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# The Pass-Through of Global Food Price Inflation to Domestic Prices Inflation: Empirical Evidence from South Asia

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**Abstract**
This study investigates and assesses how the international food price surge affects domestic inflation process in South Asia. Global food price indices (GFPI) are collected from FAOSTAT website. Data for domestic prices (CPI and CFPI) are collected from CEIC website. Exchange rates for each country are collected from IMF website. The empirical statistical results are derived by using a battery of parametric and non-parametric econometric techniques using monthly data of price series for the study period, 2005M1 to 2017M12. The co-integration analysis results confirm that the global food prices and domestic prices are co-integrated. Granger–causality test reveals the unidirectional causal relationship running from global food prices to domestic prices over the study period for Pakistan and Sri Lanka. However, In the case of India, Bangladesh and Nepal, samples do not show the evidence of causal relationship in the short run. However, in the long run, GFPI Granger cause local prices in all countries. Therefore, Governments from South Asia need to develop a safety net program for the poor and a longer term poverty reduction strategy. Policy attention needs to shift towards efforts to increase food production. The results of this study have shown various policy implications for monetary policy, food and agricultural policy and trade policy for South Asia.

**Key words:** food prices, Pass- through, co-integration, South Asia.

## Introduction

Higher food prices erode the purchasing power of households. The soaring food prices may have tremendous impact on the real incomes of poor households in developing countries, South Asia in particular. It fuels inflation risks and hits the

most vulnerable. The people who spend a large share of their income on food will be mostly affected. The food price surge during recent years has aroused intense concern worldwide about the impact on the poor in developing and emerging countries. International food prices are still above their average levels. The risk of higher food prices was highlighted in a recent World Bank publication (Global Development Finance, 2007). Rapidly rising food prices pose important macroeconomic policy challenges for decision makers in emerging and developing countries.

South Asia is the vulnerable region to food price inflation. According to the International Food Policy Research Institute (IFRI), South Asia and SSA are the regions with highest Global Hunger Index (GHI) scores and the highest poverty rates (IFRI, 2008, 2013). Sri Lanka's rank based on 2013 GHI scores (GHI=15) comes under serious category. Food prices have largest weight around more than 40 percent in the average household's consumption basket in South Asia. In globalized world, domestic food prices closely move with international food prices. These price movements lead to changes in local producer and consumer price. It influences headline inflation, local food price inflation and inflation expectations either directly or through second round effects.

Considering these transmission channels, several studies have empirically examined the relationship between global food prices and domestic inflation: Shawarby and Selim (2012), Jalil and Zea (2011), Van Duyne (1982), and El- Sakka et al. (2005). While a vast literature has examined the transmission effects of global food prices to domestic, no in-depth quantitative study investigated the pass-through effects of international food price inflation on domestic consumer price inflation for South Asia. This study attempts to fill this gap in the literature by examining pass-through and spillover effects of international food prices to the domestic inflation in South Asia. This study attempts to answer the following questions: i) to what extent world food prices pass-through domestic prices in South Asia? ii) is there long run relationship between global food price and domestic prices in each of country in South Asia?. iii) Have domestic food price inflation spillover into headline inflation?, The extent of transmission is a fundamental and important issue because it is the domestic prices that affect the welfare of poor consumers; hence it has important implications for economic welfare.

The main objective of this study is to investigate in-depth the pass through of international food prices to consumer prices in the domestic inflation dynamics in South Asia during the period of 2005M1 to 2017M12. In particular, this investigation will show the extent and speed of transmission of international food price changes to the domestic prices in South Asia. This study will uncover a robust empirical relationship between GFPI and domestic prices. Currency movements, domestic physical infrastructure, market failure and government policies to stabilize the prices may determine the size of the impact of the pass through. However, this study focuses only how pass-through occurs.

The structure of the paper is as follows. Section 2 describes data and methodology of the study. Section 3 discusses the empirical results obtained from various econometric techniques applied in this study and the final section concludes, and gives some recommendations from the results obtained.

