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Food Prices and Money Supply: A Causality Analysis for Pakistan Economy

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Abstract: This study uses robust time series technique [autoregressive distributed lag (ARDL)] in order to determine the direction of causality between the food prices and money supply. Empirical results show unidirectional causality from money supply to food prices in Pakistan. Hence the *money supply is not neutral in long run determining food prices.* Therefore it recommended that in Pakistan monetary policy instrument can use to control inflation in general and food inflation in particular case. But this study is prominences on the mutual understanding between the monetary and food price regularity authority.

Key words: Food Prices · Money Supply · ARDL

INTRODUCTION

Instability in food prices has great impact on the consumers' and farmers living standard. Conventional agricultural economics examine food consumption and prices are determined by the interaction of supply and demand forces. In the short run, supply is relatively fixed and inflexible and prices adjust so product clear the market. When supply more than demand, prices goes down and consumers buy more. Conversely, smaller supply of food than prices will be higher and smaller purchases. In the long run, framers adjust production in response to market prices, producing more of higher priced goods and less of lower priced goods. Demand of food in the aggregate is not very responsive to price changes because there is little room for substitution between food and nonfood goods in the consumer's budget. However, demand for individual foods in more responsive to prices as consumers substitute among alternative food commodities. But on the other hand the least studies on the agricultural economics examines that the macroeconomics, particularly monetary factors effect on the agricultural prices Tweeten [1] found that the monetary shocks little effect on the agricultural prices. Bessler, David [2] empirically finds out that causality from money supply to agricultural prices in Brazilian data. Devadoss and Meyers [3] support the hypothesis that agricultural prices faster response than manufacturing product prices to a change in money supply in the U.S.A. Saghaian, *et al,* [4] empirically prove that the in the long-run money neutrality does not hold in the determination of agricultural prices in U.S.A. Peng *et al.* [5] investigate that the monetary variables impacts on the food prices in China.

The literature shows that most of empirical research was conducted on the well developed market economies regarding macroeconomic variables impact on the agricultural prices or food prices. Compared with these markets, Pakistan's agricultural commodity markets not well developed. But due to the financial reforms in Pakistan, it is anticipated that the monetary policy play a more vigorous role in causing food prices in Pakistan. Hence, it is important to confirm the monetary impacts on food prices in Pakistan through quantitative method so food prices changes can be better understandable.

The objective of this paper is to investigate the impact of monetary expansion on the food prices in Pakistan by using the annual time series data for the period 1971-2007.For econometrics analysis this study utilize the Autoregressive Distributed Lag (ARDL) based causality test to determine the causal relationship between the monetary expansion and food prices in Pakistan. The sketch of the remaining paper as follows. Section 2 will discuss the empirical data used and econometric methodology. Section 3 presents the result and the final section concludes this study.

Data and Methodology: The present study uses the annual time series data by 1971 to 2007.The data is taken from the various issue of Pakistan economic survey.

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Both variables, Money supply (M2) measures in million of rupees and Food prices in index form (Food whole sale price index, 2000=100). Both Money supply (MS) and Food prices (FP) are transformed into natural logarithms prior to econometric analysis. Because Ehrlich [6] and Layson [7] argue on theoretical and empirical grounds that the log-linear form is superior to the linear form. Both Cameron [8] and Ehrlich [9] suggest that a log-linear form is more likely as compare to the linear form.

Econometric Methodology: This pioneer study adopts a three-stage procedure to test the direction of causality between the variables under consideration. In the first stage, the order of integration of the variables is established by implementing the Phillips and Perron [10] unit root test. The second step, we evaluate the question of Causal relationship between the money supply (MS) and food prices (FP) using the newly developed bound testing approach auto- regressive distributed lag (ARDL) based long-run causality test [11]. This method has certain econometric advantages in comparison to other single co-integration producers. Firstly, endogeneity problems and inability to test hypotheses on the estimated coefficients in the long-run associated simultaneously. Secondly, it is apply ir-respective the variables included in the model are purely I(0),I(1) or mutually cointegrated. Thirdly, a dynamic error correction model can be deriving through a simple linear transformation. Fourthly, all variables are assumed to be endogenous.

$$\Delta Ln(FP)_t = \lambda_0 + \sum_{i=0}^{n} \lambda_i \Delta Ln(FP)_{t-i} + \sum_{i=0}^{n} \lambda_i \Delta Ln(MS)_{t-i} + \alpha_1 Ln(FP)_{t-1} + \alpha_2 Ln(MS)_{t-1} + v_{3t} \quad (1)$$

$$\Delta Ln(MS)_t = \gamma_0 + \sum_{i=0}^{n} \lambda_i \Delta Ln(MS)_{t-i} + \sum_{i=0}^{n} \gamma_i \Delta Ln(FP)_{t-i} + \beta_1 Ln(MS)_{t-1} + \beta_2 Ln(FP)_{t-1} + v_{3t} \quad (2)$$

The F-tests are used for testing the existence of long-run relationships. The Pesaran *et al.* [11] approach compute two sets of critical values for a given significance level. One set assumes that all variables are $I(0)$ and the other set assumes they are all $I(1)$. If the computed F-statistic exceeds the upper critical bounds value, then the H_o (null hypothesis) is rejected. If the F-statistic falls into the bounds, then the test becomes inconclusive. Lastly, if the F-statistic is below the lower critical bounds value, it implies no co-integration. When long-run relationship exists, the F-test indicates which variable should be normalized. [The null hypothesis of equation (1) is $\langle H_0 = \alpha_1 = \alpha_2 = 0 \rangle$. This is denoted as F_{FP} $\langle$FP | MS$\rangle$. In equation (2), the null hypothesis is $\langle H_0 = \alpha_1 = \alpha_2 = 0 \rangle$ this is represented by $F_{MS}\langle$ MS| FP$\rangle$.]

