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Global Food Price Pass-through in Sri Lanka : a Causality Analysis

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Abstract

Food prices have been increasing sharply since 2003 in Sri Lanka as well as in the world. In the globalized world, the transmission of global food price increases to domestic market determines the decision of economic agents and policy makers of a domestic economy. Thus, this study examines how international food price increases affects domestic inflation dynamic process in Sri Lanka. To assess this purpose, the study uses the VAR Granger causality /Block Exogeneity Wald Tests. The empirical statistical results are derived by using parametric and non-parametric econometric techniques. The data span for this study is from 2003M1 to 2013M12. Granger causality reveals unidirectional causal relationship running from global food price to domestic prices and the past changes of global food price help to explain current changes of domestic prices over and above the study period in Sri Lanka. Therefore, Sri Lankan government needs to develop a safety net program for the poor and a longer term poverty reduction strategy. The results of this study have various policy implications for monetary policy, food and agricultural policy and trade policy for Sri Lanka.

Key words: Granger causality, food price inflation, global food price pass through

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1. Introduction

Over the past few decades, many developing and emerging countries have become more integrated into the global economy. In this globalized world, food prices movements have significant impact on the world's political and economic stability as well as on the welfare of the people in every country.

The Food and Agriculture Organization (FAO)-Global Information Early Warning System (GIEWS) shows the up to date global food price information. They saw global commodity prices have recently at least since 2003 exhibited high and increasing with highly volatile and persistent movements. There were unexpected price spikes in 2007/08 and 2010 for major global food commodities. United Nations Economic and Social Commission for Asia and the Pacific (ESCAP, 2011) has shown that Sri Lanka is also experiencing unexpected price pressures driven by higher global food prices.

Comparing 2013M12 with 2003M1, world market prices increased by 118.5 percent for food price, 114.8 percent for meat, 194.1 percent for dairy products, 97.6 percent for cereals, and 91 percent oil (FAO, 2013). Domestic price in Sri Lanka increased 153.5 percent for consumer price for all items, 179.8 percent for consumer price for food items (Department of Census and Statistics (DCS), 2013). The households who spend more on food in their income, net food buyers, are more affected by increasing food prices. Advanced economies spend the least around 16 percent of their total household expenditure on food (Wu, 2004). By contrast, the average household in the developing world spends roughly half of its total budget on food. Countries in South Asia spend more than 50 percent of their total expenditure on food (Asian Development Bank (ADB), 2011). Poor households in developing countries allocate more than 60 percent of total household expenditure to food. Thus, food price surge during recent years has aroused intense concern worldwide about the impact on the poor in developing and emerging countries, generally, emerging and developing economies are more vulnerable to an increase in world commodity prices than developed economies (International Monetary Fund (IMF), 2008).

In a globalized world, high world food prices are transmitted to domestic economy. The impact of high food prices has adverse impact on economy and social sector of many countries. The most (90 percent) of the global poor (income below 1.25$/day) live in countries where domestic food prices respond to international prices (Kalkuhl, 2014). Rising food prices erode the purchasing power of net buyers of food and forcing them to reduce non-food spending and shift to cheaper foods. At the national level, food importing countries face balance-of-payment problem as the cost of food imports rose. In addition, the cost of operating food aid budgets and nutrition programs at the national and international level rise. In some of the countries, high food prices are a very sensitive political issue and led social unrest, thereby can lead to political instability. High food prices have increased world hunger (Ivanic & Matin, 2008). The rising prices have increased number of undernourished populations (Mahendra Dev, 2013). Increasing food prices affect the number of people who are under poverty (ESCAP 2011, ADB, 2008, 2011). The impact of the global food price increases has been severe in Sub-Saharan Africa(SSA) (Minot, 2011). Higher food prices may increase food insecurity and undermine population health (Lee, Lim, Lee & Park, 2013). High food prices can have impact on children's health and education and having long term impact on children's health psycho–social well-being. Thus, it may retard human development, and lowering labour productivity of the economy in the long run. Moreover, general inflation could rise due to higher food prices. If wages could rise due to food prices, inflation could spiral, causing inflationary expectations with general price level rising further. Food prices have been a key driver of the sharp rises and falls in general inflation in recent years (Ferrucci, Rodriguez, & Onorante, 2010). Hence, high and increasing food prices pose a significant policy challenges for developing and emerging countries where households spend a larger share of their income on food (Kelbore, 2013).

