Food Prices and Inflation

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Abstract

This paper presents evidence that inflation in India is highly dependent on international food prices and exchange rates. Estimates based on a single equation error correction regression model indicate that high international food prices contributed about 2.5 percentage points of the 3.7 percentage point increase in inflation observed during the global food crisis (2007-2008). Our application is to India, but the findings suggest that global food prices are an important factor for explaining inflation in all countries where food is a major component of consumption, as is the case in most developing countries.

JEL Codes: C22; E31; E41

Keywords: Inflation; Food Prices; India; Error Correction Model

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1. Introduction

In India, as in many developing countries, food purchases make up a substantial portion of household expenditures. Therefore, inflation, and its impact on most households, is largely determined by changes in domestic food prices. In this paper, we use a single-equation error correction model in conjunction with the Johansen (1991) cointegration method to provide evidence of a long-run equilibrium relationship between domestic food prices in India, global food prices, and the rupee-US dollar exchange rate. We find that these international forces have had a large impact on inflation in India in recent years.

According to our regression estimates, a one percent increase in global food prices raises domestic food prices by about one percent, in the long-run. Similarly, a one percent increase in the rupee-US dollar exchange rate increases domestic food prices by just over one percent. In the short-run, if there is ‘disequilibrium’ in the global food market (i.e. if domestic food prices deviate from their equilibrium level as determined by global food prices and the rupee-US dollar exchange rate), then domestic food prices change by eight percent each quarter to correct the disequilibrium. A half-way correction toward the long-run equilibrium occurs in about 1.5 years.

We also find that if there is disequilibrium in the domestic money market, then domestic food prices change by about six percent each quarter to correct the disequilibrium. Further, total inflation changes by about seven percent per quarter when there is disequilibrium in the global food market and by six percent when there is disequilibrium in the domestic money market. However, according to our estimates, inflation does not respond to disequilibrium in the external non-food sector.

Our empirical approach builds off the work of Durevall, Loening, and Birru (2013), but we focus on India rather than Africa. We conclude that inflation in India depends on global food prices, the rupee-US dollar exchange rate, and the money supply, especially in the long-run. While other recent work, such as Lakdawala (2021), has found that monetary policy abroad affects India, we stress the connection between inflation in India and global food prices. For example, our model estimates indicate that about 2.5 percentage points of the observed 3.7 percentage point increase in inflation in India during the global food crisis was the result of high international food prices.

Our application is to India, but the findings suggest that global food prices should be accounted for when studying inflation in any country where food is a major component of consumption, particularly since food prices have been changing rapidly. After growing slowly in the early 2000s, world food prices dramatically increased, hitting a peak in 2008. This period has become known as the global food crisis. Following the onset of the financial crisis, food prices briefly subsided before climbing again in 2010-11. These sudden and large swings mainly affected the poor. The World Bank (2011) has argued that the high food prices increased the number of people living in poverty, decreased the level and quality of nutrition, and decreased consumption of other essential services such as health and education. The culmination of these effects can be disastrous at a personal level, but they also may reduce future economic growth for entire segments of the world’s population.
The rise in global food prices might have been driven by the trends in prices of other commodities, and there are several potential explanations for the general rise in global commodity prices. Hamilton (2009) and Kilian (2009) show that the rapid growth of emerging market economies led to an increase in demand for commodities, contributing to an increase in their prices. Another line of argument centres around the “financialization of commodities”, leading to large investments into commodity markets and higher prices (Tang and Xiong, 2010). Belke, Bordon, and Volz (2013) argue that the increase in global liquidity created by central banks contributed to the rise in commodity prices. More broadly, West and Wong (2014) use factor analysis to understand the movements in commodity prices.

Factors known to impact global food prices specifically include weather, speculation, oil prices, and the increasing use of bio-fuels. All of these probably contributed to the global food crisis; however, the connection between global and local food prices is not always clear. As Durevall, Loening, and Birru (2013) state, “the mechanisms that link world food prices to domestic food prices are not well understood”. Whatever the potential linkages, the fact is that India had persistently high food prices and high overall inflation during the global food crisis.

