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Do Food Prices Affect Non-Food Prices? A New Dimension of Inflation Transmission in Pakistan

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ABSTRACT

The study has attempted to see a new aspect of inflation in Pakistan, i.e. an understanding of the effect of food prices on non-food prices. For the purpose, the annual time-series data for the years 1970 to 2014 are used to determine the Granger causality between food prices and non-food prices. The results show that the food price index has a positive effect on the non-food price index and the causality is from the food price index to the non-food price index. The relationship between the index of food prices and the index of non-food prices is stable over time. The results suggest that any attempt to control inflation, one dimension of the anti-inflationary policy should be the special care of food items to restrict their price rise through the supply of food by domestic production or imports.

Keywords: Food prices, Non-food prices, Granger causality.

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1. INTRODUCTION

Investigating the causes of inflation has been a significant area of interest for economists around the world. Since developing economies are structurally different from advanced economies, inflation in developing countries may have some specific triggers. In this way, the determinants of inflation in developing economies require a separate analysis. It initiates an inflation analysis with a view to the impact of food prices on non-food prices in the developing economies such as Pakistan[1]. The emphasis is based on the fact that people in developing economies spend a larger share of their spending on food items compared to people in advanced countries, so the increase in inflation is primarily due to an increase in food prices (Gregorio, 2012)[2]. This large share of the budget for food items has implications for inflation, which requires an empirical analysis. A unique channel of inflation transmission from food prices to non-food prices is studied in this study. The

[1]Looking at how food price impacts non-food inflation can help the central bank to remain vigilant in stemming an incipient increase in non-food inflation that could spill over from food prices (Walsh, 2011).

[2]Seale, Regmi and Bernstein (2003), using the World Bank's International Comparison Project (ICP) information for 114 countries, report that, on average, consumers in low-income countries spend 52.58% of the total budget on food and drink, while consumers in high-income countries spend on average 16.97% of their budget on food and drink. These variations are much larger for individual countries. For example, Tanzania has a share of 73.24 per cent, while the United States has a share of 9.73 per cent.

argument for the hypothesis of this study is as follows: in developing countries, a large proportion of the population is poor and spends a higher proportion of its budget on food items compared to developed countries. Food prices, therefore, matter a great deal, because people spend 60 to 70 percent of their income on food items and the remaining 30 to 40 percent on other needs, such as house rent, clothing and utility bills, *etc*. Expenditures on other necessities cannot be reduced. The increase in food prices, by its nature, is different from the increase in the prices of other necessities. It has serious inflation implications than changes in the prices of other necessities. A slight increase in prices of other necessities can be quickly absorbed by the reduction in the quantity or quality of food, but an increase in the prices of food items cannot be absorbed by the reduction in the expenses on other necessities because these expenses are fixed and out of control of the household. If an increase in food prices becomes possible to be absorbed by no-food expenditures or other necessities the adjustment takes time. For example, house rent can be minimized by moving to an inferior house, but this adjustment takes time.

If food prices increase, there are two options open to households to tackle this problem: firstly, they can increase real income (goods and services produced by households) to compensate for the increase in food prices and, secondly, increase nominal income (prices of goods and services produced by households). The first alternative is difficult, because the poor are poor, and they cannot find a way to increase their real income. Households therefore increase their nominal income, i.e. they increase the prices of their goods and services. After rising food prices, people have to adjust their incomes to cope with rising food prices. They make adjustments to income through a nominal increase in income. This means that prices of goods and services are rising following an increase in food prices. Food prices therefore increase the prices of non-food products.

To further elaborate the argument, it might be insightful to see different sections of the labor force. For example, in the case of the self-employed labour force[3], who have a larger share of the food budget as food prices increase, they find their income inadequate to fulfill their food requirements and other bare necessities. They are trying to raise the prices of their own goods and services to meet their food requirements. This results in an increase in the general price level followed by an increase in food prices[4].