The third stage includes forming standard Granger-type causality tests augmented with a lagged error-correction term. The Granger representation theorem suggests that there will be Granger causality in at least one direction if there is existed co-integration relationship among the variables in equations (1) and (2), providing that they are integrated order of one. Engle and Granger [12] caution that the Granger causality test, which is conducted in first difference via a vector autoregressive (VAR), it will be misleading in the presence of co-integration. Therefore, inclusion of an additional variable to the VAR system, such as the error-correction term, would help us to capture the long-run relationship. To this end, an augmented form of Granger causality test involving the error-correction term is formulated in a multivariate pth order vector error-correction model (VECM), as follows:

$$\begin{bmatrix} \Delta Ln(FP)_t \\ \Delta Ln(MS)_t \end{bmatrix} = \begin{bmatrix} \Gamma_1 \\ \Gamma_2 \end{bmatrix} + \sum_{i=1}^{\rho} \begin{bmatrix} n_{11i} & n_{12i} \\ n_{21i} & n_{22i} \end{bmatrix} \begin{bmatrix} \Delta Ln(FP)_{t-i} \\ \Delta Ln(MS)_{t-i} \end{bmatrix} + \begin{bmatrix} \phi_1 \\ \phi_2 \end{bmatrix} [EC_{t-1}] + \begin{bmatrix} \psi_1 \\ \psi_2 \end{bmatrix} \quad (3)$$

Ect-1 is the error correction term, which is derived from the long-run relationship. The Granger causality test may be applied to equation (3) as follows: i) by checking statistical significance of the lagged differences of the variables for each vector; this is a measure of short-run causality; and ii) by examining statistical significance of the error-correction term for the vector that there exists a long-run relationship.

Empirical Result: Before testing of co-integration, this study determines order of integration for each variable by using Phillip Perron (P-P). Even though the ARDL model does not require pre-testing of unit root, the unit root test can assist whether or not the ARDL model can be used. The result in Table 2 shows that all the variables integrated order i.e I(1).

The next step is to estimating the long-run relationship among the variables. The optimal numbers of lags selected by using the Schwarz-Bayesian criteria (SBC). The lag length that minimizes SBC is one.

Table 1: Descriptive Statistic and Correlation Matrix

	Descriptive Statistic	
	Ln(FP)	*Ln(MS)*
Mean	3.91	12.47
Median	3.87	12.50
Maximum	4.89	14.95
Minimum	2.42	9.94
Std. Dev.	0.63	1.51
Correlation Matrix		
Ln(FP)	1	-
Ln(MS)	0.96	1

Table 2: Phillip Perron Unit Root Test Results

	Phillip Perron test statistic	
Variable	*Level*	*First difference*
Ln(FP)	-3.018	-4.66*
Ln(MS)	-2.93	-4.82*

*: Significant at 1% level

Table 3: ARDL Co-integration Test

Bound Test		
Dependent Variable	F-Statistic	
Ln(FP)	6.91*	
Ln(MS)	0.63	
Critical Values		
Bounds (F-test)	*Lower I(0)*	*Upper I(1)*
5%	3.96	4.53
10%	3.21	3.74
Long run elasticity (Co-integrated equation).		
Method: Ordinary Least Squares (OLS)		
Sample: 1971-2007		
Dependent variable = Ln(FP)		
Independent Variable	*Coefficient*	*t-Statistic*
Constant	-0.11	-0.22
Ln(MS)	0.34	7.83

Table 4: Augmented Granger Causality Test F-statistics

Dependent Variable	ΔLn(FP)	ΔLn(MS)	EC_{t-1}(t-statistic)
ΔLn(FP)	-	1.20	-0.34
		(0.31)	(0.00)
ΔLn(MS)	1.42	-	-0.03
	(0.25)		(0.26)

The calculated F-Statistic for the co-integration test is reported in Table 3. The critical value is reported together in the same table which based on critical values suggested by Narayan [13] using small sample size between 30 and 80. The calculated F-statistic is higher than the upper bound critical value at 5 per cent level of significance when the Food prices (FP) is dependent variable[1]. Thus there is unidirectional causality in the long run from money supply to food prices.

At the bottom of Table 3, the estimate of co-integrated equation shows a positive elasticity (equal to 0.34) for money supply with respect to food prices.

Table 4 show the results augment granger causality test the coefficient on the lagged error correction term is significant with the expected sign in the food price equation. This implies that monetary expansion Granger cause the Food prices in the long -run and the directional of causality runs interactively through the error correction term.

Conclusion and Policy Recommendation: The goal of this research is to estimate the causal relationship between the monetary expansion and food prices in Pakistan for the period 1971-2007. This relationship is estimated by using the ARDL robust technique. Empirical result of long run bound testing shows that the long run relationship exists when the food price (FP) is dependent variable. So there is unidirectional causality from money supply to food prices in the long run in case of Pakistan. The Augmented Granger causality test shows no short run causality in either direction.

On the basis of empirical results this study concludes money supply has not neutral in determining food prices in the long run. Therefore this study recommends Pakistan's policy maker can use monetary policy instrument to control inflation in general and food inflation in particular case. But it is important monetary control authority and food price regularity authority work with mutual understanding. Because in this way the true benefit of monetary policy can be achieved and it is easy to determine the fluctuation in food prices due the monetary phenomenon or other external factors.

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