Pak. J. Agri. Sci., Vol. 49(2), 199-203; 2012
ISSN (Print) 0552-9034, ISSN (Online) 2076-0906
http://www.pakjas.com.pk

AN EMPIRICAL ANALYSIS OF FACTORS AFFECTING FOOD (WHEAT) INFLATION IN PAKISTAN

Muhammad Masood Azeem[1,*], Samreen Munawwar[1] and Khalid Mushtaq[2]

[1]Department of Development Economics, University of Agriculture, Faisalabad, Pakistan; [2]Department of Agri. Economics, University of Agriculture, Faisalabad, Pakistan
[*]Corresponding author's e-mail: mazeem@uaf.edu.pk

This paper attempted to analyze the factors affecting food (wheat) inflation in Pakistan by using the annual data of time period 1981-2010. Johanson's Co-integration technique and Vector Error Correction Model (VECM) were used to check the long run and short run relationship among the variables. Results indicated that in the long run, per capita income had positive and statistically significant effect, while crude oil price had positive but statistically insignificant effect. In contrast, money supply and wheat support price had negative effect on food prices. In case of short run, lag value of food prices had positive, while money supply and wheat support price had negative effect. Although, crude oil prices and per capita income had positive effects yet these were statistically insignificant. To control food prices, it was suggested that food production may be encouraged by increasing wheat support prices. Moreover, Government may regulate prices of crude oil and input markets along with raising investment in agriculture sector.
Keywords: Wheat inflation, crude oil price, wheat support price, per capita income, co-integration

INTRODUCTION

For many years, food price inflation has been soaring not only in Pakistan but also in the world. This issue is taking the attention of researchers and policy makers as it is mostly affecting the poor and low-income groups (Lovendal *et al.,* 2007). A number of researchers have studied food price inflation (Lorie and Khan, 2006; Hye and Anwer, 2009; Tiwari, 2010; Zhang and Law, 2010; Mushtaq *et al*., 2011). Most of this literature focused on the relationship between food price inflation and monetary variables. However, the research related to Pakistan concluded that food price inflation was not a monetary phenomenon in Pakistan (Abdullah and Kalim, 2011).

The present study is different from the others as it not only attempted to explore the factors affecting food (wheat) inflation in Pakistan but it also seeks to investigate the role of oil prices, which was not taken into account in most of the earlier research on this issue. In this study, wheat is taken as a representative of food basket as it is the main crop which plays a central role in food economy of Pakistan both in case of production and consumption. It is the main staple food of Pakistan that accounts for more than 55 percent of total caloric consumption. This share is significantly higher among the poorest households.

There are many studies that stimulate and lead our work. Kargbo (2000) studied the effects of macroeconomic and monetary factors on food prices in real term in Eastern and Southern Africa. Co-integration methodology and ECM (Error Correction Model) were used to estimate the long run relationship between real food prices and other selected variables. It was found that domestic food production variability, trade, monetary policies, exchange rate and household earning were significantly effecting food prices, food availability and food security. Lorie and Khan (2006) studied the factors affecting the domestic prices of agricultural commodities in Pakistan by using Co-integration and Error Correction Model. They found weak co-integration between domestic prices, domestic support prices, international prices and exchange rate for basic agricultural commodities in Pakistan. But domestic support price was found to be important independent explanatory variable for wheat crop in the long run. Mushtaq *et al.* (2011) empirically estimated the impact of monetary and macroeconomic factors on food (wheat) prices and implications for food stability in Pakistan. This study used Johanson's co-integration approach and showed that real money supply, openness of economy and real exchange rate had a significant effect on real food prices in the long run. Abdullah and Kalim (2011) applied the same methodology and determined the factors which were responsible for food inflation in Pakistan and concluded that food price inflation was not a monetary phenomenon in case of Pakistan. In the short run, only support prices, food exports and inflation expectations affected food price inflation.

Our research work contributes to this literature by providing fresh empirical evidence on the factors affecting the food (wheat) inflation in Pakistan. Moreover, it extends the analysis by taking into consideration the effects of soaring oil prices on food inflation which has earlier been given little attention in the economic literature. More specifically, we aim at identifying the factors such as money supply, crude

oil price, wheat support price and per capita income on food (wheat) inflation of Pakistan.

