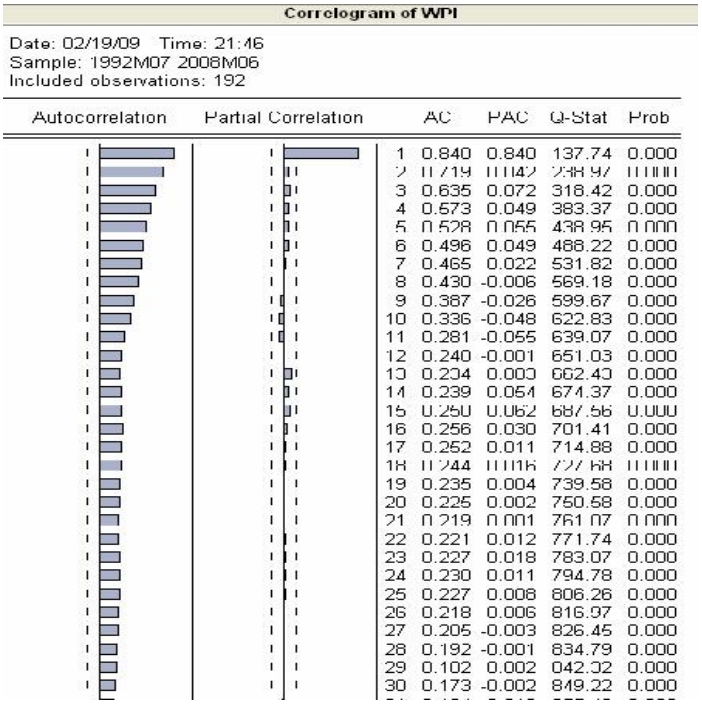
Figure 2(b): Line graph and correlogram of WPI inflation



Correlogram of CPI

Date: 02/19/09 Time: 21:40
Sample: 1992M07 2008M06
Included observations: 192

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.873	0.873	148.50	0.000
		2	0.792	0.128	271.49	0.000
		3	0.741	0.114	379.77	0.000
		4	0.702	0.070	477.28	0.000
		5	0.668	0.048	566.07	0.000
		6	0.648	0.082	650.20	0.000
		7	0.629	0.042	729.89	0.000
		8	0.604	0.006	803.76	0.000
		9	0.573	-0.017	870.71	0.000
		10	0.536	-0.046	929.40	0.000
		11	0.500	0.025	980.75	0.000
		12	0.457	-0.064	1023.9	0.000
		13	0.446	0.092	1065.3	0.000
		14	0.442	0.053	1106.3	0.000
		15	0.436	0.031	1146.2	0.000
		16	0.434	0.055	1186.1	0.000
		17	0.428	0.020	1225.1	0.000
		18	0.415	0.003	1262.0	0.000
		19	0.394	-0.026	1295.4	0.000
		20	0.374	-0.017	1325.8	0.000
		21	0.359	-0.005	1353.9	0.000
		22	0.350	0.002	1380.8	0.000
		23	0.343	0.003	1406.7	0.000
		24	0.337	0.002	1431.9	0.000
		25	0.330	0.010	1456.1	0.000
		26	0.312	-0.025	1478.0	0.000
		27	0.292	-0.019	1497.3	0.000
		28	0.272	-0.014	1514.1	0.000
		29	0.247	-0.038	1528.0	0.000
		30	0.229	-0.007	1540.1	0.000



