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Pass-through of International Food Prices to Emerging Market Economies: A Revisit

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Sharp upturns in international food prices in 2007-08 and 2010-11 have motivated a close scrutiny of their volatility, transmission and supply chains. While global food prices have remained tame since 2012, the uptick in prices of major food groups in the second half of 2019 is expected to add to the upside risks of domestic food prices across emerging market economies (EMEs), which are already witnessing high food inflation pressures due to internal supply shock conditions. Against this backdrop, this study intends to re-examine whether global food prices hold any implications for domestic prices in EMEs which have higher shares of food in their overall consumption baskets. Using data from January 2007 to July 2019, the study finds that short-term elasticities, in the range of 0.02-0.16, are lower than long-term elasticities. Moreover, there are large cross-country divergences in long-term transmission elasticities.

JEL Classification: F14, C22

Keywords: Food price transmission, law of one price, vector error correction model

Introduction

Headline consumer price index (CPI) inflation in India exhibited sharp rise in the second half of 2019, breaching monetary policy's upper band level of 6.0 per cent in December 2019. This episode of high inflation is attributed to a spike in domestic food prices resulting from supply shocks across major food items. As India has transitioned along an inflation glide path[1] since 2014-15 – a precursor to the explicit Inflation Targeting (IT) framework –

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[1] The Reserve Bank followed a glide path to bring down inflation in a phased manner – 8.0 per cent by January 2015; 6.0 per cent by January 2016 and 5.0 per cent by Q4:2016-17.

such an uptrend in domestic inflation has caused resurfacing of concerns over food price volatility, raising questions on the role of the monetary authority in containing the same. While domestic supply conditions largely drive food inflation, shocks in international food prices are also among the important sources of domestic inflation in EMEs (Furceria *et al.,* 2016). Although global food prices have remained tame since 2012, an uptick in the prices of major food groups in the second half of 2019 is expected to add further upside risks to already rising domestic food prices, not just in India but also across other major EMEs.

The transmission of food price changes from international to domestic markets strengthened for EMEs due to the increased participation of these economies in global food markets and stronger market integration. Large increases in international food prices in 2007-08 and 2010-11[2] led to close scrutiny of food prices, their volatility, transmission and supply chain. Both advanced economies (AEs) and EMEs witnessed transmission of food price pressures although with different magnitudes. While a high transmission could promote comparative advantage and higher agricultural production, highly volatile prices could undermine the incentives for farmers to increase production in response to high prices, therefore undermining the scope to reduce domestic prices.

The World Bank's nominal food price index rose sharply in 2007-08 and 2010-11 registering an increase of 23.8 per cent on year-on-year (y-o-y) basis in 2007, 33.5 per cent in 2008 and 22.5 per cent in 2011. Such unanticipated increases in world food prices during these two episodes *i.e.,* 2007-08 and 2010-11 were seen across all food groups and the effect was particularly serious across EMEs as the average household in many EMEs spends a substantial part of its income on food. While the share of disposable income spent on food is around 10-15 per cent for many AEs, it is more than 20 per cent for most EMEs. As a result, the weight of food in the CPI basket remains at high levels in EMEs. Moreover, inflation expectations in AEs are relatively better anchored than in EMEs, which has further helped limit global food price pass-through across the former (*ibid*). Though the major EMEs

[2] Refers to as the two episodes of unprecedented global food price spike.

have adopted inflation targeting to limit the pass-through of supply shocks to inflation through better anchoring of inflation expectations, high weightage of food in the overall CPI basket still remains a challenge, and thus, keeps EMEs vulnerable to such shocks.

Against this backdrop, this paper attempts to address the following issues: Are high and volatile global food prices a cause of concern for domestic inflation? If yes, to what extent do changes in world food prices get transmitted to domestic prices? While a few studies have been conducted to examine the degree of transmission at both individual and cross-country levels, no such study has been conducted in the recent past possibly because food prices have been relatively stable since 2012 until the second half of 2019, when they started showing signs of pickup again. Therefore, the present study is an attempt to re-examine whether the degree of pass-through is significant to EMEs and if any long-run relationship between world food prices and domestic food prices still holds.

The pass-through of fluctuations in world food prices to domestic food prices was examined for six EMEs, *viz*. China, Brazil, Sri Lanka, Thailand, Turkey and India as food products hold higher weightage in the CPIs of these countries. Based on monthly data from January 2007 to July 2019, the study finds that while all the transmission elasticities are positive, they differ across countries. The short-term pass-through coefficients are limited to a range of 0.02-0.16. While the findings of this paper reaffirm that transmission from global food prices to domestic food prices is incomplete in case of EMEs, it finds that there has been a large cross-country divergence in transmission elasticities in the long term. Moreover, the paper contributes to the literature by examining whether the nature of pass-through from international to domestic food prices has changed over time with evolving global and domestic trade dynamics.

The remaining of the paper is structured as follows. Section II briefly reviews the literature, while some stylised facts on global food prices are discussed in Section III. The methodology used in the paper is explained in Section IV. Empirical findings are presented in Section V. The concluding observations are set out in Section VI.

Section II
Review of the Literature

Global food price volatility has always been a matter of concern as it holds implications for domestic food inflation across economies and, therefore, poses a significant challenge in designing appropriate policy responses. Such concerns are specifically serious for EMEs than those for AEs since food forms a larger part of their consumption basket and their monetary policy may lack credibility to anchor inflation expectations and find it difficult to contain pass-through effects effectively (Furceria *et al.*, 2016). A vast pool of studies could be found in the literature which analysed the transmission of global food price shocks to domestic food price inflation and volatility, both individual and cross-country experiences (Appendix Table A.1).

Some of the earlier studies have examined the pass-through of global food price shocks to both AEs and EMEs and suggested that such pass-through could be incomplete across economies (Ianchovichina *et al*., 2012; IMF, 2011a; Sharma, 2003). Moreover, such transmission has also been found to be asymmetric across AEs and EMEs, with pass-through tending to be higher for the latter (IMF, 2011a). Dawe (2008), Imai *et al.* (2008) and Minot (2011) even found evidence of heterogeneity in transmission across different varieties of crops.