South Asia that includes Sri Lanka is the vulnerable region to food price inflation. Sri Lanka is a small open and dependent economy in South Asia region. Sri Lanka is a price taker in world food markets. According to 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, 2014). Sri Lanka's rank based on 2014 GHI scores (GHI=15) comes under serious category. The share of food and beverages imports expenditure of total consumer

goods imports expenditure is around 50 percent for the period of 2009-2012 (Central Bank of Sri Lanka, 2013). More than 80 percent of total population lives in rural and estate sectors in Sri Lanka (DCS, 2012/13). They are net buyers of staple foods. Thus average food inflation became a large source of headline inflation in Sri Lanka. Sri Lanka is highly vulnerable to shocks in the international food prices since the food consumption basket has large food import component and large number of households spend large share of their income on food. The main food items of imports (percent of total supply) in Sri Lanka are wheat (100 percent), sugar (90 percent), milk powder (85 percent), pulses and nuts (77 percent), meat, maize, big onion (50 percent), potato, Dried fish and rice, whereas wheat and maize are used as intermediate goods. Food and beverages, wheat and maize account approximately in the range of 9-12 percent of total import expenditure in Sri Lanka.

In this structure of the Sri Lankan economy, food prices have a significant inter linkages between global food prices and domestic prices. How the shocks come to domestic market from world market is a researchable phenomenon. The inter relationship between world food prices and domestic prices provides insights into marketing efficiency, as well as consumer and producer welfare.

To our knowledge, that there remain scarce in-depth studies in terms of econometric analysis with little systematic empirical evidence on the global food price transmission to domestic prices in Sri Lanka. ADB, FAO, World Bank publications show that there are large amount of literature on this issue for Africa, Latin America, Advanced economies, developing Asia consisting Pakistan, India, Vietnam, Philippine and Bangladesh. Carrasco & Mukhopadhyay (2012) have studied food price escalation in South Asia including Sri Lanka. However, this study has not focused on global food price transmission issue. Surprisingly there is no comprehensive and systematic analysis of the global food price transmission to domestic market in Sri Lanka. This study intends to fill this gap in the literature by providing a comprehensive study of global food price transmission to domestic prices in Sri Lanka. This study attempts to answer the following questions: i) Do global food prices pass-through domestic prices in Sri Lanka? ii) is there any causal linkages in long run or short run from global food price to domestic prices in Sri Lanka?. The direction of causal relationship of transmission is important because it is domestic prices that affect the welfare of poor consumers; hence it has important implications for economic welfare.

The objective of this study is to investigate in-depth the pass-through effects of global food prices to producer and consumer prices in the domestic inflation dynamics in Sri Lanka for the periods of 2003M1-2013M12. The plan of the paper is as follows. Section 2 briefly reviews the literature. Section 3 describes data and methodology of the study. Section 4 discusses the empirical results obtained from various econometric techniques applied for food prices and the final section concludes, and gives some recommendations from the results obtained.

2. Literature Review

In this section, we briefly overview the existing works about global price transmission to domestic prices. The literature in the area of food price transmission shows a group of stylized facts (SF), (i) the food price pass through varies largely depending on the product category, (ii) the food price pass through differs across countries, (iii) the size of food price pass through has changed over time, (iv) the pass through to producer prices is higher than to consumer prices, (v) the food price pass through is asymmetric. Dewbre, Giner, Thomson and von Lampe (2008) have highlighted the importance of price transmission which is at the center of our paper.

In recent years, there have been a large number of studies that have investigated the transmission of world food prices to domestic economy. For some examples; Shawarby and Selim (2012), Jalil and Zea (2011), Rapsomanikis (2011), Lee and Park (2013). Imai, Gaiha and Thapa (2008).

Most of them found transmission was incomplete, and some are asymmetric. Further, global food price is significantly contributing to domestic inflation. Ferrucci, Jimenez-Rodriguez and Onorante (2012) concluded that international commodity price inflation is the main determinant of producer and consumer food price inflation in the

Euro area. However, there were few studies about specific country studies about this issue in South Asia, in particular Sri Lanka.