As measured by the Consumer Price Index (CPI), both food price inflation and total inflation averaged between 3 and 4 percent per year from 2000 to 2005. But they increased to 10.2 and 7 percent, respectively, during 2006-08, and they further increased to 10.6 and 10.4 percent during 2010-12. The manifestation of high food prices despite favourable harvests is puzzling. Past episodes of high inflation often coincided with adverse supply shocks in agricultural production.

There is no general agreement on why India had such high inflation. Explanations for the high food inflation in India include those proposed by Sthanumoorthy (2008), Chand (2010), Mohanty (2010), Kumar, Vashisht, and Kalita, (2010), Gokarn, (2010; 2011), Subbarao (2011), Nair and Eapen (2012), Sonna, Joshi, Sebastian, and Sharma (2014), and Rajan (2014), all of which focus on domestic factors.

However, the increase in international trade makes it likely that global forces play an important role. Bernanke (2007) and Trichet (2008) have emphasized that even the US central bank needs to monitor international price developments and analyse their implications for the domestic economy. Ito and Sato (2008) document the importance of exchange rates for importer, producer, and consumer prices in East Asian countries. Kapur (2013) and Mohanty and John (2015) consider global prices of crude oil. Mallick and Sousa (2013) show that the commodity price shock contributes to higher inflationary pressures in five key emerging economies. Clark and Terry (2010) examine the pass through of global energy prices to core inflation in the US. Monacelli and Sala (2009) find that international common factors explain some of the variation in inflation rates across goods in the US, Germany, France, and the United Kingdom. Our paper also focuses on global forces, particularly exchange rates and world food prices. There exists little evidence

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1 Agricultural and allied activities grew at 5 percent per annum during 2006-08, compared to a 3 percent average from 1996 to 2015.
regarding the importance of global food prices for inflation in India, other than Holtemöller and Mallick (2016).

To help fill this gap, we examine whether the rise in global food prices and the depreciation of the rupee-US dollar exchange rate caused food prices to increase in India. We also investigate whether these global factors led to an increase in aggregate CPI inflation. Specifically, we estimate separate single equation error correction models for food, non-food, and overall consumer price inflation, using a general-to-specific approach and quarterly data from 1996 to 2015. Again, our methodology builds off of Durevall, Loening, and Birru (2013). We first separately measure the deviations from the long run equilibrium in the external food, non-food, and domestic money markets. We also calculate the deviations from trend in the domestic agricultural and non-agricultural markets. We then combine these five long-run deviations with various short-run variables into single equation error correction models (one for each measure of inflation) in order to estimate their effect on inflation in India.

The rest of the article is structured as follows. Section 2 presents data on the evolution of inflation and food prices in India. Section 3 details the estimation of the deviations from the long-run equilibrium relationships (or trends) in the five markets (the external food and non-food markets, and the domestic money, agricultural, and non-agricultural markets). Section 4 presents the estimates for the single equation error correction models, incorporating these deviations, and discusses our main findings. Section 5 concludes.

2. Inflation and Food Prices in India

Table 1: Main Components of the CPI (Industrial Workers) (Base: 2001=100)

<table>
<thead>
<tr>
<th>Components</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Food Total</td>
<td>46.20</td>
</tr>
<tr>
<td>(i) Cereals</td>
<td>13.48</td>
</tr>
<tr>
<td>(ii) Pulses</td>
<td>2.91</td>
</tr>
<tr>
<td>(iii) Oil and fats</td>
<td>3.23</td>
</tr>
<tr>
<td>(iv) Meat, fish, and eggs</td>
<td>3.97</td>
</tr>
<tr>
<td>(v) Milk</td>
<td>7.31</td>
</tr>
<tr>
<td>(vi) Condiments and spices</td>
<td>2.57</td>
</tr>
<tr>
<td>(vii) Vegetables and fruits</td>
<td>6.05</td>
</tr>
<tr>
<td>(viii) Other food</td>
<td>6.68</td>
</tr>
<tr>
<td>b. Pan, supari, tobacco and intoxicants</td>
<td>2.27</td>
</tr>
<tr>
<td>c. Fuel and Light</td>
<td>6.43</td>
</tr>
<tr>
<td>d. Housing</td>
<td>15.27</td>
</tr>
<tr>
<td>e. Clothing, bedding and footwear</td>
<td>6.57</td>
</tr>
<tr>
<td>f. Miscellaneous</td>
<td>23.26</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: The Indian Ministry of Labour and Employment.