MATERIALS AND METHODS

Annual time series data ranging from 1981-2010 (in logarithmic form and converted into real term by dividing with GDP deflator) were used in this study. Data were related to real food (Wheat) prices (Rs./40kgs), wheat support price (Rs./40kg), real money supply (M_2, Rs. Million), crude oil (crude petroleum) price (Rs./mt), and per capita income (Rs./person). This data was taken from Federal Bureau of Statistics Pakistan, State Bank of Pakistan, 50 years of Agricultural Statistics of Pakistan and Pakistan Statistical Yearbook.

The data regarding wheat prices is based on the Lahore Market of the Punjab province. Since Punjab has the larger share in area and production of wheat, therefore its capital Lahore is considered in this analysis to be the best representative of the whole sale prices of wheat.

***Model Specification and Estimation*:** The general form of the model specified in logarithmic form where real food price (FP) was assumed to be the function of crude oil price (COP), money supply (MS), wheat support price (WSP) and per capita income (Y) in time period (t) is given below:

$$LRFP_t = \beta_0 + \beta_1 LRCOP_t + \beta_2 LRMS_t + \beta_3 LRWSP_t + \beta_4 LRY_t + \varepsilon_t \quad (1)$$

Here β_0 is intercept and β_1, β_2, $\beta 3$ and β_4 are coefficients of crude oil price, money supply, wheat support price and per capita income. All the variables were assumed to be identically and normally distributed with zero mean and variance.

The following VECM (Vector Error Correction Model) representation of variables included in the study was specified to determine the short run relationship among the variables.

$$\Delta LFP_t = \delta_0 + \Sigma^n_{i=1} \delta_{1i} \Delta Lfp_{t-1} + \Sigma^n_{i=1} \delta_{2i} \Delta LRCOP_{t-1} + \Sigma^n_{i=1} \delta_{3i} \Delta LRMS_{t-1} + \Sigma^n_{i=1} \delta_{4i} \Delta LRWSP_{t-1} + \Sigma^n_{i=1} \delta_{5i} \Delta LRPY_{t-1} + \lambda ECT_{t-1} + \varepsilon_t \quad (2)$$

Where, Lfp_{t-1} represented last year's food prices, Δ is difference operator, δ and ε_t are vector of constant and error term, respectively.

Johansen's Co-integration technique was used to identify long run and Error Correction mechanism was used to investigate the short run relationship among the variables. The main objective of co-integration is to identify the long run relationships between variables. Co-integration test using Johansen's methodology starts from vector auto-regression (VAR) of order 'k' given as under

$$X_t = \alpha_0 + \partial_1 X_{t-1} + \ldots\ldots + \partial_k X_{t-k} + \mu_t$$

Here Xt is an (n x1) vector of variables that are integrated of order one (i.e) I(1). The co integrated variables satisfy two conditions. First of which is that at least two of individual variables series have same order while second is that integrated variables show linear combination to an order, which is lower than the individual variables.

Estimation was carried out using Microfit, while ADF (Augmented Dickey Fuller) test was carried out using Eviews. ADF test is used to check the stationarity of Data before analysis. A stationary time series is that whose mean, variance and co variance is constant over the time period and the value of co-variance between two time periods depends only on the distance or lag between two time periods and not the actual time at which the co-variance is computed. In other words they remain constant over time.

RESULTS AND DISCUSSION

The results of series (in logarithms) for unit roots showed that no variable was stationary at level as the absolute value of ADF statistics was smaller than 95 percent critical value of test statistics for both trended and non trended models (Table 1). However, all the variables were stationary at first difference as the absolute values of ADF statistics was greater than 95% critical value of test statistics (Table 2).