This study contributes to the literature and seeks to provide updated estimates of global food price pass-through effects using econometric methodologies. Consequently, this study provides a more comprehensive analysis of pass-through effects in South Asia by focusing on the short run and long runs. In order to conduct monetary policy and food policy successfully, a thorough understanding of price transmission mechanism is required. The understanding of the dynamic pass-through relationship between global food prices and domestic prices has important benefits for analyzing and forecasting inflation and implication for monetary, food, trade and agricultural policies.

**Data and Methods**

This study area covers some selected South Asian countries, namely , Bangladesh, Nepal, India, Pakistan, and Sri Lanka. The data related for Afghanistan, Bhutan, and Maldives are not available for all sample period. The sample period of the study is 2005M1 to 2017M12. Time series (monthly) data are used for this study. Global food price indices (GFPI) are collected from FAOSTAT website. Data for domestic prices (CPI and CFPI) are collected from CEIC website. Exchange rates for each country are collected from IMF website.

There are eight countries namely, Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, India, Pakistan, and Sri Lanka form South Asia but this paper analysed the data from the selected five countries except Afghanistan, Bhutan, and Maldives out of the above mentioned eight countries because of the unavailability of adequate data.

This study adopts a simple model based on the Law of One Price (LOP) to express the relationship between global food prices and domestic prices and test the transmission effect.

The empirical statistical results are derived by using descriptive statistics, confidence ellipse, non-parametric regression (Kernel), Granger causality test, co-integration and error correction technique. To estimate the transmission effects of global food price changes on domestic prices, the models were formulated for each domestic price based on LOP. Further, Johansen co-integration analysis is adopted to examine the long run equilibrium relationships and Error correction model is used to capture short run dynamics around a long term equilibrium relationship between time series and to estimate feedback speed. Granger causality test is employed to identify the direction of causal relationship between the variables.

**Results & Discussion**

The time series plot in Figure-1shows that international food prices, Consumer Price index, domestic food price index move upward closely. Local food price has been higher and increasing trend compared to global food price dynamics. Global food price series are more volatile than domestic price series. However, local food prices in South Asia follow global food price movements.

Global food price inflation has asymmetric effects on domestic food prices and overall price behaviour. Pass-through of food price hikes is significantly higher than that of food price falls in South Asia. Domestic price trends of food items have broadly mirrored global trends. However, while domestic prices rise in tandem with global food prices they do not tend to decline to the same extent that global food prices do. This may be owing to local market inefficiencies, domestic monopolies, and limited global trade integration.