While assessing the impact of various internal and external factors on domestic food price inflation, Lee and Park (2013) found evidence of transmission of global food price inflation and volatility to domestic economies. According to their findings, domestic food inflation, specifically in Asia, was found to be strongly related to past values of global food inflation, while volatility spillovers from global to domestic food prices were found to be contemporaneous. Moreover, the study suggested that the degree of pass-through of global food prices to domestic food prices differs across regions and internal factors play an important role in determining national food price inflation and volatility. While examining the implications of high international food prices for inflation in select Central Asian economies, *viz.* Tajikistan, Kazakhstan, Uzbekistan, and the Kyrgyz Republic, Al-Eyd *et al.* (2012) concluded that global food prices have significant short-run effects on

headline inflation in these economies. Based on a simulation experiment, they found that administrative measures are ineffective in controlling domestic inflation in these economies. Similarly, Minot (2011) in his study based on 11 Sub-Saharan African countries for eight food items during 2007 and 2008 found evidence of transmission of global food prices to domestic prices of rice and, to some extent, maize. Imai *et al.* (2008) found a faster transmission of prices for crops like rice, maize and wheat than for fruits and vegetables in India and China.

Among country-specific studies, the study by Barahona and Chulaphan (2017) examined the extent to which changes in global food price indices get transmitted to consumer price indices for diverse groups of consumers in Thailand in order to understand if the welfare of different types of consumers was equally affected by variations in world food prices. Their findings suggested that food inflation faced by the rural household was more responsive to changes in world food prices as their food basket consisted more of fresh agricultural commodities and essential food items which in turn were found to be highly sensitive to world price fluctuations. Selliah *et al.* (2015) empirically assessed the impact of the global food price surge on domestic inflation using monthly price series between 2003 and 2012 for Sri Lanka. Their results suggested a strong co-movement between global and domestic food prices. A similar study by Gomez Lopez and Gallardo (2013) on Mexican markets suggested that global food price pass-through exists in the long run and not in the short run for these markets. Shittu *et al.* (2017) examined the patterns, drivers and policy responses to food price spikes and volatility in Nigeria. They found that international food prices and crude oil prices, along with other domestic macroeconomic factors, *viz.* real exchange rate, monetary policy rate and narrow money, contributed to food price instability in Nigeria.

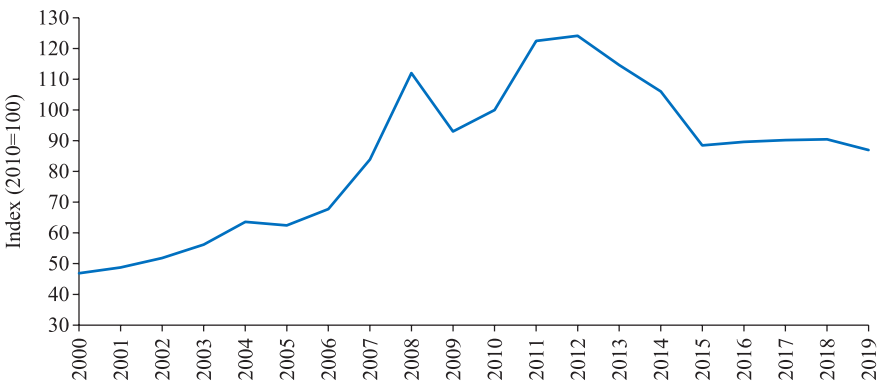
In the Indian context, we found very few studies that particularly examined the pass-through of global food prices to Indian food prices. In most studies, the variations in global food prices have either been included as one of the factors affecting Indian food inflation (Bhattacharya and Sen Gupta, 2017; Mishra and Roy, 2012) or India has been considered as one of the EMEs in the cross-country analysis (Dawe, 2008; Imai *et al*., 2008; Sivabalasingam, 2018). Rajmal and Misra (2009) have, however, particularly looked into the

pass-through of global food prices to the Indian food prices. In their analytical review, they suggested that domestic food price levels and volatility remained lower than that of international prices and were driven mainly by domestic factors which led to limited pass-through during the price hike episode of 2007-08. The findings of the above-mentioned studies have, however, been quite unanimous, showing limited pass-through from international food prices to domestic prices as local factors play a dominant role in driving food prices in India. With this background, the present study attempts to revisit the phenomenon of international food price pass-through to domestic prices in some of the major EMEs and to empirically examine whether international food prices, which have been relatively stable yet high over the past couple of years but have shown signs of firming up in the second half of 2019, drive domestic food prices.

Section III
International Food Prices: Stylised Facts

Global food prices have eased since 2012 after witnessing a sharp increase in 2007-08 and 2010-11 and remained relatively stable since 2015, until recently when global food prices showed signs of pickup in second half of 2019. The rise was particularly significant between 2000 and 2008, as reflected in an increase of more than 80 per cent in real terms in the World Bank's food price index (Chart 1). During the first episode of 2007-08, world food prices firmed up by 24 per cent in 2007. This increase accelerated further

Chart 1: World Bank Global Food Prices



Source: World Bank Commodity Price Data (The Pink Sheet).

in the first half of 2008 on demand-supply imbalances in the global market, resulting in an overall increase of around 34 per cent in 2008. Besides, the rise in demand for biofuels, increased agricultural input prices due to high oil prices, adverse weather conditions in some major producing countries and speculative transactions in commodity markets further added to the upward pressure on food prices during that period. The upturn in international food prices resulted in increased food price inflation around the world, thereby raising concerns over food security and its impact on health and nutrition, specifically for countries with a larger proportion of low-income consumers who spend a substantial portion of their income on food commodities (Table 1). Although food prices declined in the second half of 2008, the uptrend resumed in mid-2010, marking a second consecutive spike within a decade, thus reviving concerns over high prices and the associated volatility.

In both the episodes (2007-08 and 2010-11), movements in the world and domestic food prices were in line with earlier episodes of high prices seen in 1970s, where domestic prices adjusted gradually to rapidly rising world prices. However, the major difference between these two episodes of 2007-08 and 2010-11 was that the food price increase in 2007-08 followed a long period of stability in prices, while in 2010-11, the food price spike episode occurred when world markets and domestic polices were still in the phase of

Table 1: Food Weightage in Consumer Price Index

(In per cent)

Country	Food Share	Does Target Inflation?
Bangladesh	58.84	No
Brazil	22.90	Yes (4.0 ± 1.5)
China	30.20	No
India	45.86	Yes (4.0 ± 2.0)
Indonesia	36.20	Yes (3.0 ± 1.0)
Pakistan	40.34	No
Philippines	46.58	Yes (3.0 ± 1.0)
Russia	37.30	Yes (4.0)
South Africa	17.24	Yes (3.0-6.0)
Sri Lanka	45.50	No
Thailand	33.01	Yes (1.0 - 3.0)
Turkey	34.78	Yes (5.0)