3. Data and Methodology

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

3.1 A*nalytical framework*

The analytical framework draws on the LOP (Ardeni, 1989). The LOP is in its strict form as $P^{d}_{i,t} = ER_t * P^{w}_{i,t}$ where ER is nominal exchange rate (units of domestic currency per unit of foreign currency: RS/USD), P^w is world (foreign) price, P^d is domestic price for specific commodity *'i'*, time period *t*. In statistical terms, the stochastic form of the LOP is $P^{d}_{i,t} = ER_t * P^{w}_{i,t} e^{\varepsilon_t}$. The relationship between the variables can be written in natural log form (depicted in lower case) as

[1] $$p^{d}_t = \beta_0 + \beta_1 p^w + \beta_2 er_t + \varepsilon_t, \quad \varepsilon_t \sim IID(\mu, \sigma^2)$$

We implicitly assume that ER, is an exogenous variable as Sri Lanka is a price taker. β_1 is the price transmission elasticity. Commodity market arbitrage and purchasing power parity suggest that in the short run, prices of similar products in varied markets might differ. However, arbiters will prevent the various prices from moving too far apart even if the prices are nonstationary. Hence, our empirical model is Equation [1]. From this model, we form five models for each domestic price series separately to study the transmission effect of global food prices to domestic prices. The degree of pass-through from international food price changes to domestic price changes is estimated using the above models.

First, we characterize the data using exploratory data analysis, contemporaneous correlations, and unit root tests. Graphical displays are used to explore the underlying dynamic behavior of the domestic price series and global food price series and their hidden underlying relationships. Three standard unit-root test techniques, namely, Augmented Dickey Fuller (ADF) test, PP test and KPSS test conducted to identify the order of the integration of each price series. Three unit root tests are done in order to check the consistency of results. After determining the order of the integration of the series, then, lag length in the VAR model were selected using lag selection criteria, AIC, SC and HC. Then, VECM is estimated using Johansen maximum likelihood method. The existence of a relationship between variables does not prove causality. But, in order to examine the direction of influence between variables, to estimate transmission effects we employ Granger causality tests (GCT). Using parametric approach under the vector autoregressive frame work (VAR), pairwise Granger causality test (F test) and VEC Granger's Causality/Block Exogeneity Wald test based upon VECM and impulse response function analysis are employed.

3.1.1 Granger's causality test

Granger causality from one variable to another means that the conditional forecast for the latter can be significantly improved by adding lagged variables of the former to the information set. Causality is defined as: X_t is said not to Granger cause Y_t if

[2] $$E(Y_{t+h} \mid J_t, X_t) = E(Y_{t+h} \mid J_t) \quad .$$

Various Granger causality tests are employed to get robust results in this study. They are (i) Pairwise Granger causality test (F test) from single equation method, F test applied to the joint significance of the sum of the lags of each explanatory variable ii) VAR Granger causality/Block Exogeneity Wald Tests (Chi-Square), iii) VEC Granger causality/Block Exogeneity Wald Tests (Chi-Square) to find the causality relationship between variables.

In a VECM, there are two possible sources of causality: error correction term, which shows long run causality, and lagged explanatory variables that revealing short run causality. Granger (1988) proposed a test for long run causality within the context of the error correction representation of a cointegrated system of variables. The presence and the direction of Granger causality in the long run can be assessed by testing the null that the error correction coefficients, α , in VECM are zero, a test that also reveals weak exogeneity in the econometric sense. The dependence of ECT is referred as weak exogeneity while the dependence on the sum of joint lagged differenced variables is referred as the strict exogeneity. It is worth to note that cointegration between variables implies Granger causality in at least one direction, opposite is not necessarily true. However, lack of Granger causality may not imply an absence of transmission.

3.1.2 Impulse Response Function

We use impulse response function (IRF) analysis in this study to provide dynamic simulations of the effects of shocks of known size and duration in global food price on domestic prices. An IRF traces the response of current and future values of the endogenous variables to a one standard deviation shock through the dynamic structure of the VAR. Plots of the IRF over time provide a graphical illustration of the period by period simulation, describing both adjustment path and long run effect on the domestic prices in response to the shock in global food price. Assuming that all series in Y_t are stationary and they can be expressed in a vector moving average (VMA) representation as $Y_{t+s} = \sum_{i=0}^{\infty} \Psi \varepsilon_{t+n-i}$, then the IRF is defines as $\{\Psi_n\}_{i,j} = \frac{\partial Y_{i,t+n}}{\partial \varepsilon_{j,t}}$. The matrix Ψ can be interpreted as that its (*i*,*j*) element measures the consequences of a one unit increase in the j^{th} variable's innovation at date t, (ε_{jt}) for the value of the i^{th} variable at time $t+n$ holding all other innovations at all dates constant. The IRF is derived by plotting these elements as a function of *s*. The advantage of examining impulse response functions is that they show the size of the impact of the shock plus the rate at which the shock dissipates, allowing for interdependencies.