The owners of the firms are rich enough not to take care of food prices, but their employees are not in general. After rising food prices, employees seek to raise their wages to compensate for the rise in food prices. Everything being constant, employers are raising wages and, in order to compensate for the increase in wages, they are increasing the price of their products. In this way, inflationary pressures are developing in the economy. Thus, an inflationary transmission mechanism is being developed, i.e. an increase in food prices tends to increase the general price level of the economy. Beak and Koo (2010) provide a detailed analysis of the factors that influence inflation caused by an increase in food prices.

Researchers have been drawn to this economic mechanism to explain the phenomenon of inflation in developing economies (see Mishra & Roy, 2011 for India; Adam, Kwimbere, Mbowe, & O'Connell, 2012 for Tanzania; Radukic, Markovic, & Radovic, 2015 for Serbia; Missati and Munene, 2015 for Kenya; Zaman & Khan, 2018 for developing economies). For Pakistan, some of the studies have analyzed support/procurement price of wheat, among others, as determinants of inflation. They seem to explain that since wheat and its derived products constitute a major share of the consumer price index (CPI), so rise in wheat support/procurement price raise CPI and general inflation. The mechanism for the wheat price to influence general prices is more mathematical than economic. According to Khan, Qazi, & Hyder (2007)… "This effect

[3]Self-employed workers are in large fraction of labor force in developing countries due to weak industrial base.

[4]It is reasonable to assume that these self-employed workers would make adjustments by increasing the prices of their goods and services, following an increase in food prices, much faster than ordinary workers in the industrial sector. Who in the event of an increase in food prices, would have to resort to an increase in wages in the labor union.

(effect of wheat price on general price level) is due to the fact that wheat and wheat-related products account for 5.1 percent of the CPI basket". Hasan, Khan, Pasha, Rasheed, & Hussain (1995) narrated that "A substantial increase in support prices has an inflationary effect on consumer prices". The study did not mention the mechanism by which an increase in food prices could lead to a general price level. The precise objective of the current study is to assess the impact of food prices on non-food prices in Pakistan.

The rest of the paper has the following organization: a review of literature is given in section two, section three explains the research methodology, econometric estimation is given in section four, and conclusion is given in section five.

2. LITERATURE REVIEW

Much of the literature exists on inflation and its determinants, but few studies exist on the relationship between food prices and non-food prices. Hasan *et al*. (1995) regressed CPI food and non-food components on money supply, domestic economic activity (GDP) and import price index. They found that all variables significantly explain food inflation and non-food inflation.

Seale *et al*. (2003) estimated income and price elasticity for categories of consumption and food subgroups using data from 1996 International Comparison Project (ICP) for 114 countries. The study used the two-stage demand system and the ML procedure to find that low, middle and high-income groups react differently to income and food price shocks. They find that low-income countries respond more to such shocks than rich countries do.

Khan and Schimmelpfinning (2006a) investigated CPI's response to the money supply, credit to the private sector, real GDP, nominal effective exchange rate, interest rate, exchange rate and support price of wheat in Pakistan using monthly data for the period 1998-2005. They concluded that inflation was determined by monetary factors (credit to the private sector performed well then money supply in the equation), real GDP, and the short-term wheat support price through co-integration and ECM. For the long-run dynamics of the relationship, they concluded that inflation is explained solely by monetary factors. Wheat support prices do not explain inflation in the long run. The explanation was that prices should have enough time to adjust in response to a change in the price of support for wheat. Prices in Pakistan are not so flexible that they can be adjusted in one month in response to changes in food (wheat) prices. Annual data may best capture the postulated mechanism.

Khan *et al*. (2007) regressed CPI on government borrowing, real demand relative to real supply, private sector borrowing, import prices, exchange rate, and government taxes on nominal value added in the manufacturing sector, adaptive expectations and the wheat support price. The results of the ordinary least square showed that all variables significantly explain inflation.