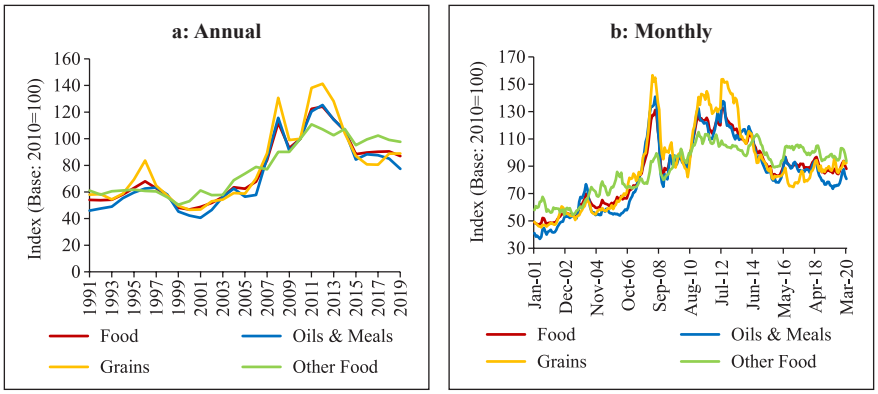
Source: Websites of respective central banks and statistics authorities.

recovery from the 2007-08 price shock (Laborde *et al.*, 2019; World Bank, 2019).

The unanticipated spikes were witnessed across all food groups with grains contributing to the highest increase in price followed by oils and meals (Chart 2). While the extent of price hike in both episodes was more or less the same, the affected commodities were not the same. During 2007-08, while sugar prices remained low, prices of rice, wheat, oil and other cereals remained elevated.

World rice prices increased by almost 100 per cent in 2008 (y-o-y) following export restrictions by major producers amid concerns over food security, while a weak dollar and rising oil prices added further upward pressures (World Bank, 2019). During 2010-11, however, rice prices increased merely by around 15 per cent - much less than that during the first episode (Chart 3a). Rice prices were particularly high in Asia, while the rise in wheat and maize prices was much more prominent in Central and South America (Rajmal and Misra, 2009). World wheat prices increased sharply by around 70 per cent between 2006 and 2008 on supply disruptions caused by drought in major exporting countries, while in 2011 it increased by 41 per cent (y-o-y), driven by supply-demand imbalances (Chart 3b). Similarly, world maize prices increased by around 57 per cent in 2011 compared to 36 per cent increase in 2008 (Chart 3f), largely driven by adverse weather conditions in

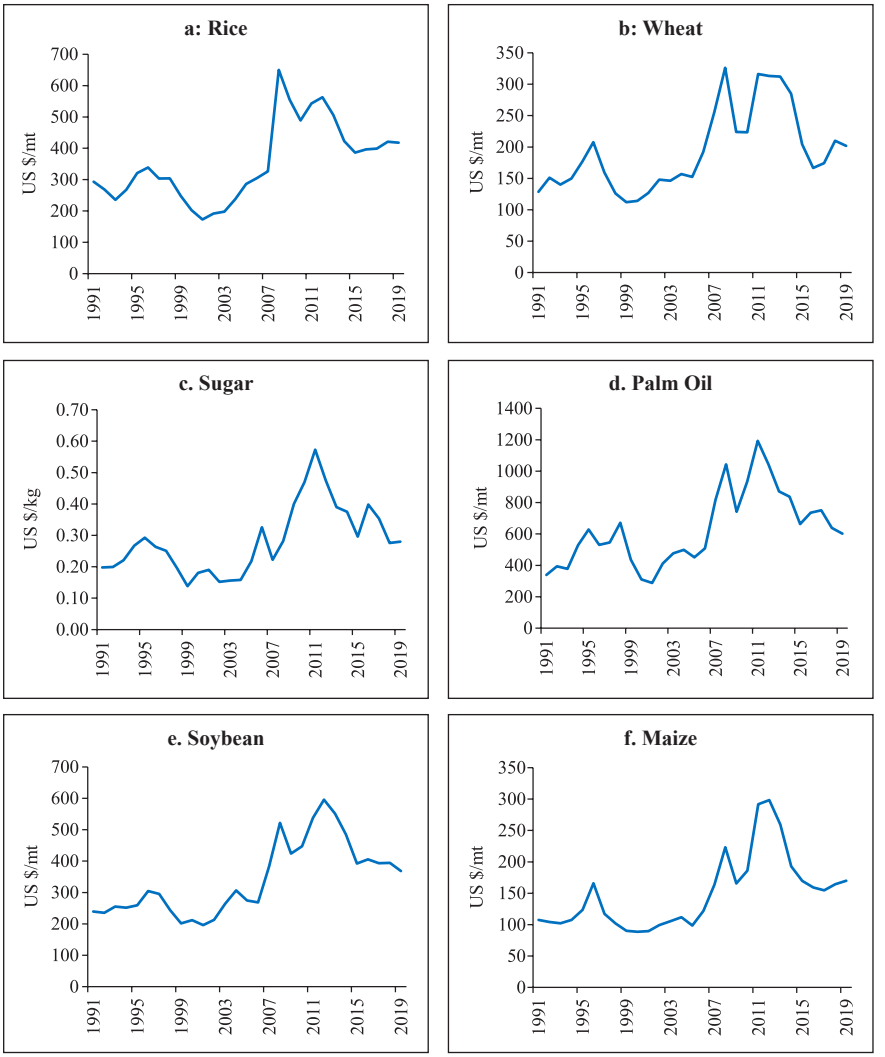
Chart 2: Global Food Prices – Major Components



Source: World Bank Commodity Price Data (The Pink Sheet).

major maize exporting countries and increased demand from the United States (US) to meet mandatory targets of ethanol production (World Bank, 2019). In contrast to cereals, sugar prices remained relatively stable during the first episode, picking up gradually to register a sharp rise in 2011 due to demand pressures emerging out of rising biofuel production (Chart 3c). A similar trend was witnessed for palm oil and soybean (Charts 3d and 3e).