3.2 Data

This study uses monthly data on domestic consumer prices, producer prices and global food prices. The sample period chosen for this study extend from January 2003 to the December 2013 which gives a total of 132 observations. The period of 2003 was used as a starting time because international oil, cereal and fertilizer prices and domestic food price started to rise exponentially. Food price indices are used as a proxy for food price series. The variables used in this study are Colombo Consumer Price Index (CCPI), CCPI for food(CFPI), CCPI for nonfood (CNFPI), wholesale price index (WPI), wholesale food price Index (WFPI) global food price index v(GFPI)and exchange rate (ER). All variables are transformed into natural logarithmic form in order to get elasticity estimates. The variable GFPI is collected from FAO web site and domestic consumer prices; CCPI, CPFPI and CCNFPI are collected from DCS, Sri Lanka. WPI, WFPI, Exchange rates (ER) data are collected from the Central Bank, Sri Lanka. As international prices are often denominated in US dollar, the key currency is the US dollar in all external trade in Sri Lanka, the monthly official exchange rate rupees per US dollar (RS/USD) is used as exchange rate variable. Exchange rate variable is assumed to be exogenous as Sri Lanka is a small country in the Foreign exchange market.

4. Empirical results

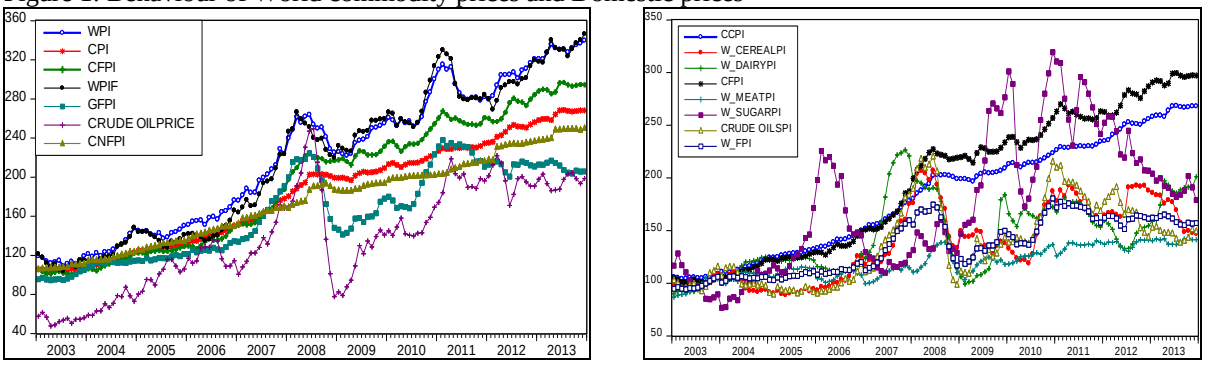
This section focuses on the analysis of the empirical results from the performed econometric and statistical tests. Our investigation highlights a number of interesting results. Contrary to the existing literature, we find evidence of a statistically and economically significant world food price Granger cause domestic prices in Sri Lanka.

4.1 Preliminary data analysis

The time series plot in Figure 1(a) shows the evolution of global food price and domestic prices. They 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 Sri Lanka mirrored global food price movements. The food price in Sri Lanka is not only increasing but also relatively more volatile. Since 2003, the food prices have started to increase in upward direction and it started to increase faster than nonfood price, overall consumer prices since 2007. In terms of volatility and average level, food price inflation play crucial role in Sri Lanka.

Figure 1(b) shows the behavior of various commodity prices in the world market. Figure 1(a) shows the comparison of domestic prices and global food price behavior during the study period. They indicate that domestic prices are co-moved with global food prices. Simple statistical contemporaneous correlation analysis confirms the strong positive correlation between global food price and local food prices (0.94), overall consumer price (0.91), wholesale food price (0.95) wholesale price (0.96).