Walsh (2011) explained that food inflation in many countries is transmitted into non-food inflation in a significant and important way, and this is particularly so in developing economies. In both rich and poor countries, large upward food price shocks spread relatively quickly to non-food prices. However, this effect is more pronounced in poor countries than in rich countries. In rich countries, a one percent shock to food prices on average results in a 0.15 percent increase in non-food prices, but in poor countries, the average is around 0.3 percent. This effect is compounded by the high volatility of food prices and the right skew. With large price shocks more likely to occur between food prices than between non-food prices, discounting food prices in countries where food price shocks are strongly or rapidly transmitted to non-food prices can lead to underestimation of the medium-term effect of these shocks.

By using the 2005 ICP data for 144 countries, Muhammad, Seale, Meade, and Regmi (2011) analyzed the income and price elasticity of demand for the major categories of consumption and food groups. They

concluded that poor countries spend more of their budgets on necessities such as food, while high-income countries spend more of their budgets on luxuries such as recreation. Low-value food, such as cereals, accounts for a larger share of the food budget of low-income countries, while high-value food accounts for a larger share of the food budget in rich countries. Low-income countries respond more to changes in income and prices and make greater adjustments to their food consumption patterns when income and prices change, but this adjustment is not the same across all food categories. Cereal consumption changes the least, while high-value food consumption changes the most.

Meade, Regmi, Seale, and Muhammad (2014) also used data from 144 countries to analyze cross-price elasticity the major categories of consumption. It also estimated the cross-price elasticity between food and non-food items. The results showed that cross-price elasticity for food in relation to non-food prices remained low in low-income countries because, in poor countries, people spend little of their budget on non-food items and a higher portion of food items. So the change in non-food prices has little effect on food consumption. The cross-price elasticity of non-food items remained high in low-income countries, suggesting a high response of non-food expenditure due to changes in food prices. It is due to the fact that food items represent a larger share of the budget in low-income countries.

Pourroya, Carton, and Coulibaly (2016) investigated the optimal monetary policy that could manage food price shocks. They have developed a new - Keynesian small open-economy model that incorporates world food price shocks. The results explain that the optimal monetary policy depends on the level of the country's income. Overall consumer price targeting is optimal in low and medium-income countries, while non-food inflation targeting is the best option in high-income countries. This is due not only to the fact that food is a significant part of total consumption in low and medium-income countries but also to the fact that food is of good composition.

Bhattacharya and Gupta (2018) analyzed the impact of global food prices, fuel prices, agricultural wages and demand for food products on domestic food inflation (aggregate and main products) in India through Structural Vector Autoregression using the entire sale price index of the items. The study further looked at the extent of the transfer of food prices to non-food prices and aggregate prices and concluded that the effect of food prices on non-food prices and headline inflation exists in India.

A large number of studies have attempted to estimate inflation determinants and some of the studies (Hasan *et al*., 1995; Khan & Qasim, 1996; Khan & Schimmelpfenning, 2006a, 2006b; Khan *et al*., 2007) have investigated the effect of food prices (wheat only) on general inflation in Pakistan[5]. Mishra and Roy (2011) quantified the contribution of specific commodities to inflation in India. Foods from animal sources (milk, fish), processed foods (sugar, edible oils), fruits and vegetables (e.g. onions) and cereals (rice and wheat) have been identified as primary drivers. However, according to our knowledge, none of the studies have investigated the effect of overall food prices on general / non-food inflation in the country.

3. METHODOLOGY

The main objective of the current study is to check the impact of food prices on non-food prices. The following model has been created for the purpose.

[5]All these studies have not eliminated the specific component, `that is a wheat price from the general CPI, on which they regress the general CPI. This, in a sense, is regressing a variable on itself because wheat and related products constitutes a quite reasonable share of the general CPI.

$$CPI_{nf}=f(CPI_{f,}\ M_{2,}GDP,\ CPI_{nf\ t-1})\ \ldots\ldots\ldots\ldots(1)$$

Where

CPI_{nf} = Growth rate of non-food CPI

CPI_f= Growth rate of food CPI (food and beverages price index)

M_2= Growth rate of money supply

GDP = Growth rate of GDP

$CPI_{nf\ t-1}$ = One period lagged non-food CPI

The linear form of the function is as follows

$$CPI_{nf}= \alpha + \beta_1 CPI_f + \beta_2 M_2 + \beta_3 GDP + \beta_4 CPI_{nf\ t-1} + \mu \ldots\ldots\ldots (2)$$

First of all stationarity of the variables is checked by the ADF test. It decides whether the OLS is sufficient or whether we should go to a co-integration analysis. After estimating the above model (2), the study used a dummy variable approach to test the stability of the relationship between food prices and non-food prices, and the Granger causality test is used to determine the direction of causality between food prices and non-food prices.