Table 1. Augmented Dickey-Fuller (ADF) Test results (at level)

Variable	ADF statistics without trend	ADF statistics with trend & intercept	Conclusion
LRFP	0.4287	-2.2900	**I(1)
LRMS	-1.9201	-1.0327	I(1)
LRCOP	-1.8188	-1.9906	I(1)
LRWSP	-1.4720	-3.2269	I(1)
LRPY	-0.4830	-2.8413	I(1)
Critical Values*	-2.9718	-3.5744	-

*Critical Values (95% confidence level) are used from Fuller (1976); **I(1) = Non-Stationary

Table 2. Augmented Dickey-Fuller (ADF) Test results (at first difference)

Variable	ADF statistics Without trend	ADF statistics Trend & Intercept	Conclusion
LRFP	-2.9868**	-3.0257	I(0)
LRMS	-4.2071**	-4.7633**	I(0)
LRCOP	-5.5839*	-5.6018*	I(0)
LRWSP	-7.3812*	-8.6348*	I(0)
LRPY	-5.3515*	-5.2398*	I(0)
Critical Values	-2.9718	-3.5744	-

Critical Values (95% confidence level) are used from Fuller (1976); I(0) = Stationary;

**represent significant level at 1%; * represents significant level at 5%

The first step in Johansen's co-integration analysis is the selection of order of Vector Autoregressive (VAR). It was selected on the base of Schwarz Bayesian Criterion (SBC) and Akaike information Criterion (AIC). The results showed (Table 3) that both were having different order of VAR that's why a third criterion Adjusted LR test was used which is the most authentic as per theory. Results showed that maximum SBC and Adjusted LR test values were 162.87 and 56.45 respectively at which order is one. Thus order of VAR =1.

Table 3. Choice Criteria for Selecting the Order of VAR Model

Order	AIC	SBC	Adjusted LR Test
3	192.5842*	143.9903	---
2	181.4989	149.1030	32.07(.156)
1*	179.0684	162.8705*	56.45(.246)*
0	-70.0196	-70.0196	300.09(.000)

*Indicates lag order selected by the criterion; AIC: Akaike Information Criterion; SBC: Schwarz Bayesian Criterion

After selection of VAR, the next step of Johansen's co-integration method is to determine the presence and number of co-integrating vector among the series of each model. For this purpose, Trace statistics was used. The first value of Trace statistics was 143.47 that were greater than the critical value of 75.98 at 5 percent significance level (Table 4). Therefore, the null hypothesis that r=0 was rejected. According to Trace statistics, there was only one co-integrating vector in the concerned series which meant that it was an appropriate model for further analysis.

Table 4. Co-integration Results based on Trace Statistics

List of variables included in the co-integrating FP MS COP WSP PY List of I(0) Variables included in the VAR			
Null Hypothesis	**Alternative Hypothesis**	**Trace Statistics**	**95% Critical values**
r = 0	r = 1	143.4782	75.9800
r ≤ 1	r = 2	47.0537*	53.4800
r≤ 2	r = 3	23.7192	34.8700
r ≤ 3	r = 4	10.7341	20.1800

*****denotes rejection of alternate hypothesis at 95% significance level; Critical values (95% confidence level) are from Pesaran *et al.* (2000).

The results of our study show that money supply had negative impact (both in the long run and shot run) on food (wheat) prices in Pakistan. This indicates that food inflation is not a monetary phenomenon in Pakistan. As increase in money supply results in inflation which reduces effective demand for wheat, thereby reducing wheat price which ultimately lead to reduced food prices. This result is in line with Tweeten (1980), Hasan *et al.* (1995), Loaning *et al*. (2009), Mushtaq *et al.* (2011), Abdullah and Kalim (2011). However, findings of this research study are in contrast to Bakucs and Ferto (2005), Asfaha and Jooste (2007), Khan *et al*. (2007), Hye and Anwer (2009) and Tiwari (2010).

Crude oil price had a positive but statistically insignificant effect on food (wheat) prices. In case of Pakistan, to the best of our knowledge, no research has been conducted to ascertain the relationship between crude oil prices and the wheat inflation. However, the findings of Kinai (2001) suggests a positive but less elastic response of economic growth in Pakistan with respect to changes in the crude oil prices. Effect of crude oil prices on food price inflation requires more research to ascertain why this effect is insignificant. However, as the direction of relationship is concerned this finding is in line with Baek and Koo (2009) who found that energy prices had a positive impact on food prices.