Chart 3: World Prices of Major Food Items



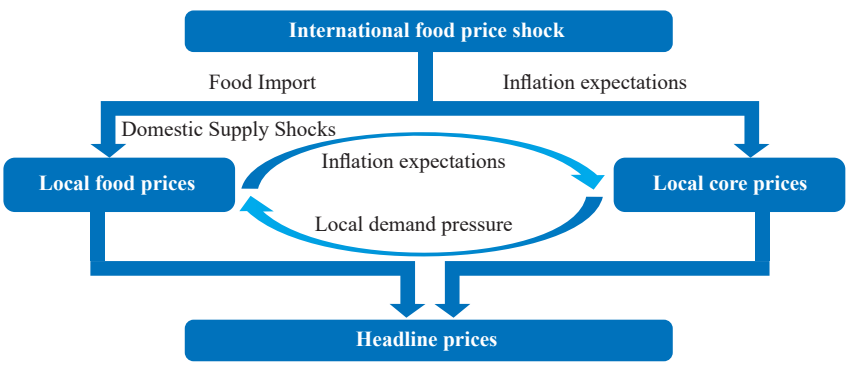
Source: World Bank Commodity Price Data (The Pink Sheet).

III.1 Transmission of Global to Domestic Food Prices

International food prices can get transmitted to domestic prices through different channels. First, and the most direct, is the import channel which operates (a) when economies are either highly dependent on imported food items to meet their domestic demand or (b) in situations of internal supply shocks where economies attempt to contain the price rise through imports. In such situations, the possibility of pass-through from elevated global prices to domestic prices increases. Second, an increase in prices of imported food items encourages import substitution with locally produced goods, thereby adding upward pressure to the local prices of those goods (Jalil and Tamayo Zea, 2011). Furthermore, high global prices incentivise local producers to increase their share of exports in total production to earn higher profits, which in turn pushes domestic prices upwards on the back of internal supply shortages (Chart 4).

While there are various channels through which changes in international prices get transmitted to domestic prices, country-specific factors play an important role in determining the effectiveness and magnitude of these pass-through channels, thereby explaining the differential impact of international food price shocks on different economies. Moreover, the extent of pass-through also varies across countries, depending on the strength of the policy framework and other structural factors (IMF, 2011b). For instance, a country's

Chart 4: International Food Price Shocks to Domestic Prices – Transmission Channels



Source: Reproduced from Jalil and Tamayo Zea, 2011.

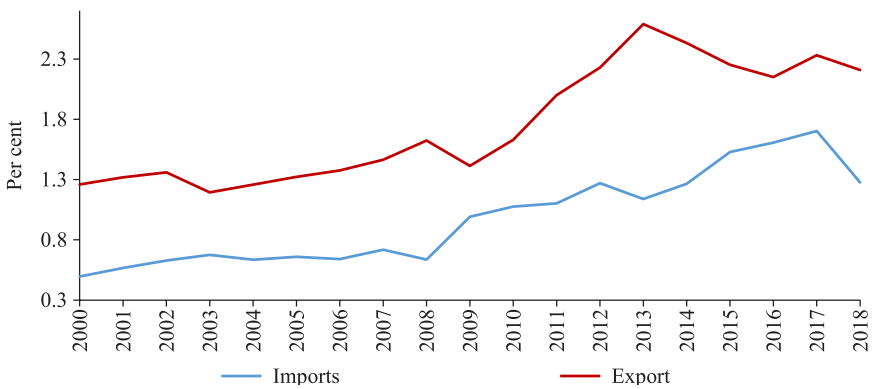
prevailing market structure and design for distribution chains determine the market power of the sellers and their ability to transmit price shocks to the consumers. Other country-specific factors, *viz*. policy interventions, transport facility, transaction cost and exchange rate regime, also determine the magnitude and intensity of the transmission process (Cachia, 2014).

III.2 India's Experience

In the Indian context, the share of food exports in world food exports has remained higher than the share of food imports in world food imports, implying the dominance of the export channel. However, as India's share in world food trade in terms of both exports and imports has remained very low, the pass-through might have been weak (Chart 5).

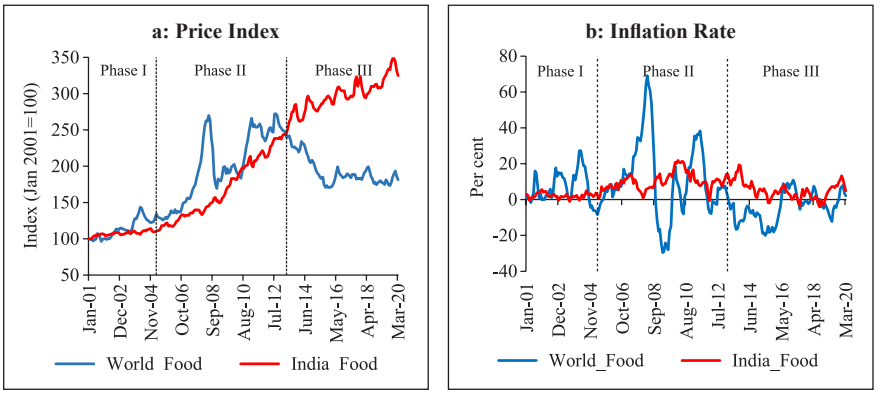
The movement of Indian food prices *versus* global food prices during the last two decades could broadly be classified into three distinct phases. Generally, Indian food prices moved in tandem with international food prices in the first two phases, between 2001 and 2013. In the first phase between 2001 and 2005, while international and domestic prices moved in close sync, they exhibited intermittent divergent movements in the second phase, *i.e*., between 2006 and early 2013 as the rise in world food prices was much sharper than the rise in Indian food prices (Chart 6a). Global food prices spiked sharply twice, *i.e.* in 2007-08 and 2010-11, while Indian food prices registered a steady increase, rising by almost 90 per cent between July 2006 and December 2012

Chart 5: India's Share in World Food Trade



Source: World Trade Organization and authors' estimates.