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2 Lakdawala and Singh (2019) study other global factors affecting India. Also, see Furceria, Lounganib, Simon, and Wachter (2016) for a paper that examines the relationship between global food prices and inflation across a set of countries.
Table 1 lists the major components of the Consumer Price Index (CPI) for India. Food makes up almost half of the index, with cereals, milk, and fruits and vegetables accounting for over 25 percent. Spending by the typical Indian household clearly depends on food prices. For poorer families, most of their budget goes toward food.

Figure 1 shows that the fluctuations in overall inflation (as measured annually by the CPI) are correlated with changes in food prices in India. The rapid increase in the CPI during 1997-98 followed from the 1997-98 droughts. Subsequently, there were good harvests in 1998-99 and disinflation. The early 2000’s was a period of calm for both food prices and overall inflation. Beginning in 2005, however, food prices and total inflation both began to increase. Inflation went from 3.1 percent in August 2005 to 9.5 percent in May 2006, and as high as 21 percent in December 2009. The price increases were massive, bigger than in any other G-20 country (Karat 2010). A September 20, 2013 article in the Times of India stated, “if you were to ask any random aam admi [common man] anywhere in India what is the single biggest failing of UPA [United Progressive Alliance], the answer would be -price rise. This is so because the most important items of family spending- food items- have relentlessly risen for the past several years despite repeated promises to bring them down by the economic mandarins and policy wonks that run the country”. Throughout our period of study, inflation closely tracks food prices. This fact gives an early indication that food prices play an important role in determining overall inflation in India.

![Figure 1. Annual CPI and Food Inflation in India (%) 1996-2015](image)

**Notes:** The CPI inflation is measured by the annual percentage change in consumer price index (Base:2001=100). Food inflation is measured by the annual percentage change in domestic food consumer price index for Industrial workers. The consumer price index and the food consumer price index for industrial workers come
from the Handbook of Statistics on Indian Economy, 2015-16, Reserve Bank of India. The increase in food prices after 2005 had many harmful consequences. A 2009 United Nations Department of Economic and Social Affairs report suggested that as many as 13.6 million Indians were pushed into poverty, in part due to the high rates of inflation (The Hindu, February 23, 2010). Further, the high food prices may have increased neonatal, infant, and under five mortality rates in India, especially within the more economically deprived states (Fledderjohann, Vellakkal, Khan, Ebrahim, & Stuckler, 2016).

What caused the food price to increase so rapidly? In her February 22, 2010 address to Parliament, India’s President Patil said, “While we were able to avert any threat to our food security, there has been unhappy pressure on the prices of food grains and food products. Higher prices were inevitable given the shortfall in domestic production and prevailing high prices of rice, cereals, and edible oils globally.” India’s food market has become increasingly integrated with the world food market. For instance, the share of agricultural imports as a percentage of agricultural output increased from 1.4 percent in 1996 to over 5 percent in 2012; the share of agricultural output exported also doubled to over 13 percent. As India’s food sector continues to integrate with the rest of the world, local prices will likely depend more on external factors, such as global food prices and exchange rates.

Figure 2. Log of world food price plus exchange rate (wfp+er) and domestic food prices, fp, 1996 to 2015.