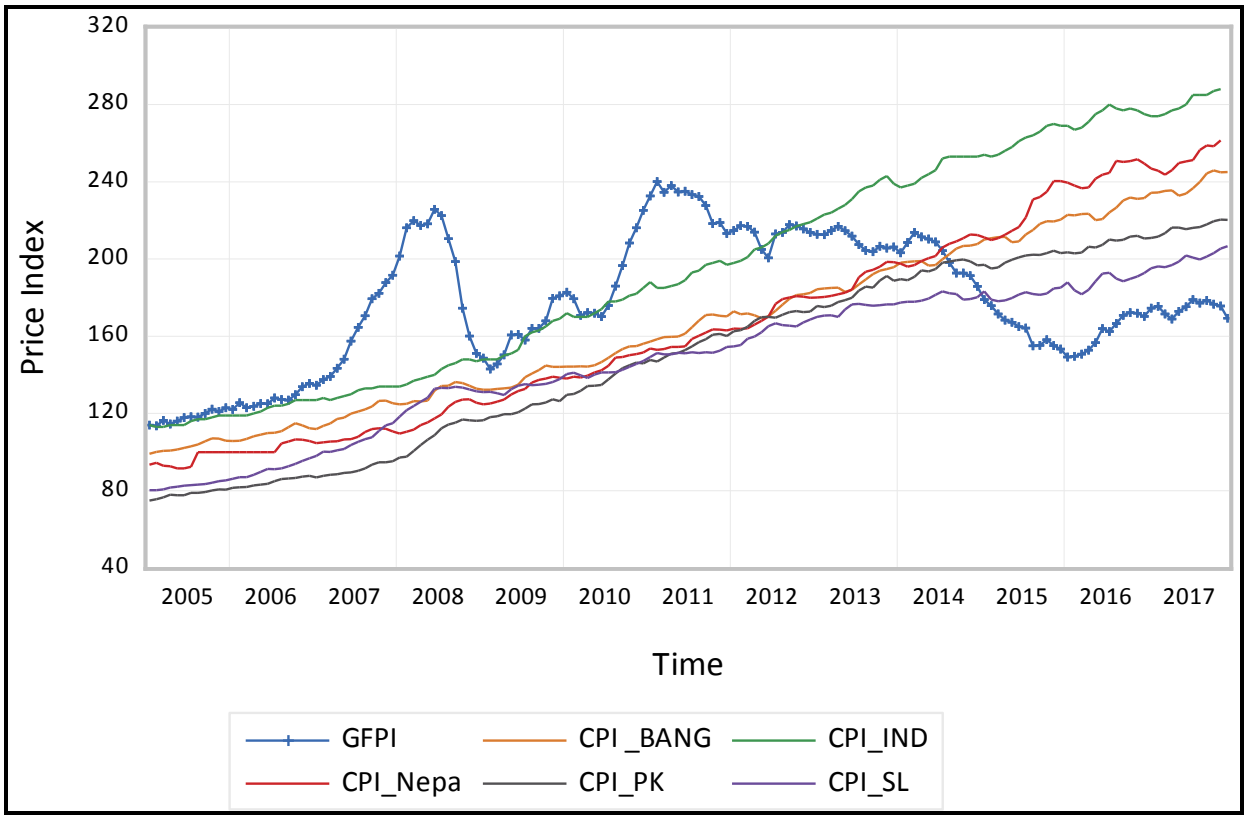


*Figure 1- CPI and CFPI , GFPI Dynamics in selected countries, 2005M1-2017M12*

The overall shape of the confidence ellipse indicates that world food price, CPI are and positively correlated. Therefore, international food prices have been claimed that it has been their main driving factor. The volatility of global food price inflation is also positively related to domestic inflation. we can observe the underlying dynamic inter relationship between global food price and domestic prices from the confidence ellipse graphs in Figure 2, -Figure 6 . The overall shape of the confidence ellipse indicates that CFPI, GPFI, CPI are positively correlated. The Lowess linear fit indicates that the dynamic relationships are nonlinear and positive.