Correlogram of WPI

Date: 02/19/09 Time: 21:46
Sample: 1992M07 2008M06
Included observations: 192

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.840	0.840	137.74	0.000
		2	0.719	0.042	248.97	0.000
		3	0.635	0.072	318.42	0.000
		4	0.573	0.049	383.37	0.000
		5	0.528	0.055	438.95	0.000
		6	0.496	0.049	488.22	0.000
		7	0.465	0.022	531.82	0.000
		8	0.430	-0.006	569.18	0.000
		9	0.387	-0.026	599.67	0.000
		10	0.336	-0.048	622.83	0.000
		11	0.281	-0.055	639.07	0.000
		12	0.240	-0.001	651.03	0.000
		13	0.234	0.003	662.43	0.000
		14	0.239	0.054	674.37	0.000
		15	0.250	0.062	687.56	0.000
		16	0.256	0.030	701.41	0.000
		17	0.252	0.011	714.88	0.000
		18	0.244	0.016	727.68	0.000
		19	0.235	0.004	739.58	0.000
		20	0.225	0.002	750.58	0.000
		21	0.219	0.001	761.07	0.000
		22	0.221	0.012	771.74	0.000
		23	0.227	0.018	783.07	0.000
		24	0.230	0.011	794.78	0.000
		25	0.227	0.008	806.26	0.000
		26	0.218	0.006	816.97	0.000
		27	0.205	-0.003	826.45	0.000
		28	0.192	-0.001	834.79	0.000
		29	0.102	0.002	842.32	0.000
		30	0.173	-0.002	849.22	0.000

to test for causality between two related economic time series, in our case these are CPI inflation and the WPI inflation. The Granger approach identifies how much of the current value of a variable is explained by a regression containing lagged values of itself and the related variable. Two regressions are specified to allow for testing for causality between CPI inflation and WPI inflation in both directions:

$$CPI_t = f(\ldots CPI_{t-1}; CPI_{t-2}; \ldots; CPI_{t-p}; WPI_{t-1}; WPI_{t-2}; \ldots; WPI_{t-p} \ldots) \quad (1)$$

H_0 = coefficients of the lagged WPI's are jointly non-significant

$$WPI_t = f(\ldots WPI_{t-1}; WPI_{t-2}; \ldots; WPI_{t-p}; CPI_{t-1}; CPI_{t-2}; \ldots; CPI_{t-p} \ldots) \quad (2)$$

H_0 = coefficients of the lagged CPI's are jointly non-significant

Where ***t*** is time period and p is number of lag lengths. Using the F-test of joint significance, the causality tests are:

(a) WPI inflation Granger-causes CPI inflation if the null hypothesis is rejected in Equation 1.
(b) CPI inflation Granger-causes WPI inflation if the null hypothesis is rejected in Equation 2.
(c) Bidirectional causality exists between WPI inflation and CPI inflation if the null hypothesis is rejected in both Equations 1 and 2.
(d) No causality exists when both null hypotheses are accepted.

Table 1: Tests for Unit Root

Series	Tests	In Levels		In 1st Difference	
		With drift	With trend and drift	With drift	With trend and drift
CPI	ADF	-0.5758(12)	0.252217	-4.184547 (11)*	-4.428127*
	PP	-0.8909 (4)	-0.208368 (3)	-13.34021 (4)*	-13.49790(3)*
WPI	ADF	-1.3087(1)	-1.0274	-9.332907(0)*	-5.186610*
	PP	-0.7498 (2)	-0.144155 (1)	-9.206332 (6)*	-9.271679*

Note: * indicates rejection of null hypotheses at 5% significance level

Causality tests are well known to be sensitive to the choice of lag lengths used in the specification [13-14]. Theoretical justifications for a given temporal distance between cause and effect are difficult to find[15]. Hence, for this study lags of one to twelve months were examined for both regressions variables. Time series properties of both of the variable have been checked. Traditional unit root tests like Augmented Dickey-Fuller test and Phillipe-Perron test have been used for checking the unit root in the series. For simplicity, we never use cointegration test for checking long-term relationship between variables.

3. RESULTS AND DISCUSSIONS:

To check the co-movement of both of the series we look at Figure 1 which is the combined graph of WPI inflation and CPI inflation. By examining the graph we observe that from 1993 to 1995 although the CPI inflation follows WPI inflation but CPI inflation measures were significantly lower than the WPI inflation. Further, from 1995 to 2001 the CPI inflation closely follows WPI inflation i.e. there is a greater convergence between the two measures. Lastly, from 2001 to 2008, there is also evenly change in both inflations although WPI inflation has generally been higher. In this situation we may not be sure whether CPI inflation is predicated by WPI inflation.