Notes: World food price is measured by the world food price index. Domestic food price is measured by the domestic food consumer price index for industrial workers. Exchange rate is measured by the rupee-US dollar exchange rate. Domestic food consumer price index for industrial workers and exchange rate come from the Handbook of Statistics on Indian Economy, 2015-16, Reserve Bank of India. World food price index comes from the World Bank’s Development Prospects Group (WBDPG).
Figure 2 depicts the positive correlation between domestic food prices in India and the world food prices (the product of the world food price index and rupee-US dollar exchange rate). They are very highly correlated (the correlation coefficient equals 0.96). This tells a provocative story in which the inflation rate in India depends on domestic food prices, and domestic food prices are, at least partially, determined globally. The remainder of this paper develops a model of inflation in order to test this hypothesis.

3. Deviations from Long-run Equilibrium and Trends

The single-equation Error Correction Model (ECM) detailed in the next section takes the deviations from long-run equilibrium conditions in several sectors as inputs (or controls) for explaining inflation. We use this approach because we have a small number of observations, and it minimizes the risks associated with a heavily parameterized Vector Autoregression model. We begin by estimating the long-run equilibrium relationships in the relevant sectors. Then, the deviations from the long-run equilibrium relationship (the error correction terms) are included in a short-run model to develop an ECM for each measure of inflation. We estimate a separate ECM for total inflation, inflation in food prices, and inflation in non-food prices. This section provides the details for the long-run equilibrium conditions in each sector and then explains how we estimate the deviations from the long-run relationships.

3.1 Long-run Equilibrium Conditions for the Component Sectors

We consider five sectors:
1. the external food sector,
2. the external non-food sector,
3. the domestic money market,
4. the domestic non-agricultural sector,
5. and the domestic agricultural sector.

In the single-equation ECM detailed below, inflation is determined in part by the deviations from the long-run equilibrium in these five sectors. We explain each sector in turn.

As per the theory of purchasing power parity (PPP), the long run equilibrium relationship in the external food and non-food sectors can be written as

\[ \text{df}_{pt} = e_r + \text{wfp}_{pt} \]  \hspace{1cm} (1)
\[ \text{dnfp}_{pt} = e_r + \text{wnf}_{pt} \]  \hspace{1cm} (2)

where \( \text{df}_{pt} \) is the log of the domestic food price, \( e_r \) is the log of the exchange rate, \( \text{wfp}_{pt} \) is the log of the world food price, \( \text{dnfp}_{pt} \) is the log of the domestic non-food price and \( \text{wnf}_{pt} \) is the log of the world non-
food price level. As food items are traded in the international market, domestic food prices in a small open economy like India depend on world food prices. Further, international food prices might be transmitted to overall consumer prices, as food makes up nearly half of household expenditures (see Table 1). We also assume that the price level for domestic non-food items is determined globally.

We write the long-run equilibrium relationship in the domestic money market as

$$m_t - p_t = \rho_0 + \rho_1 y_t + \rho_2 i_t + \rho_3 p_{t-1} + \rho_4 \Delta_1 e_{t-1} + \rho_5 \text{inf}_{n_t}$$

(3)

where $m_t - p_t$ is the log of the real broad money supply, $y_t$ is the log of real gross domestic product, $i_t$ is the interest rate, $p_{t-1}$ is the percentage change in the price of gold, $\Delta_1 e_{t-1}$ is the percentage change in the exchange rate, and $\text{inf}_{n_t}$ is the rate of inflation. The demand for real money balances depends on the number of transactions (measured by real output) and the opportunity cost of holding money (measured by returns on other assets such as gold, the exchange rate, and the loss of purchasing power due to inflation). The parameters $\rho_0-\rho_5$ are estimated below.