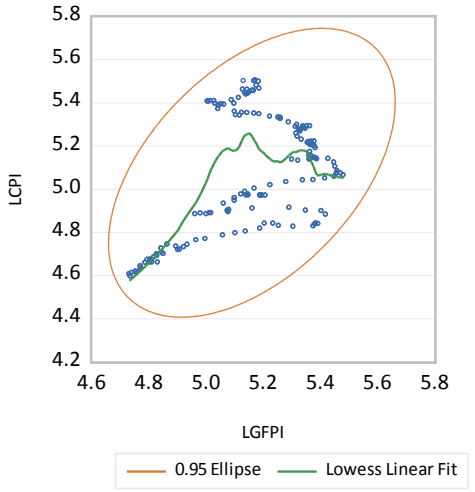


*Figure 2 - Bangladesh*

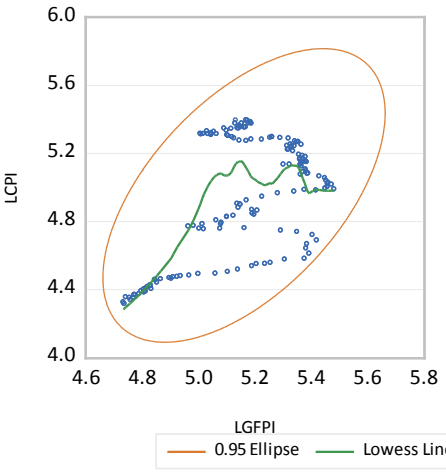


*Figure 3 - Pakistan*

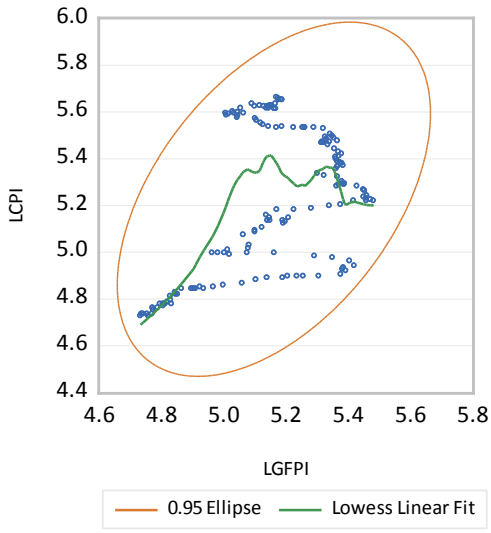


*Figure 4 - India*

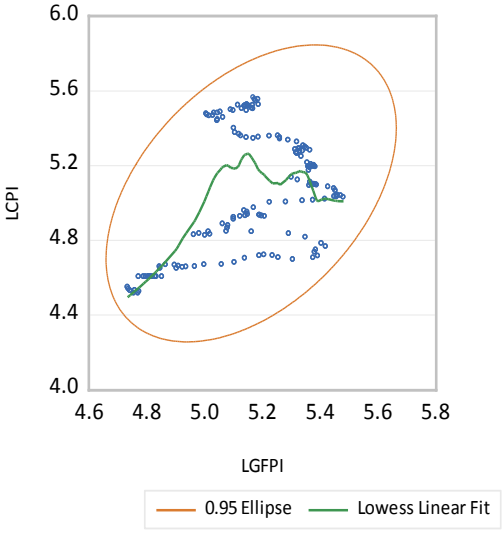


*Figure 5 - Nepal*

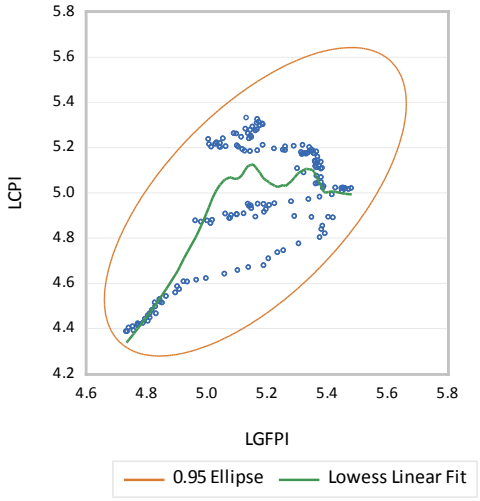


*Figure 6 - Sri Lanka*

**Unit Root Tests of Variables**

The ADF unit root test indicated that all these price series are non-stationary series and integrated order one, I(1). These series in first difference are stationary, I(0). All "P" values of the ADF test statistic for each variable of every country in this study

are less than 0.05. The first difference series are strongly mean reverting and I(0). Therefore, all the series in this study are I(1) in level form.

*Table 1- Unit Root Test Results for Variables.*

| Countries | Level Intercept with trend | | | | First Difference Intercept with trend | | | | Order of integration |
|---|---|---|---|---|---|---|---|---|---|
| | ADF t- test statistics | | | | ADF t- test statistics | | | | |
| | LCFPI | LCPI | LER | LGFPI | LCFPI | LCPI | LER | LGFPI | |
| Sri Lanka | -1.69 (0.75) | -1.48 (0.83) | -2.57 (0.29) | -2.11 (0.53) | -7.62* (0.00) | -6.98* (0.00 | -4.60* (0.00) | -4.59* (0.00) | I(1) |
| India | -1.75 (0.72) | -0.76 (0.96) | -2.34 (0.40) | -2.11 (0.53) | -6.87* (0.00) | -6.01* (0.00) | -6.59* (0.00) | -4.59* (0.00) | I(1) |
| Bangladesh | -3.13 (0.10) | -3.33 (0.06) | -2.00 (0.59) | -2.11 (0.53) | -7.21* (0.00) | -7.29* (0.00) | -6.58* (0.00) | -4.59* (0.00) | I(1) |
| Pakistan | -0.21 (0.99) | -0.06 (0.99) | -1.73 (0.73) | -2.11 (0.53) | -6.56* (0.00) | -5.03* (0.00) | -4.66* (0.00) | -4.59* (0.00) | I(1) |
| Nepal | -3.04 (0.12) | -2.56 (0.29) | -2.39 (0.38) | -2.11 (0.53) | -6.89* (0.00) | -6.66* (0.00) | -6.91* (0.00) | -4.59* (0.00) | I(1) |

Note: * indicates significance at 5% level. P value is in parenthesis. Unit root test regression model is selected with intercept and trend.