Figure 1: Behaviour of World commodity prices and Domestic prices



(a) (b)

Source: Data from Department of Census and Statistics, Sri Lanka, FAO website and author[1]'s calculation

Note: CPI=Colombo Consumer Price Index, CFPI=Colombo Consumer Food Price Index, CNFPI=consumer nonfood price index, GFPI= Global Food Price Index, WFPI=Wholesale Food Price Index, WPI=Wholesale Price Index, Crude OilPI=Oil Price Index, W_CEREALPI=world cereal price index, W_DAIRYPI=dairy price index, W_FPI=world food price index, W_SUGARPI=world sugar price index, W_MEATPI=world meat price index

Global food price inflation has asymmetric effects on domestic price behaviour. Pass-through of food price hikes is significantly higher than that of food price falls in Sri Lanka. 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. Further, one can observe explicitly the underlying dynamic inter relationship between global food price and domestic prices if a confidence ellipse graph is implemented.

Based on the visual inspection of the line graph of each variable, suitable ADF, PP, KPSS unit root tests (among none or intercept or intercept with trend) are selected. The order of integration of the food price series is assessed by the ADF test, PP test and the KPSS test. Three unit root tests are done in order to check any contradiction results exist. As all three test results are similar, ADF test results are only reported in the text in Table 4. The results of PP test and KPSS test are not shown to economize on space. Unit root test results show that all these price series in level are non-stationary and I(1). These series in first difference are stationary, I(0). All "P" values of the ADF test statistic for each variable 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. Preliminary data analysis showed that all price time series used in this study are non-stationary, I(1). The results show that optimal lag was 2 for all models.

Table 2: ADF Unit root test results for level data

series	Level with intercept and trend		First Difference with intercept and trend	
	ADF statistic	P value	ADF statistic	P value
LCCPI	-0.8059	0.9617	-7.8894	0.0000
LCCFPI	-1.4666	0.8361	-7.2237	0.0000
LCCNFPI	-1.2503	0.8952	-11.045	0.0000
LGFPI	-3.1000	0.1107	-6.0333	0.0000
LWFPI	-2.2557	0.4546	-8.7396	0.0000
LWPI	-1.5059	0.8229	-10.0361	0.0000
LUSD	-2.7435	0.2213	-7.6999	0.0000
Critical value 5%)	-3.4447		-3.4447	

* Mackinnon (1996) one-side p-value

4.2 Empirical Results of Granger Causality Analysis

Unit root tests showed that all price series in this study are I(1), and are stationary in first difference form. Thus, in this study, differenced prices (growth rates) are used for GCT. Table 7 depicts results of short run causality test. For each of the price series (growth) pairwise causality testing was carried out using the F test.

Results show evidence of one way causality running from global food price to producer prices and from producer to consumer prices. As Sri Lanka is a price taker, one way direction, $World \rightarrow Domestic$, is consistent with economic trade theory.

The results from Pairwise Granger causality (F-test) from single equation, VAR Granger causality/Block Exogeneity Wald Tests and VEC Granger causality/Block Exogeneity Wald tests are given in Table 3, Table 5 and Table 6 respectively. The P-values given in these Tables indicate that each null hypothesis of no–causality, $"X \xrightarrow{not} Y"$, is rejected at 5 percent level. Results show that global food price granger cause consumer prices; CCPI, CCFPI, CCNFPI, WPI, WFPI in Sri Lanka. Thus, GFP helps to predict these domestic price series. These results imply that domestic market depends on world market situation. Results show evidence of one way causality running from global food price to producer prices and from producer to consumer prices. As Sri Lanka, price taker, one way direction, $World \rightarrow Domestic$, is consistent with economic trade theory.

Table 3 Granger Causality Test Results-pairwise

Null Hypothesis:	F-Statistic	Prob.
DLGFPI $\xrightarrow{not}$ DLCCPI	8.183	0.0005*
DLGFPI $\xrightarrow{not}$ DLCCFPI	5.266	0.0064*
DLGFPI $\xrightarrow{not}$ DLCCNFPI	3.287	0.0406*
DLGFPI $\xrightarrow{not}$ DLWFPI	3.902	0.0227*
DLCCFPI $\xrightarrow{not}$ DLCCPI	3.989	0.0209*
DLWPI $\xrightarrow{not}$ DLCCFPI	6.939	0.0014*
DLWPI $\xrightarrow{not}$ DLCCPI	8.284	0.0004*
DLWFPI $\xrightarrow{not}$ DLCCFPI	5.279	0.0063*
DLWFPI $\xrightarrow{not}$ DLCCPI	5.134	0.0072*

DLCCNFPI $\xrightarrow{\text{not}}$ DLCCPI	4.372	0.0146*

Note: "*" Significant at 5 percent level, lag=2. $"X \xrightarrow{SR} Y"$ indicates one way causal relation (X to Y)

The pairwise Granger causality test results Table 3 indicate short run causal relationship. According to this result, global food price granger causes CCPI, CCFPI, WFPI, WPI. The short run Granger causality test results are summarized in Table 4.