We assume that the domestic agricultural and non-agricultural sectors balance in the long-run. Thus,

$$a_{gt} = a_{gt}$$

(4)

$$non-ag_{t} = non-ag_{t}$$

(5)

where $a_{gt}$ and non-$ag_{t}$ are the log of actual agricultural and non-agricultural production, and $a_{gt}$ and non-$ag_{t}$ are the log of potential agricultural and non-agricultural production. The assumption is that if actual agricultural production is equal to potential output, it does not affect food inflation as demand grows along with production. However, a deviation in domestic agricultural output relative to the trend output (i.e., an adverse agricultural supply shock or a negative domestic agricultural output gap) is assumed to increase food and overall inflation in the short run. Similarly, an increase in the domestic non-agricultural output gap (i.e., a favourable demand shock or a positive non-agricultural output gap) increases food and overall inflation.

### 3.2 Estimates of the Deviations from the Long-Run Equilibrium Relationships

To estimate the deviations from these long-run relationships (Equations 1-5), we use quarterly data from 1996 to 2015, as quarterly data on agricultural and non-agricultural output are available only after 1996. All variables are expressed in logarithmic form except the interest rate, the percentage change in the rupee-US dollar exchange rate, and the percentage change in world gold price. Table A1 in part A of the Online Appendix lists the data sources and variable definitions.

We first test for stationarity in the above-mentioned variables using the Augmented Dickey Fuller (ADF) unit root test. All the variables, except $a_{gt}$ and non-$ag_{t}$, are non-stationary in levels but are stationary
in their first difference (see Appendix Table A2). Then, we estimate the long-run equilibrium relationship in the external food, non-food, and domestic monetary sectors (Equations 1-3) using the Johansen (1991) cointegration method. To do so, we formulate an unrestricted VAR with an intercept and three centered quarterly seasonal dummies to determine the optimum lag length for the cointegration test. Centered seasonal dummies are used to account for any deterministic seasonality, as the data are quarterly. We also estimate the trend (or potential) agricultural (agp) and non-agricultural (non-agp) output (Equations 4 and 5) using the Hodrick-Prescott filter method.

After estimating the cointegrating (long-run equilibrium) relationships, we obtain the deviations (i.e. equilibrium error) in the markets from Equations 1 - 3 by subtracting the equilibrium values of dfp, dnfp, and m-p from their actual values. The deviations (error correction terms) for the external food (ECextfood), non-food (ECextnon-food), and domestic monetary (ECmoney) sectors are calculated quarterly as (suppressing the time subscripts) ECextfood = dfp - \lambda_0 - \lambda_1er - \lambda_2dwfp; ECextnon-food = dnfp - \mu_0 - \mu_1ert - \mu_2wnfp; and ECmoney = m-p - \rho_0 - \rho_1yt - \rho_2i - \rho_3goldp - \rho_4\Delta12er - \rho_5infn. Similarly, after estimating trend agricultural (agp) and non-agricultural (non-agp) output, we obtain their deviations by subtracting their actual values. In other words, the deviations for agricultural (i.e. devag) and non-agricultural (devnonag) sectors are calculated as devag = ag - agp and devnonag = nonag - nonagp. The remainder of this section provides the specifics for estimating the deviations from the long-run relationships in the five sectors, with further details collected in Section C of the Online Appendix.

### 3.2.1 The External Food Sector

A preliminary understanding of the relationship between the world food price measured in rupees (the product wfp and er) and the domestic food price (dfp) can be inferred from the relative food price (the ratio). If there a long-run equilibrium relationship between global and domestic food prices exists, then the relative price should revert to its mean level after a shock (assuming food prices are stationary). In Figure C1 in Appendix C, the relative food price appears to be stationary even though the fluctuations around the mean are large, particularly from 2006 to 2010.

Relatedly, we find strong evidence of one cointegrating vector between dfp, er, and wfp, as we cannot reject the null hypothesis of one cointegrating relationship (i.e. r=1). The long run estimates for dfp are reported in Table C1 in Appendix C. The coefficients for both wfp and er have positive signs. The dfp, on average, increases by 0.99 and 1.16 percent due to 1 percent increase in wfp and er, respectively.\(^3\)

The error correction term (ECextfood), representing the deviations in dfp, for food sector is ECextfood = dfp - 1.16er - 0.99dwfp + 3.64, calculated quarterly. Figure C2 in Appendix C plots the deviations and provides evidence that the linear combination of dfp, er, and dwfp is stationary.