**Co-integration analysis**

Cointegration analysis is performed using the Johansen method to estimate long run equilibrium relationship between global food price and domestic prices in South Asia. Two models are estimated separately for two domestic prices, namely, CPI and CFPI. Unit root test results are given in Table 1 indicate that all series are in the same order of integration, I(1).

**Determining the Optimal Lag**

Before performing the test for the existence of co-integration, it is vital to choose an appropriate lag order of the model specification. The Johansen method is known to be sensitive to the lag length (Banerjee *et al*., 1993). Therefore, first, the optimal lag is estimated. The appropriate lag length for the co-integration test is selected based on VAR lag order selection criteria. The optimal lag for each domestic price of all countries in level series are reported in Table .2

*Table 2 - VAR Lag Order Selection Criteria*

| | Sri Lanka | | India | | Bangladesh | | Pakistan | | Nepal | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model | LCPI | LCFPI | LCPI | LCFPI | LCPI | LCFPI | LCPI | LCFPI | LCPI | LCFPI |
| SC | -17.32 | -16.11 | -16.30 | -15.31 | -17.31 | -16.53 | -16.37 | -16.02 | -15.62 | -15.14 |
| Lag | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

Then, co-integration tests are carried out for two domestic price models. Domestic prices are deliberately chosen as the dependent variable (normalized to one) to

examine the global food price transmission to the domestic prices in South Asia. The Johansen test procedure for co-integration among the variables is used by looking at a rank of the long run impact matrix (referred to as the $\Pi$ matrix in many expositions) via its eigenvalues. Using Johansen's (1988, 1991) maximum eigenvalue and trace tests, a sequential procedure is used to decide the number of co-integrating relations. Two sets of models employed to test co-integration using Johansen's method are:

1. Model 1 LCPI = f (LGFPI, LER)
2. Model LCFPI = f (LGFPI, LER)

The results of the Johansen co-integration test for each domestic price model are presented in Table 3.

***Table 3 - Rank Test of Cointegration for Global Food Price Transmission.***

| | | **No of Cointeg** | | Trace Stat | No of Cointegration (r) | | Max-Eigen value |
|---|---|---|---|---|---|---|---|
| Country | Model | $H_o$ | $H_1$ | | $H_o$ | $H_1$ | |
| **Sri Lanka** | LCPI | r =0 | r ≥ 1 | 32.41 (29.79) * | r = 0 | r =1 | 23.62 (21.13) * |
| | | r ≤ 1 | r ≥ 2 | 8.79 (15.49) | r =1 | r =2 | 7.19 (14.26) |
| | LCFPI | r =0 | r ≥ 1 | 45.35(35.19) * | r = 0 | r = 1 | 31.92(22.29) * |
| | | r ≤ 1 | r ≥ 2 | 13.42 (20.26) | r =1 | r =2 | 7.95(15.89) |
| **India** | LCPI | r =0 | r ≥ 1 | 53.98(35.19) * | r = 0 | r = 1 | 33.69(22.29) * |
| | | r ≤ 1 | r ≥ 2 | 20.8 (20.26) | r =1 | r = 2 | 12.37 (15.89) |
| | | r ≤ 2 | r ≥ 3 | 7.90(9.16) | r =2 | r =3 | 7.90 (9.16) |
| | LCFPI | r =0 | r ≥ 1 | 43.71 (35.19) * | r = 0 | r = 1 | 20.79 (17.79)* |
| | | r ≤ 1 | r ≥ 2 | 21.27 (20.26) | r = 1 | r = 2 | 9.15 (11.22) |
| | | r ≤ 2 | r ≥ 3 | 9.01 (9.16) | r =2 | r =3 | 9.01 (9.16) |
| **Bangladesh** | LCPI | r =0 | r ≥ 1 | 40.04 (42.91) | r = 0 | r = 1 | 28.31 (25.82)* |
| | | r ≤ 1 | r ≥ 2 | 11.72 (25.87) | r = 1 | r = 2 | 6.85 (19.38) |
| | LCFPI | r =0 | r ≥ 1 | 29.79 (24.27)* | r = 0 | r = 1 | 23.44 (17.79)* |
| | | r ≤ 1 | r ≥ 2 | 6.35 (12.32) | r = 1 | r =2 | 6.34 (11.22) |
| **Pakistan** | LCPI | r =0 | r ≥ 1 | 59.10 (35.19) | r = 0 | r = 1 | 41.66 (22.29)* |
| | | r ≤ 1 | r ≥ 2 | 17.43 (20.26) | r = 1 | r = 2 | 13.37 (15.89) |
| | LCFPI | r =0 | r ≥ 1 | 52.28 (35.19)* | r = 0 | r = 1 | 36.08 (22.29) |
| | | r ≤1 | r ≥2 | 16.20 (20.26) | r = 1 | r = 2 | 12.45( 15.89) |
| **Nepal** | LCPI | r =0 | r ≥ 1 | 27.73 (24.27)* | r = 0 | r = 1 | 19.00 (17.79)* |
| | | r ≤ 1 | r ≥ 2 | 8.72 (12.32) | r = 1 | r = 2 | 8.61 (11.22) |
| | LCFPI | r =0 | r ≥ 1 | 40.11 (35.19)* | r = 0 | r = 1 | 18.58 (22.29) |
| | | r ≤1 | r ≥2 | 21.52 (20.26) | r = 1 | r = 2 | 12.75 (15.89) |
| | | r ≤2 | r ≥3 | 8.77 (9.16) | r =2 | r =3 | 8.77(9.16) |