Chart 6: World vs Indian Food Prices

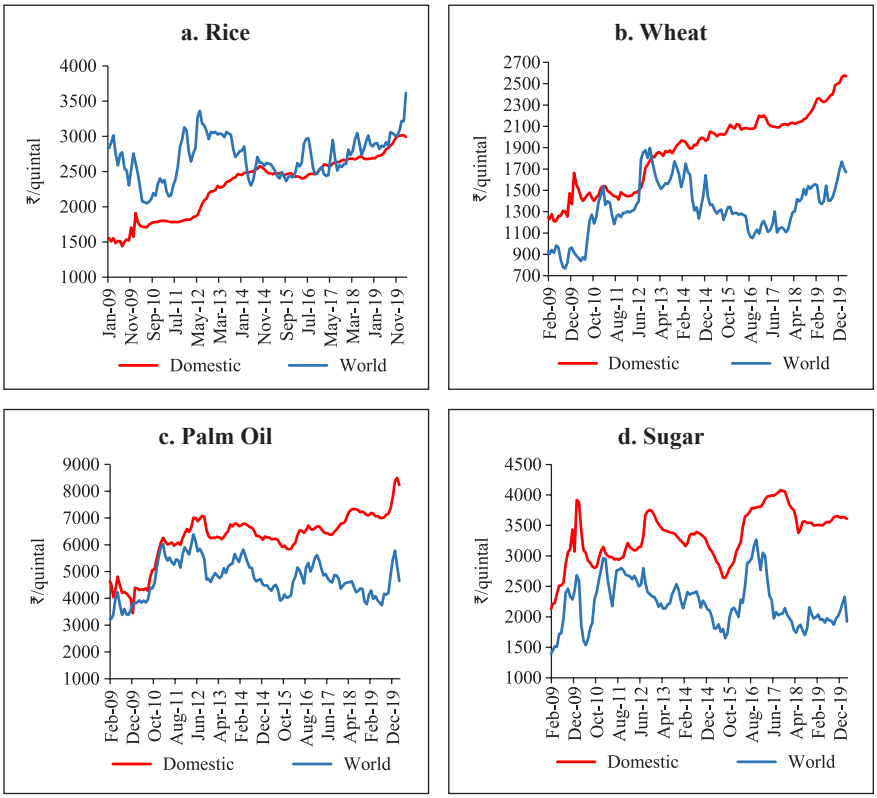


Source: World Bank Commodity Price Data (The Pink Sheet), RBI, and authors' estimates.

– much higher than that in the first phase. Therefore, the upward pressure on Indian food prices that started building up in early 2006 on domestic factors was further accentuated by episodes of global food price shocks. Such shocks in global food prices led to a sharp rise in global food inflation by around 70 per cent in early 2008 and 35 per cent in early 2011 (Chart 6b). Domestic food inflation also picked up during this period, reaching to almost 20 per cent in early 2010 – much higher than the level which prevailed between 2001 and 2005. In the third phase, beginning 2013, however, global and domestic food prices showed signs of divergence as global prices fell sharply on the back of excess supply leading to deflation, while domestic prices remained slightly elevated. Although Indian food prices also moderated during this period, leading to disinflation in Indian food prices, the extent of the decline was not as sharp as in global food prices. During this phase, Indian food prices were supported by an administered price policy and low import content which delinked domestic prices from global prices to some extent.

At the commodity level, significant variations could be found across different commodity prices (Chart 7). Palm oil and sugar prices – both being tradeable goods in world markets – co-moved with international prices. As a net importer of palm oil, India is a price-taker in the world market and thus domestic prices are highly influenced by global prices. In the case of sugar, while Indian prices are highly administered, a certain degree of co-movement in international and domestic sugar prices is visible due to the possibility of

Chart 7: India vs World Food Prices



Source: World Bank Commodity Price Data (The Pink Sheet), Department of Consumer Affairs, Government of India and authors' estimates.

global sugar prices being taken as the benchmark while deciding on domestic sugar prices. However, in the case of rice and wheat, such co-movement could not be traced as the prices of these commodities are highly influenced by domestic factors and the policies of the government at different points of time to limit the fluctuations in their prices, *viz.* public distribution system, minimum support price and interventions through different trade policy instruments.

In sum, while world food prices have decreased since 2012, they continue to remain higher than the levels observed before 2007-08. Also, as mentioned earlier, world food prices showed signs of uptick in last few months of 2019. Moreover, domestic food prices across some major EMEs have also edged

up in recent months on supply-demand imbalances. Therefore, if global food prices continue to rise, they may add upside risks to the domestic food prices, which will in turn pose challenges in containing inflation. Thus, with this background, we examine whether global food prices still have implications for domestic prices of EMEs which have a higher share of food in their overall consumption basket.

Section IV
Methodology

The pass-through effect of global food prices on domestic prices could be drawn from the principle of the Law of One Price (LOP) (Ardeni, 1989; Selliah *et al*., 2015). According to the LOP principle, in efficient markets, assuming there is no transport cost or hindrances to trade, prices for a single homogenous commodity, when expressed in a common currency, are defined as follows[3] (RBI, 2019):

$$P_d = EP_w \tag{1}$$

where,

P_d : domestic food price;

E : exchange rate [unit(s) of domestic currency per unit of foreign currency]; and

P_w: world (foreign) food price.

Equation (1) can be modified to its estimable form after expressing in natural logarithm form as:

$$lnP_{d_t} = \alpha + \beta lnP_{w_t} + \gamma lnE_t + \varepsilon_t \tag{2}$$

In equation (2), lnP_w is assumed to be exogenous as EMEs are usually price-takers. The coefficient β is expressed as the long-term price transmission elasticity when the long-term relationship is empirically established through cointegration test. It may be noted that LOP expressed in equation (1) is in its strict form based on the theory of purchasing power parity (PPP) which states that the exchange rate is proportional to the ratio of price levels in two

[3] The methodology used in this paper is from the authors' earlier work (RBI, 2019).

countries. Equation (2) is an estimable version of equation (1) or a weak form of LOP under the belief that PPP holds in the long run.

Short-term price elasticity is derived from the estimated error correction model (ECM) of the following form:

$$\Delta lnP_{d_t} = \delta + \sum_{i=1}^{k} \rho_i \, \Delta lnP_{d_{t-i}} + \sum_{i=1}^{l} \varphi_i \, \Delta lnP_{w_{t-i}} + \sum_{i=1}^{m} \gamma_i \, \Delta lnE_{t-i} + \theta ECT_{t-1} + \epsilon_t \quad (3)$$

In the above equation, ECT is defined as the error correction term and Δ is the first difference operator. The parameters φ and γ are the short-term transmission elasticities and ρ is the persistence parameter.

Section V
Empirical Findings

To estimate the degree of pass-through from international food prices to domestic food prices, this study uses the data on six EMEs which have higher shares of food products in their respective consumer price indices, *viz.* China, Brazil, India, Sri Lanka, Turkey and Thailand. The estimated model also included the share of each country's food imports (barring Sri Lanka and Thailand) to world merchandise import and share of food exports to world merchandise exports as control variables. Data are sourced from the Food and Agriculture Organization (FAO), CEIC, the Bloomberg database and official websites of individual countries. The monthly data from January 2007 to July 2019 were used for the analysis. Further, in order to make a common base, the data were spliced wherever required. For estimation purposes, all variables were transformed to the natural logarithm.