Table. 5. Johansen's Long Run Elasticities

Dependent Variable = FP		
Variable	**Long run Elasticities**	**t-Ratio**
LRFP	1.00	1.00
LRMS	-0.52	-2.9*
LRCOP	0.06	0.31
LRWSP	-1.14	-1.96*
LRPY	0.34	2.45*
Intercept	9.65	2.31

*indicate significant at 5%.

Table. 6. Short Run Analysis

Dependent Variable = DFP			
Variable	**Short run Elasticities**	**t-Ratio**	**Prob-Value**
Constant	-0.0390	-0.8839	0.389
$DLFP_{t-1}$	0.4836	2.4752*	0.024
DLRMS	-0.5410	-3.5278*	0.003
$DLRMS_{t-1}$	0.0863	0.5268	0.605
DLRCOP	0.0351	1.0042	0.329
$DLRCOP_{t-1}$	0.0502	1.3510	0.194
DLRWSP	-0.0376	-2.5432*	0.005
$DLRWSP_{t-1}$	-0.0034	-0.0603	0.953
DLRY	-0.0060	-0.0391	0.969
$DLRY_{t-1}$	-0.1338	-0.8852	0.388
ECM_{t-1}	-0.552	-3.3532*	0.004
R^2 = 0.75, F-Statistics = 5.0710, Prob(F-Statistics)=0.002, Durbin-Watson = 1.92			

Results of our study show a depressing effect of wheat support price on food prices. Farmers increase their production of wheat to avail this support price, therefore, supply of wheat also increases. The result is in line with Khan and Schimmelpfennig (2006) who found that wheat

support price did not influenced inflation in the long run. It is also in line with economic experts who favor to increase the farm gate price of wheat to encourage farmers to grow wheat crop, which will gradually decrease the inflationary pressure (Zia, 2011). However, this study is not in line with Hasan *et al.*, (1995), Khan and Qasim (1996), Dorosh, and Salam (2006), who found that increase in wheat support price, raised the CPI index.

Our findings suggest that per capita income effects positively in the long run while negatively in the short run. However, this effect is statistically insignificant in case of short run. The rationale for the positive relation may be that with increase in per capita income, people change their dietary habits and increase consumption of meat (Abdullah and Kalim, 2011). They move towards luxury food items, restaurants and spend more income on food which leads to food prices inflation. On the other hand the negative relationship in the short run case may be due to speed of adjustment of income with time. Since people realize the real increase in income after some time and they do not have saving in short run that is why they consume less that ultimately leave a negative impact on food prices in short run.

Table 4 shows that the coefficient of last year's food prices ($DLFPt_{-1}$) was positive and statistically significant which means that previous year's food (wheat) price affect current year food price inflation. When the prices rise, people start hoarding and storing food items as they expect their prices will rise in next season as well. As a result, food items become scarce in market, as their supply goes limited, consequently food prices increase. The finding of this study is in line with Abdullah and Kalim (2011), Hasan *et al*. (1995), Loening *et al*. (2009) and Khan *et al*. (2007).

The coefficient of error correction term (ECM_{t-1}) had negative sign and measures adjustment towards long run equilibrium. The coefficient of ECM_{t-1} was -0.552, indicating that approximately 0.55 percent of equilibrium in previous year was corrected in the current year. The t-statistic value of ECM_{t-1} was also significant.

The R^2 was 0.75 showing that the explanatory variables were explaining 75 percent changes in the dependant variable. This means that the variables chosen were strong enough to explain food price inflation in Pakistan. As this study utilized the secondary data set for the purpose of estimation therefore the value of R^2 is considered normal for such type of data. Moreover, "as the number of regressors in the model increases the value of R^2 increases" (Gujrati, 2005). The Durbin-Watson statistic, which was 1.92, falls within the acceptable range in applied research of no autocorrelation (between 1.8 and 2.5). Thus, it showed that model was free from autocorrelation.

CONCLUSION

In this study, Johansen's co-integration technique was used to investigate the factors affecting food (wheat) price inflation in Pakistan. Our findings verified that food inflation is not a monetary phenomenon in Pakistan. We found a strong negative association between wheat support prices and the food inflation. It is therefore recommended that wheat support prices must be used as a policy variable (instead of manipulation in the money supply) to alter the food price inflation in Pakistan. We also recommend instead of providing money, government should help farmers by extending inputs (modern technology, fertilizer, pesticides) according to their requirement.