Note: r = number of cointegration,relationships * denotes Ho is rejected at 5 % level.
5% critical value in parenthesis.

The Rank test (Trace and Maximum eigenvalue tests) shows that the null hypothesis of no co-integration, $H_0$ : r = 0 is rejected at the 5 percent level in favour of at least one co-integrating relationship. For Nepal, only trace statistics of LCFPI indicates two co-integrating relationships. Max-eigenvalue indicates no co-integrating relationship.

The co-integrating vector and speed of adjustment parameters are estimated for characterizing the extent of global food price transmissions and the disequilibrium behavior of domestic prices respectively. The results indicated that GFPI and domestic prices obey long run equilibrium relationships. This implies that GFPI and domestic prices never diverge too far from each other, they are in co-movement.

**Long Run Global Food Price Transmission Elasticities**

The long run parameter estimates from the co-integration analysis are reported in Table .4, for each model of CPI and CFPI.

*Table 4 - Global Food Price Transmission Elasticities in Long Run, 2005M1-2017M12*

| Countries | | Model 1: LCPI =f ( LGFPI,LER) | | | Model 2: LCFPI =f (LGFPI, LER) | | |
|---|---|---|---|---|---|---|---|
| | | Coefficient | SE | t-value | Coefficient | SE | t- value |
| **Sri Lanka** | LGFPI | 0.600* | 0.062 | 9.677 | 0.597* | 0.136 | 4.389 |
| | LER | 1.424* | 0.102 | 13.921 | 1.839* | 0.216 | 8.513 |
| **India** | LGFPI | 0.730* | 0.321 | 2.274 | 0.908* | 0.172 | 5.279 |
| | LER | 1.096* | 0.384 | 2.843 | 1.410* | 0.204 | 6.911 |
| **Bangladesh** | LGFPI | 0.074* | 0.013 | 5.547 | 1.331 | 1.843 | 0.722 |
| | LER | 0.100 | 0.071 | 1.412 | 0.02 | 2.213 | 0.009 |
| **Pakistan** | LGFPI | 0.482* | 0.132 | 3.651 | 0.543* | 0.132 | 4.133 |
| | LER | 1.055* | 0.128 | 8.242 | 1.220* | 0.128 | 9.531 |
| **Nepal** | LGFPI | 0.494 | 0.991 | 0.498 | 1.622* | 0.488 | 3.323 |
| | LER | 0.876 | 1.153 | 0.759 | 1.277* | 0.580 | 2.201 |

Note: * indicates significant at 5% level, others are not significant. Critical values for 5% level is 1.645.