Time series data for the years 1970 to 2014 are obtained from Federal Bureau of Statistics Pakistan, and State Bank of Pakistan. Since data on non-food prices are not available, it is computed from general CPI and food price index following (Khan and Qasim, 1996).

$$CPIg = \theta\ F + (1-\theta)\ CPInf \ldots\ldots\ldots (3)$$

Where $CPIg =$ General CPI

$$\theta = \text{Share of food in general CPI}$$

$$1-\theta = \text{Share of non} - \text{food items in general CPI, and}$$

$$CPInf = \text{Non} - \text{food CPI}$$

From (2), we have

$$CPInf = CPIg - \theta\ F/(1-\theta)$$

4. ECONOMETRIC ESTIMATION

The results of the econometric estimation are shown in this section. The stationarity of all the variables is checked by the ADF test. The Schwarz Information criterion was used to select the correct model, i.e. to decide whether or not the intercepted model should be used or whether or not the intercepted model should be used. The Schwarz Information Criterion was also used to decide the length of the lag.

4.1. Stationarity Test

The results of the ADF are shown in Table **1**. All of the variables are stationary. So we do not need to proceed with the co-integration analysis and the Error Correction Model (ECM), but ordinary econometric analysis can be applied.

Table 1. Results of ADF test.

Variable	ADF value	Preferred trend specification
CPI_{nf}	-7.6 (0.000)	Intercept
CPI_{nft-1}	-7.46 (0.000)	Intercept
CPI_f	-3.66 (0.008)	Intercept
M_2	-4.97 (0.000)	Intercept
GDP	-5.75 (0.000)	Intercept

Note: The p-values of the ADF statistic are in the parenthesis

4.2. OLS Estimation

The results of OLS model (2) are presented in Table **2**.

Table 2. OLS estimation results.

Variable	Coefficient	Stdd.error	t-statistic	Prob
C	5.03	3.99	1.26	0.21
CPI_{nft-1}	-0.25	0.12	-2.09	0.04
M_2	0.43	0.18	2.35	0.02
GDP	-1.13	0.50	-2.24	0.03
CPI_f	0.63	0.16	3.75	0.0006
R^2=0.42				
Diagnostics				
Ramsey RESET F-stat = 0.002				0.96
Breush Godfrey LM stat = 0.36				0.54

The results of the OLS show that the Food Price Index (CPIf) has the expected positive sign and is highly significant. This finding underlies our hypothesis. Such types of results are shown in the literature. that food prices have a positive effect on non-food prices. World food prices, for example, are increasing inflation in Tanzania (Adam *et al*., 2012). Radukic *et al*. (2015) have shown for Serbia that the increase in food prices is the main determinant of the increase in the inflation rate. Cruz, Sanchez, and Amann (2011) have shown that the movement of world food prices contributes to the development of inflation in Mexico. Walsh (2011) concluded that the transmission of food price shocks to non-food prices is strong in many low-income countries. Mishra and Roy (2011) explained that food inflation is a consistent driver of non-food inflation and therefore of overall inflation in India. Rangasamy (2011) concluded that food prices could create enormous inflationary pressures in South Africa. Bhattacharya and Gupta (2018) revealed the significant pass-through effects from food to non-food and to the headline inflation in India[6]. Bhattacharya and Gupta (2018) have

[6]However, they have found a negative impact of food inflation on non-food inflation in the long run suggesting that in an economy where food has a large share in the consumption basket, the high food inflation reduces real income in the long run, causing proportionately decline in consumption of non-food items compared to food items (Engels' law) and hence the negative impact on non-food prices.

revealed a significant shift from food to non-food and headline inflation in India (see also Misati & Munene, 2015 for Kenya). Zaman and Khan (2018) demonstrated an inflation the transmission mechanism for food prices to non-food prices in developing economies.