The descriptive statistics of CPI-food and exchange rates of all six countries (Appendix Tables A.2 and A.3) indicate that the statistical properties of the series were not the same across countries. While volatility in the CPI-food measured by standard deviation was highest for Brazil, it was the lowest for Thailand. The Sri Lankan rupee exhibited the highest volatility, while volatility in the Chinese yuan was the least.

Before estimating the transmission elasticity through the ECM model, the stationarity property of the time series variables was tested by conducting unit root tests. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP)

Table 2: ADF Unit Root Test

Country	ADF (level)		ADF (first difference)	
	CPI Food	Exchange rate	CPI Food	Exchange rate
Brazil	-1.7253	-2.5080	-6.2446	-11.5531
China	-1.7855	-2.5080	-6.1810	-8.73680
India	0.2334	-2.6024	-8.4563	-11.3840
Sri Lanka	-3.8280	-2.1749	-8.9570	-9.61650
Thailand	-1.8469	-2.0644	-9.9883	-10.6706
Turkey	-3.0233	-2.4584	-7.6827	-10.8894
World	-2.9592		-7.4802	

Note*:* ADF statistics are calculated at level and first difference. All differenced series statistics are significant at 5 per cent level.
Source: Authors' estimates.

tests were used to test the stationarity of the series. All variables of interest were found to be stationary in the first difference, *i.e*. I (1) (Tables 2 and 3).

Given that all the variables were I(1), Johansen's cointegration test was performed which confirmed the presence of one cointegrating relationship between the international food prices and domestic food prices of individual countries based on maximum eigen value and trace tests. Subsequently, vector error correction models (VECM), with optimal lag lengths based on Akaike Information Criteria (AIC), were used to examine if any relationship exists in the long run and the short run. The estimated VECM model for each country satisfies the condition that there is no serial correlation in the residuals.

Table 3: PP Unit Root Test

Country	PP (level)		PP (first difference)	
	CPI Food	Exchange rate	CPI Food	Exchange rate
Brazil	-1.0977	-2.6947	-5.9184	-11.6374
China	-1.5034	-1.7892	-6.1488	-8.70770
India	-1.3297	-2.6024	-6.4200	-11.3660
Sri Lanka	-3.7662	-2.3750	-10.213	-9.84850
Thailand	-1.3600	-2.1747	-9.9883	-10.6137
Turkey	-2.2787	-2.5602	-9.9818	-10.8510
World	-2.8891		-7.5344	

Note: PP statistics are calculated at level and first difference. All differenced series statistics are significant at 5 per cent level.
Source: Authors' estimates.

V.1. Food Price Pass-through

The dynamics of food price pass-through were analysed by estimating long-term coefficients and short-term coefficients using the VECM framework. The short-term and long-term coefficients were obtained from the error correction models and cointegration equations, respectively. The estimated error correction term for each country was found to be negative and statistically significant, implying that the system was not explosive and thus ensured long-run equilibrium (Appendix Table A.4). The pass-through coefficient of world food prices was positive and statistically significant for all six countries, *viz.* China, Brazil, India, Sri Lanka, Turkey and Thailand (Table 4). The estimated price transmission elasticities from the VECM confirm the heterogeneity of price transmission across countries but at a lower magnitude. The pass-through coefficient ranged from 0.02 to 0.16 and the largest value 0.16 was found for Turkey. The results of the study are in line with the empirical findings of Selliah *et al.* (2015) and Sivabalasingam (2018).

In the case of India, the short-term price transmission elasticity for food price is 0.07, which implies that a 10 per cent increase in world food prices could lead to an increase of 0.7 per cent in Indian food CPI.

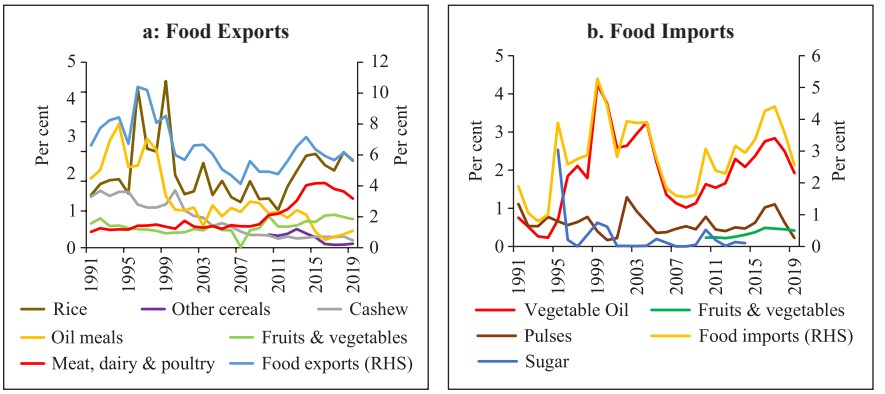
The long-term transmission elasticities were obtained from the estimated cointegrating equations. There was a high degree of heterogeneity in the pass-through of world food prices to domestic food prices. The long-term transmission elasticity of world food price ranged from a low of 0.25 for China to a high of 1.97 for Brazil (Appendix Table A.5).

Table 4: Estimated Pass-through Parameters – World Food Prices

Country	Short Run		Long Run	
	Coefficient	t-Statistics	Coefficient	t-Statistics
Brazil	0.028*	1.612	1.971***	23.44
China	0.024*	1.690	0.247*	1.625
India	0.077***	2.251	0.298**	2.104
Thailand	0.036**	1.784	0.396***	2.039
Sri Lanka	0.127***	2.754	0.426*	1.85
Turkey	0.162***	2.937	1.030***	14.65

Note: ****, ***, ** and * denote 1 per cent, 5 per cent and 10 per cent and 15 per cent level of significance, respectively.
Source: Authors' estimates.

Chart 8: Share of Different Food Items in Total Export and Import in India



Source: Reserve Bank of India and authors' estimates.

The heterogeneity in the degree of pass-through of international food prices to domestic prices could be due to divergences in the import of food items across countries. For example, a muted pass-through for India could be reflective of a very low share of food imports to total imports (Chart 8). The share of import of three major food items, *viz*. vegetable oil, pulses, and fruits and vegetables, was very low at 2.6 per cent of total imports in 2018-19. India's export of major food items was 5.0 per cent of total exports in 2018-19. However, during periods of a very sharp increase in international food prices of more than 20 per cent or so, as witnessed during 2007-08 and 2010-11, the transmission elasticity of 0.07 could lead to an increase in domestic food prices by over 1.0 per cent. This, therefore, signifies the need for examination of the extent of the pass-through from international to domestic prices for it might have serious implications for domestic inflation in EMEs when global prices witness sudden shocks. Such an examination would help these economies to respond with appropriate policies.