Table 4 shows that the coefficient for GFPI in each CFPI and CPI model is statistically different from zero at the 5 percent level, except LCFPI for Bangladesh, and LCPI for Nepal. This implies that GFPI is influencing domestic price positively and significantly. Therefore, one can conclude that GFPI co-moves with (cointegrated) domestic food prices (CFPI), overall consumer price (CPI) indicating that a long run relationship exists between GFPI and CFPI and CPI. The estimated significant coefficient of GFPI implies that GFPI transmits positively and significantly to domestic food and overall prices.

The estimated transmission elasticity indicates that when GFPI increases by one percent, average CPI will increase by 0.60% for Sri Lanka, 0.73% for India, 0.48% for Pakistan, 0.07% for Bangladesh, domestic average consumer food price (CFPI) increases by 0.73% for Sri Lanka, 0.90% for India, 0.54% for Pakistan and 1.62% for Nepal. All transmission elasticities are positive and significantly different from zero.

Error correction model results show that, global food price inflation has positive and statistically significant response on headline inflation and domestic food inflation in the short run. The coefficient of error correction term is statistically significant for each model (CPI, CFPI) for each country and has expected negative sign in the case of headline , food inflation equations. This indicates that global food price has long run causal relationship with headline inflation, domestic food inflation in the long run. All of the coefficients of error correction term are statistically significant at the 5 percent level and have correct signs and absolute values of them are less than one. This implies the stability of the corresponding model and each response variable (domestic prices) moves towards the long run equilibrium path. The estimate of adjustment coefficient for DLCPI, DLCFPI models shows that the disequilibrium is corrected in every month significantly.

***Table 5 - Estimates of adjustment coefficient***

| Country | LCPI | LCFPI |
|---|---|---|
| Sri Lanka | -0.049* (-4.347) | -0.043* (-5.613) |
| India | -0.090* (-5.887) | -0.024* (-2.223) |
| Pakistan | -0.029* (-5.59) | -0.060* (-5.752) |
| Bangladesh | -0.256* (-5.07) | -0.002* (-4.260) |
| Nepal | -0.003* (-4.276) | -0.025* (-1.878) |

Granger causality test shows that global food inflation Granger cause headline inflation, domestic food inflation in Pakistan and Sri Lanka. In other countries, there is no evidence that GFPI Granger cause local prices in the short run.

***Table 6 - Granger causality Test results***

| Countries | Null Hypothesis | Obs | F-Statistics | P value |
|---|---|---|---|---|
| Sri Lanka | $DLGFPI \xrightarrow{No} DLCFPI$ | 153 | 6.177* | 0.003 |
| | $DLGFPI \xrightarrow{No} DLCPI$ | | 9.620* | 0.0001 |
| Pakistan | $DLGFPI \xrightarrow{No} DLCFPI$ | 153 | 4.963* | 0.008 |
| | $DLGFPI \xrightarrow{No} DLCPI$ | | 4.126* | 0.018 |
| India | $DLGFPI \xrightarrow{No} DLCFPI$ | 153 | 3.123 | 0.079 |

| | | | | |
|---|---|---|---|---|
| | $DLGFPI \xrightarrow{No} DLCPI$ | | 2.222 | 0.966 |
| Nepal | $DLGFPI \xrightarrow{No} DLCFPI$ | 153 | 0.408 | 0.666 |
| | $DLGFPI \xrightarrow{No} DLCPI$ | | 0.236 | 0.789 |
| Bangladesh | $DLGFPI \xrightarrow{No} DLCFPI$ | 153 | 2.382 | 0.095 |
| | $DLGFPI \xrightarrow{No} DLCPI$ | | 1.947 | 0.146 |

**Conclusions and policy recommendation**

We find evidence of a statistically and economically significant international food price pass-through to domestic inflation dynamics in South Asia in the long run. The results of this study show domestic headline inflation, food inflation have been accompanied by the spikes in international food prices. Local consumer food price increases in higher rate than overall CPI prices due to global food price changes. The co-integration test results confirm that global food price inflation, local headline inflation and domestic food inflation are co-integrated in South Asian countries. It seems that the global food prices, both inflation and volatilities, affect the national food markets all countries in South Asia. Therefore, every government must develop a safety net program for the poor. Safety net interventions need to be made consistent with a longer term poverty reduction strategy and fiscal sustainability. Policy attention needs to shift toward efforts to increase food production and lower the vulnerability of the poor.

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