REFERENCES

Abdullah, M. and R. Kalim. 2011. Determinants of food price inflation in Pakistan. (Available online with updates at http://www.umt.edu.pk/icobm/ proceedings/ pdf/paper6.pdf).

Asfaha, T.A. and A. Jooste. 2007. The effect of monetary changes on relative agricultural prices. Agrekon. 46:440-474.

Baek, J. and W.W. Koo. 2009. Analyzing factors affecting U.S food price inflation. Canad. J. Agri. Eco. 58:303-320.

Bakucs, L.Z. and I. Ferto. 2005. The influence of macroeconomic variables on the Hungarian agriculture. Agri. & Applied Eco. Association. No. 19232.

Dorosh, P. and A. Salam. 2006. Wheat markets and price stabilization in Pakistan: an analysis of policy options. Pak. Institute of Dev. Econ. (PIDE). Working Paper No. 2006/5.

Gujrati, D.N. 2005. Basic Econometrics. United States Military Academy. 4th ed. p. 216-217.

Hasan, M.A., A.H. Khan, H.A. Pasha and M.A. Rasheed. 1995. What explain the current high rate of inflation in Pakistan? The Pak. Dev. Review. 34:927-934.

Hye, Q.M.A. and S. Anwer. 2009. Food price and money supply: A causality analysis for Pakistan economy. American-Eurasian J. Agri. & Environ. Sci. 6:227-230.

Kargbo, J.M. 2000. Impacts of monetary and macroeconomic factors on food prices in Eastern and Southern Africa. Appl. Eco. 32:1373-1389.

Khan, M.S. and A. Schimmelpfennig. 2006. Inflation in Pakistan: Money or Wheat? SBP-Research Bulletin 2(1). IMF Working Paper No. 06/60. (Available online with updates at www.ers.usda.gov/publications/err76).

Khan, A.H. and M.A. Qasim. 1996. Inflation in Pakistan revisited. The Pak. Dev. Review. 35:747-759.

Kiani, A. 2011. Impact of high oil prices on Pakistan's economic growth. International Journal of Business and

Social Science 2(17). (Available online with updates at http://www.ijbssnet.com/update/archive/607.html).

Loening, J.L., D. Durevall and Y.A. Birru. 2009. Inflation dynamics and food prices in an agricultural economy: the case of Ethiopia. The World Bank. Working Paper No. 4969.

Lorie, H. and Y. Khan. 2006. What determines the domestic prices of agricultural commodities in Pakistan? The Pak. Dev. Rev. 45:667-687.

Lovendal, C.R., K.T. Jakobsen and A. Jacque. 2007. Food prices and food security in Trinidad and Tobago. Working Paper No. 07-27, Agricultural Development Economics Division, Food and Agriculture Organization.Rome, Italy.

Mushtaq, K., A. Gafoor, Abedullah and A. Farhan. 2011. Impact of monetary and macroeconomic factors on food (Wheat) prices in Pakistan: implications for food security. The Lhr. J. Eco. 16:95-110.

Pesaran, M.H., Y. Shin, and R.J. Smith. 2000. Structural analysis of Vector Error Correction Models with Exogenous I(1) Variables. J. Eco. 97:293-343

Timmer, C.P. 2010. Reflections on food crises past. Food Policy 35:1-11.

Tiwari, A.K. 2010. Impact of supply of money on food prices in India: A causality analysis. MPRA P.24679. (Available online with updates at http://mpra.ub.uni-muenchen.de/24679/1/MPRA_paper_24679.pdf).

Tweeten, L.G. 1980. Macroeconomics in crisis: Agriculture in an underachieving economy. Amer. J. Agri. Eco. 62:853-865.

Zhang, W. and D. Law. 2010. What drives China's food-price inflation and how does it affect the aggregate inflation. Hong Kong Monetary Authority, Working Paper No. 1006, Hong Kong Monetary Authority.

Zia, A. 2011. Support price mechanism takes toll on poor. The NEWS, International. (Available online with updates at http://www.thenews.com.pk/TodaysPrint Detail.aspx?ID= 38262&Cat=3).