Section VI
Concluding Remarks

The main objective of this paper was to examine, in a cross-country context, the following: (i) the degree of pass-through of global food price variations to domestic food prices; and (ii) whether a long-run relationship exists between global food prices and domestic food prices. Using cointegration

tests, the paper found that while there exists a significant degree of global food price transmission to domestic prices in the long-run, such pass-through is relatively weak in the short-run. The short-run price transmission elasticities are of lower magnitude, ranging from 0.02 to 0.16, and differ across countries. The long-run transmission elasticities of world food prices range from 0.25 to 1.97.

As the weight of food is substantial in the CPI baskets of many EMEs, it is crucial that authorities design appropriate policy measures to limit the impact of high and volatile international food prices on domestic markets. Moreover, countries with a high degree of transmission need to shift policy attention towards ensuring food security by increasing food production, investing in agricultural research, facilitating grain trade, and promoting diversification. While the study signifies the importance of monitoring the impact of global food prices on domestic prices at an aggregate level, it may be useful to examine pass-through at the commodity level as well to further explore the cross-country variations in pass-through.

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Appendix

Table A.1: Pass-through of International Food Prices – Empirical Evidence from Select Studies

Author(s) and Year	Period of Study/Data	Objective	Methodology	Key findings
Al-Eyd *et al.* 2012	Monthly data from December 2003 to October 2010	The paper examined the implications of elevated global food prices for inflation in select Central Asian economies – Kazakhstan, the Kyrgyz Republic, Tajikistan, and Uzbekistan – by analysing the drivers of inflation in these countries.	A simple model of inflation was estimated using panel data techniques. The transmission of monetary policy through policy interest rates was examined for which inflation outcomes were simulated under alternative scenarios for global wheat prices for each of the CA-4 using simple AR models.	The major findings of the paper suggested that global food prices have significant short-run effects on headline inflations of domestic economies of Kazakhstan, the Kyrgyz Republic, Tajikistan, and Uzbekistan, where headline inflations, driven by rising international food prices, have been found to be larger than other regions of the world. Moreover, based on a simulation experiment, the results indicated that administrative measures were ineffective in controlling domestic inflation.
Dawe 2008	Monthly data for the period 2003-07	The paper analysed the extent to which domestic food prices in seven large Asian countries have increased since 2003, specifically cereal prices, following an increase in world cereal prices	The paper conducted comparative analysis between international and domestic cereal prices to analyse the extent of pass-through. The core of the analysis was to perform a very	Major findings of the study showed that increase in world cereal prices were accompanied by real depreciation of the US dollar, which in turn neutralised, to some extent, the impact of high world

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Author(s) and Year	Period of Study/Data	Objective	Methodology	Key findings
		from 2003. Furthermore, it examined changes in both consumer and producer prices to see if these groups were affected differently.	basic calculation of cumulative changes in international and domestic prices in real (inflation-adjusted) terms between the fourth quarter of 2003 and the fourth quarter of 2007.	prices for many countries. Additionally, the domestic commodity-specific policies further helped to stabilise domestic prices, especially for rice and wheat, relative to world prices in these Asian countries. Also, no significant difference was found in terms of the impact of world price shock on farmgate prices and consumer prices, thus reflecting that price changes were transmitting rather efficiently between farmers and consumers in the domestic markets of these Asian countries.
Furceria *et al.* 2016	Two data sets were used. The first data set consists of annual data from 1960 to 2012 for 44 countries, including both AEs and EMEs. The second data set consists of monthly data on CPI	The paper analysed the impact of fluctuations in global food prices on domestic inflation of various AEs and EMEs.	To estimate the impact of global food prices on domestic inflation, the study estimated impulse response functions directly from local projections.	The study found that the fluctuations in global food prices played a significant role in driving the domestic inflation of AEs since 1960. This considerable impact, however, declined and became less persistent over time. The study also suggested that

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Author(s) and Year	Period of Study/Data	Objective	Methodology	Key findings
	and food prices for 34 AEs and 50 EMEs for the period 2000-2013.			global food price shocks of 2007-08 and 2010-11 had a bigger impact on EMEs than AEs as the former have a larger share of food in their consumption baskets and relatively less anchored inflation expectations than the latter.
Lee and Park 2013	Panel data for the period 2000-2011 (yearly) for 72 countries.	This paper conducted a comprehensive assessment of the transmission of global food prices and their volatilities to national food prices and their volatilities. It also assessed the effects of the various internal and external factors on domestic food price inflation and volatility.	In order to assess the global transmission of food price inflation and volatilities to individual countries, the study used fixed effects model with inflation and volatility measures as two different dependent variables.	The paper found evidence in support of international transmission of food price inflation and volatility specifically in Asia, where domestic food price inflation is strongly associated with the lagged value of global food price inflation, while volatility spillovers from global to domestic food prices were rather contemporaneous. Also, the paper found that national food price inflation and volatilities were affected by both intra- and extra-regional food price inflation and volatilities, respectively.

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Author(s) and Year	Period of Study/Data	Objective	Methodology	Key findings
Bara hona and Chulaphan 2017	Monthly data from January 1995 to November 2015.	The paper studied the extent and degree to which changes in world prices were transmitted to the consumer prices of different types of consumers in Thailand.	Cointegration between world and domestic food prices was investigated using Engle-Granger's cointegration test.	The study found that world prices were cointegrated with domestic prices and the speeds of adjustment were found to be similar across different consumer price indices, *i.e.* consumer food price indices for average consumers and low-income consumers were found to be equally sensitive to changes in world prices.
Minot 2011	More than 60 price series from 11 African countries for 2007-08.	This paper examined the degree to which variations in world food markets influence the price of staple foods in Sub-Saharan Africa.	The study examined the price trend over 2007-08 and used an error correction model to estimate the degree of price transmission.	Key findings suggested that the food prices in Sub-Saharan African countries rose between 2007 and 2008, ¾ times the proportional increase in world prices. Empirical results indicate that a long-term relationship exists between world prices and 13 out of 62 Sub-Saharan African countries which were examined. Furthermore, policy responses and local factors further exacerbated the impact of the global food crisis in some cases.