Bhattacharya and Gupta (2018) have revealed a significant shift from food to non-food and headline inflation in India (see also Misati and Munene, 2015 for Kenya). Zaman and Khan (2018) demonstrated an inflation transmission mechanism for food prices to non-food prices in developing economies.

The other variables included for the well specification of the model, have the signs in accordance with the economic theory except for lagged non-food CPI(CPI_{nft-1}) which has a negative sign but this may be due to the fact that in our model it is not the lagged general CPI which is expected to have the positive sign but lagged CPI for non-food prices. The negative sign of the lagged non-food CPI might be due to the fact that people, while forming expectations, do not attach much importance to non-food prices and mostly care about food prices.

The Food Price Index (CPI_f) has the expected positive sign that underpins our hypothesis. We will use causality tests to further justify the hypothesis. The Ramsey RESET and Breush Godfrey LM test indicate that the model is well specified and free of auto-correlation.

4.3. Multicollinearity Test

The correlation between variables is shown in Table **3** by the matrix of all variables. It shows that the model does not suffer from multicollinearity.

Table 3. Correlations Matrix.

Correlation Probability	**CPI_f**	**CPI_{nf}**	**GDP**	**M2**	**CPI_{nft-1}**
CPI_f	1.000000 -----				
CPI_{nf}	0.480736 (0.0008)	1.000000 -----			
GDP	0.062587 (0.6830)	-0.182467 (0.2303)	1.000000 -----		
M2	0.249033 (0.0990)	0.379655 (0.0101)	0.114386 (0.4543)	1.000000 -----	
CPI_{nft-1}	0.196038	-0.135169	-0.105346	0.002669	1.000000
	0.1968	0.3760	0.4910	0.9861	-----

The p-values of the correlation coefficient are in the parenthesis.

4.4. Test for Stability of the Model

Pakistan's economy has been subject to many shocks, both internal and external, and it may be appropriate to check the stability of the relationship between food and non-food prices. The dummy variable technique is most insightful in the stability tests because it specifically informs the source of instability. It also indicates whether the instability is due to the interception of the equation or to the slope of the variable.

The following equation will be estimated by OLS to check the stability of the relationship between the non-food price index and the food price index:

$$CPI_{nf} = \beta_1 + \beta_2 CPI_f + \beta_3 M_2 + \beta_4 GDP + \beta_5 CPI_{nf\ t-1} + \beta_6 D_1 + \beta_7 D_1 CPI_f + u$$

Where D_1 is the dummy variable and the term $\beta_6 D_1$ checks the stability of the intercept while the term $\beta_7 D_1 CPI_f$ checks the stability of the slope of the food price index.

The findings in Table **4** show that the intercept of the formula did not change as is obvious from the outcome of the Dummy factor test: the term D1 is not important. The results also indicate that the slope of the CPI_f (Food and Beverages Index) has not changed since the term D1CPIf is not relevant.

Table 4. Results of dummy variable test.

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	5.86	4.59	1.27	0.21
CPI_{nft-1}	-0.27	0.12	-2.2	0.03
GDP	-1.29	0.53	-2.42	0.02
M_2	0.44	0.18	2.4	0.02
CPI_f	0.74	0.2	3.59	0.0009
D_1	1.0	4.12	0.24	0.8
D_1CPI_f	-0.31	0.34	-0.9	0.36
$R^2 = 0.44$				
DW = 2.29				

4.5. Granger Causality Test

The Granger causality test was used for non-food CPIs and food CPIs. Since the variables are stationary, the usual Granger causality test is used instead of the ECMs to determine the direction of causality between the food price index and the non-food price index. The Food Price Index (CPI_f) and the Non-Food Price Index (CPI_{nf}) are in their growth rate form. The findings of the Granger Causality Test is shown in Table **5**.

Table 5. Results of Granger causality test.