Results from VAR Granger causality/Block Exogeneity Wald Test in Table 5 shows that global food price Granger cause CCPI, CCFP, WFPI, WPI significantly .

Table 5 Chi-square Statistic- VAR Granger Causality /Block Exogeneity Wald Tests

Excluded variable	$\Delta LCCPI$	$\Delta LCCFPI$	$\Delta LCCNFPI$	$\Delta LWFPI$	$\Delta LWPI$
$\Delta LGFPI$	11.662**	5.696*	3.644	6.557**	14.015**
	(0.006)	(0.017)	(0.056)	(0.010)	(0.000)

Note: P values of Wald test statistics, are in parenthesis, * Significant at 5 percent level, ** significant at 1 % level.

According to VECM Granger causality /Block Exogeneity test (Table 6), GFPI Granger causes CCPI, CCFPI, WFPI, WPI except CCNFPI in the short run.

Table 6 Chi-square Statistic- VECM Granger Causality /Block Exogeneity Wald Tests

Excluded variable	$\Delta LCCPI$	$\Delta LCCFPI$	$\Delta LCCNFPI$	$\Delta LWFPI$	$\Delta LWPI$
$\Delta LGFPI$	9.154**	6.948*	0.9086	10.775**	17.988**
	(0.0103)	(0.031)	(0.634)	(0.005)	(0.000)

Note: P values of Wald test statistics, χ^2 are in parenthesis, * Significant at 5 percent level, ** significant at 1 % level.

Causality test results (Table 3, Table 5, Table 6), show that global food price Granger cause domestic prices in Sri Lanka in the short run. Further, Granger causality test shows that global food prices Granger cause domestic prices even in the long run, indicated by the coefficient of ECT negative sign and statistically significant. Long run causality results are exhibited by error correction term coefficient estimate. Table 7 shows that GFPI Granger causes all the price variables food and nonfood prices in Sri Lanka in the long run. So, we can conclude that GFPI Granger cause domestic prices in the short run as well as in the long run.

Table 7 Long Run Causality Measure

Response Variables					
	LCCPI	LCCFPI	LCCNFPI	LWFPI	LWPI
ECTt-1	-0.047*	-0.053*	-0.061*	-0.115*	-0.083
	[-3.392]	[-2.222]	[-3.106]	[-2.748]	[-1.928]

Note: DV refers dependent variable, ECT refers error correction term, ** significant at 1 percent Level, * Significant at 5 percent level, "t" statistic values in [ ],

GFP helps to predict these domestic price series. These results imply that domestic market depends on world market situation.

4.3 Impulse Response Function

A positive one standard deviation shock to the global food prices is simulated and the IRFs are estimated. The impulse responses of LCCPI indicate the direct inflationary effects due to LGFP increases. CCPI increases faster till up to five months then started to flatter or decline very slowly. A positive shock to global food price (GFPI) has an immediate positive impact on domestic food prices (CCFPI) and CCFPI increase up to five months then declines. Nonfood price is also increase till nine months. This longer period may be due to secondary effects. Every response of domestic prices is all positive at each responsive period. Overall, global food price induce price inflation in Sri Lanka.

5. Conclusions and policy implications

We find evidence of a statistically and economically significant causal relationship from international food price to domestic price inflation dynamics in Sri Lanka. Granger causality tests indicate a unidirectional causal effect from world food prices to domestic prices. Global food price does not influence statistically significantly nonfood price inflation in the short run. But world food price influence all domestic prices (food and nonfood) in Sri Lanka in the long run. The increases in global food prices generate increases in headline inflation and domestic food inflation. Therefore, Sri Lankan government needs to develop a safety net program for the poor and a longer term poverty reduction strategy. Policy attention needs to shift toward efforts to increase food production, investing agricultural research, promoting diversification in staples consumption. Future empirical work in this area should strive for a more comprehensive analysis to investigate the aspects of international food price volatility transmission.

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