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Author(s) and Year	Period of Study/Data	Objective	Methodology	Key findings
Ardeni 1989	Monthly series for seven commodities across four countries, mostly between January 1964 and January 1986.	In this paper, the author tried to refute the assumption of perfect arbitrage of commodity prices and provided empirical evidence to support it. Moreover, the paper proposed an alternative methodology, *i.e.* cointegration to test the long-run relationship between non-stationary series, which allows the testing without imposing any restrictions on short-run dynamics.	A unit root test for non-stationarity and cointegration tests were conducted for a group of commodities for four countries.	The results of the study show quite uniformly that the 'law of one price' doesn't hold as a long-run relationship, and that the deviations from the pattern are permanent.
Rajmal and Mishra 2009	1995-2008	This paper examined the trends in international and domestic food prices and attempted to analyse the nature and extent of transmission from international food prices to domestic food prices in India.	The paper used comparative analysis of international prices vis-à-vis domestic prices to explore evidence on the nature of the pass-through.	The paper found that domestic and international food prices moved in the same direction. Food prices in India, however, remained lower than international prices in terms of absolute levels, percentage variations as well as volatility. The paper also pointed out that food prices in India were predominantly driven by domestic factors, which explained the limited pass-

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Author(s) and Year	Period of Study/Data	Objective	Methodology	Key findings
				through from international food prices to domestic food prices in India during the period under consideration.
Bhattacharya and Sen Gupta 2017	Monthly data from April 1998 to September 2014	This paper analysed the behaviour and determinants of food inflation in India.	The study used the SVAR framework and estimated the models for aggregate food inflation as well as inflation in individual commodities using fuel inflation, agricultural wage inflation and demand for food from the industrial sector as common factors along with global prices for the respective food components.	Major findings of the study indicated that the surge in food inflation in India between 2006 and 2013 was primarily driven by agricultural wage inflation which increased significantly in the post-MGNREGA era. Also, fuel inflation and international prices had a limited role except for tradeable goods. Finally, results suggested significant pass-through effects from food to non-food and to headline inflation.
Selliah *et al*. 2015	Monthly series from 2003 to 2012.	The objective of the study was to assess how the global food price surge affects the domestic inflation process in Sri Lanka.	Parametric and non-parametric econometric techniques were used along with cointegration analysis.	Based on the empirical results, the study confirmed that domestic prices in Sri Lanka were cointegrated with global food prices.

Table A.2: Descriptive Statistics – CPI-Food

	Brazil	China	India	Sri Lanka	Thailand	Turkey	World
Mean	3781.185	104.974	105.996	101.977	4.495	255.141	4.600
Median	3777.240	104.100	107.500	100.899	4.551	231.380	4.546
Maximum	5368.250	115.600	143.400	137.000	4.656	507.120	4.886
Minimum	2184.960	100.200	57.983	68.090	4.165	133.180	4.298
Std. Dev.	1012.816	3.896	27.243	19.691	0.143	95.380	0.149
Skewness	0.115	0.906	-0.290	0.147	-0.832	0.879	0.331
Kurtosis	1.570	3.075	1.659	1.810	2.422	3.052	1.936
Jarque-Bera	13.198	20.683	13.436	8.702	19.533	19.452	9.882
Probability	0.001	0.000	0.001	0.013	0.000	0.000	0.007
Samples	151	151	151	139	151	151	151

Source: Food and Agriculture Organization and authors' estimates.

Table A.3: Descriptive Statistics - Exchange Rates (domestic currency/US$)

	Brazil	China	India	Sri Lanka	Thailand	Turkey
Mean	2.516	6.630	56.052	132.867	32.807	2.449
Median	2.232	6.630	56.385	130.730	32.692	1.875
Maximum	4.053	7.774	74.066	182.900	36.370	6.543
Minimum	1.550	6.056	39.350	107.600	29.265	1.160
Std. Dev.	0.793	0.397	10.055	20.164	1.779	1.268
Skewness	0.570	0.862	-0.120	0.648	0.086	1.376
Kurtosis	1.844	3.605	1.563	2.587	2.038	4.125
Jarque-Bera	16.593	20.992	13.356	10.718	6.004	55.603
Probability	0.000	0.000	0.001	0.005	0.050	0.000
Sample size	151	151	151	139	151	151

Source: Food and Agriculture Organization and authors' estimates.

Table A.4: Estimated Pass-through Parameters (short-run)

Country	Error correction term		World food price		Exchange rate		Import		Export	
	Coefficient	t-Statistics	Coefficient	t-Statistics	Coefficient	t-Statistics	Coefficient	t-Statistics	Coefficient	t-Statistics
Brazil	-0.004***	-4.139	0.028*	1.612	0.030***	2.578	-0.002*	-1.887	0.0007*	1.842
China	-0.008**	-1.932	0.024*	1.690	0.026	1.358	0.000	0.193	-0.009***	-2.09
India	-0.025***	-4.96	0.077***	2.251	0.031	0.753	-0.014***	-3.185	-0.023***	2.75
Thailand	-0.012***	-3.145	0.036**	1.784	0.060*	1.685	-	-	0.006***	2.191
Sri Lanka	-0.0321***	-3.382	0.127***	2.754	0.172*	1.650	-	-	0.085*	1.84
Turkey	-0.075***	-4.718	0.162***	2.937	0.035	0.900	-0.001***	-2.91	0.019***	2.33

Note: ***, ** and * denote 1 per cent, 5 per cent and 10 per cent level of significance, respectively.
Source: Authors' estimates.

Table A.5: Estimated Pass-through Parameters (long-run)

Country	World food price		Exchange rate		Import		Export	
	Coefficient	t-Statistics	Coefficient	t-Statistics	Coefficient	t-Statistics	Coefficient	t-Statistics
Brazil	1.971***	23.44	1.482***	7.380	0.187***	2.409	-0.262***	7.44
China	0.247*	1.625	1.479**	4.534	-0.018***	4.143	0.097***	4.453
India	0.298**	2.104	0.873***	5.432	0.096	1.43	-0.037	0.168
Sri Lanka	0.396***	2.039	0.930***	6.282	-	-	-4.70***	3.47
Thailand	0.426*	1.85	0.633***	2.566	-	-	0.140	0.912
Turkey	1.030***	14.65	0.947***	20.985	-0.006***	4.68	0.076	0.863

Note: ***, ** and * denote 1 per cent, 5 per cent and 10 per cent level of significance, respectively.
Source: Authors' estimates.