Lags	CPI_{nf} does not cause CPI_f	CPI_f does not cause CPI_{nf}	Number of observation
1	0.25 (0.61)	7.19 (0.01)	44
2	0.33 (0.71)	2.95 (0.06)	47
3	0.38 (0.76)	2.14 (0.11)	46
4	0.29 (0.87)	2.11 (0.10)	45
5	0.24 (0.94)	2.06 (0.09)	44
6	0.13 (0.99)	1.45 (0.23)	43

Note: The values in the parenthesis are the p values.

The results show that at lag one, we can reject the hypothesis that CPI_f does not cause CPI_{nf} at a 1% level of significance and conclude that CPI_f causes CPI_{nf} with 99 percent confidence. At lag two, four and five we can reject the null hypothesis that CPI_f does not cause CPI_{nf} at a 10 percent level of significance that concludes that CPInf causes CPInf. At lag three and six, we can reject the null hypothesis that CPI_{nf} does not trigger CPInf at a 25 percent level of significance that concludes that CPI_f causes CPI_{nf}. The results show that at every lag the

null hypothesis, that is CPI_f does not cause CPI_{nf} performs better and can be rejected while the other hypothesis that is CPI_{nf} does not cause CPI_f cannot be rejected even in a single case (at any lag) even at 25 percent level of significance.

4.6. Causality Test Between the First Difference of Food and Non-Food Price Index

The more clear analysis, about the direction of causality, is presented when we check the direction of causality between the first difference of food price index (not the growth rate as in the previous case) and first difference of non-food price index (not the growth rate as in the previous case). The first differentiated series for both variables are stationary. The results of the ADF test are shown in Table **6**.

Table 6. Results of ADF test for first difference CPI food first difference CPI non-food.

Variable	ADF value	Preferred trend specification
First differenced food CPI($DCPI_f$)	-4.06 (0.01)	Trend and intercept
First differenced non-food CPI($DCPI_{nf}$)	4.01 (0.003)	intercept

Note: The values in the parenthesis are the p-value of the ADF statistic

The results of Granger causality for these two variables are presented in Table **7**.

Table 7. Results of Granger causality for $DCPI_f$ and $DCPI_{nf}$.

Lags	First differenced non-food CPI does not cause first differenced food CPI	First differenced food CPI does not cause first differenced non-food CPI	No. of observation
1	0.89 (0.35)	17.35 (0.0002)	44
2	0.22 (0.8)	12.34 (0.000007)	43
3	0.41 (0.74)	6.43 (0.001)	42
4	0.38 (0.81)	7.12 (0.0003)	44
5	1.76 (0.15)	5.33 (0.001)	43
6	1.75 (0.14)	4.72 (0.002)	42

Note: The values in the parenthesis are the p values.

The results in Table **7** show that up to lag six, we can reject the null hypothesis that is first differenced food CPI does not cause first differenced non-food CPI at percent. The estimated F value is much higher than the theoretical value at a 1 percent level of significance, while the other the hypothesis that the first differentiated non-food CPI does not trigger the first differentiated food CPI cannot be dismissed in a single case (at any lag). Therefore, the causality test when applied to the first differentiated food and non-food CPI indicates explicitly that variance in food CPI causes variation in non-food CPIs, since the first differentiated series for these two variables mean a series that tests changes in these two variables on an annual basis.

5. CONCLUSION

It is concluded that the food price index has a positive effect on the non-food price index and that the causal direction appears to be from the food price index to the non-food price index. It is the hypothesis that postulates a new aspect of inflation that food prices have an impact on non-food prices in Pakistan. It could have an effect on the government, trying to control inflation. In any attempt to control inflation, special attention to food

items should be paid to one aspect of the anti-inflationary policy, which is not to let their prices rise. It may be through an ample supply of food by increasing domestic production or by importing food[7].

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[7]Radukic *et al*. (2015) also demonstrated that the value of commodity reserves and storage policy should be added to preserving price stability due to the impact of food prices on inflation. The central banks should be aware of the impact that food prices may have on the wider price index (Walsh, 2011).