To perform Granger causality it is to be preferred to check the time series properties of both measures. Figure 2a &2b show the line graph and correlogram of both of the series. Figures demonstrate that sample autocorrelations dies down slowly which is the indication of non-stationary series hence unit root is warranted.

The results of Augmented Dickey and Fuller (ADF) and Phillipe- Perron test (PP) under the null hypothesis that there is unit root is reported in table 1. The choice of lag length is based on the minimum Akaik Information Criterion (AIC). We use maximum twenty lags and the figures in parentheses are the optimal lags length. For Phillipe-Perron test, Newey-West bandwidth selection procedure is adopted which uses Bartlett kernel spectral estimation method.

The results clearly indicate that the null hypothesis is rejected in differences but not in levels. Hence, both of the series are first difference stationary. The results confirm that all the variables are integrated of order one in levels but integrated of order zero in first differences.

In view of the above it is established that the series follow the same order of integration, we can test for the causal relationship between both the series using pair wise Granger causality test. In Table 2 the results of pair wise Granger causality tests are presented. Since variables under considerations are I (1), we use the first differenced series in the model for checking causality instead of levels.

The null hypothesis in each case is that the variable under consideration does not "Granger causes" the other variable. These results suggest that there is no statistically discernible relationship between the two variables up to lag 10 during the study period 1992:07 to 2008:06 as the computed F values lie below the critical value at 5 percent level. The null hypothesis that WPI does not Granger cause CPI at lag 1 is rejected at 10% significance level. Hence at lag 1 and 12 the results depict that the direction of causality is from WPI inflation to CPI inflation. The results also indicate that the outcome of the Granger test is sensitive to the number of lags introduced in the model as claimed by [13] and [16].

4. CONCLUSION

We used monthly point to point inflation from July 1992 to June 2008 for CPI and WPI. Unit roots tests indicated that both series are 1st difference stationary. We used 1st difference stationary series to check the causality between CPI and WPI inflation. Granger causality test was employed to check that WPI inflation causes CPI inflation or CPI inflation rates reflected by the WPI inflation rates. The result demonstrated that there was no visible causality between both types of inflation up to lag 10 at 5% level of significance whereas there was causality between the series at lag 1(10% level of significance) and at lag 12 (5% level of significance). In view of this we can say that Granger causality is sensitive by the number of lags included in the model. This causality runs from WPI inflation to CPI inflation. Alternatively, the WPI inflation is influenced by the CPI inflation. This finding can help policy makers to predict the early inflating through WPI inflation.

Table 2: Pair wise Granger Causality Tests

Null Hypothesis		obs	F-Stat	Prob.	Remarks
DCPI does not Granger Cause DWPI	1	190	0.09909	0.75328	do not reject
DWPI does not Granger Cause DCPI			2.76688	0.09791	Reject at 10%
DCPI does not Granger Cause DWPI	2	189	0.08782	0.91597	do not reject
DWPI does not Granger Cause DCPI			1.83283	0.16287	do not reject
DCPI does not Granger Cause DWPI	4	187	0.05602	0.99412	do not reject
DWPI does not Granger Cause DCPI			1.10324	0.35659	do not reject
DCPI does not Granger Cause DWPI	6	185	0.66138	0.68093	do not reject
DWPI does not Granger Cause DCPI			0.66244	0.68008	do not reject
DCPI does not Granger Cause DWPI	8	183	0.67188	0.71577	do not reject
DWPI does not Granger Cause DCPI			0.84717	0.56255	do not reject
DCPI does not Granger Cause DWPI	10	181	0.80063	0.62828	do not reject
DWPI does not Granger Cause DCPI			1.42673	0.17282	do not reject
DCPI does not Granger Cause DWPI	12	179	1.24975	0.25434	do not reject
DWPI does not Granger Cause DCPI			2.05321	0.02317	Reject

Note: * indicates rejection at 5% level of significance

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