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\(^3\) As the long run coefficients are close to one (0.99 and 1.16), we examine whether the PPP holds for the food prices. To this end, we test whether the coefficients of world food price and exchange rate both be equal to 1. The likelihood ratio statistic for imposing -1 and -1 for the word food price and the exchange rate on the cointegrating vector is insignificant. The \(\chi^2\) statistic with 2 degrees of freedom is found to be 0.65 with 0.72 p-values. This provides evidence in favour of the validity of PPP for the domestic food prices during the sample period.
3.2.2 The External Non-Food Sector

The relative price of non-food items (the ratio of the log of the world non-food price to the domestic non-food price (dnfp), both measured in rupees) appears to be non-stationary (see Figure C3 in Appendix C). Thus, we assume that the trend relative non-food price equals the long-run equilibrium non-food price. In similar settings, the trend values of variables have been used to proxy for equilibrium values when cointegration is not present (for example, see Durevall, Loening, and Birru, 2013). Therefore, we estimate the deviations from the equilibrium relative non-food price using the Hodrick-Prescott filter method. The deviations in the external non-food sector (the difference between the actual non-food relative price and the equilibrium/trend) appear to be stationary (see Figure C4 in Appendix C).

3.2.3 The Domestic Monetary Sector

We find evidence of one cointegrating vector (i.e. r=1) in the domestic monetary sector. Table C2 in Appendix C reports the long-run estimation results. As one might expect, the demand for real balances is positively related to GDP, the percentage change in the gold price, and inflation and negatively related to interest rates and changes in the exchange rate. Our estimated long-run income elasticity for money demand is about 1.3 percent and the interest rate elasticity equals -0.21, at the mean interest rate of 8.16. These results are comparable to those of Rao and Singh (2006), who find an income elasticity equal to 1.2 percent and an interest rate elasticity of -0.18. Our estimated elasticities for gold price inflation, the exchange rate, and inflation are 0.03, -0.03, and 0.08, respectively.

The error correction term (ECmoney) representing the deviations in the domestic money market is $EC_{\text{money}} = (m-p) - 1.31y + 0.03i - 0.002\text{gold} + 0.007er - 0.012infr$, calculated quarterly. The deviations appear to be stationary; see Figure C5 in Appendix C.

3.2.4 The Domestic Non-Agricultural and Agricultural Sectors

We used the Hodrick-Prescott filter to estimate trend agricultural (agp) and non-agricultural (nonagp) output, and then, based on Equations 4 and 5, we estimate the deviations in the agricultural (devagl) and non-agricultural (devnonagl) sectors. Overall, inflation and the non-agricultural output gap (devnonag) are positively related (see Figure C6 in Appendix C). There was also a sustained increase in the non-agricultural output gap during 2006q3 and 2011q1. This increase might have contributed to the rise in inflation during 2006-2010. In contrast, the agricultural output gap and inflation are generally negatively

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4 Relatedly, the Johansen method indicates that there is no co-integrating relationship between dnfp, wnfp, and er.
5 See Lakdawala and Sengupta (2021) on the topic of measuring monetary policy shocks and transmission in India.
6 Non-agricultural output is the value of real GDP from activities such as mining and quarrying, manufacturing, electricity, gas, water supply and other utilities, construction, trade, hotels, transport, communication, finance, insurance, real estate and business services, and community and social services. Agricultural output is the value of real GDP from agriculture and allied activities.
related (see Figure C7 in Appendix C). We next consider these deviations, along with those from the other sectors, as potential controls in a series of single equation ECMs for inflation.

4. Single-Equation Error Correction Models for Inflation

This section presents the main estimation results for our three models of inflation dynamics (for food, non-food, and overall CPI inflation). The relationships of interest are represented in single-equation error correction models (ECM). The ECM approach allows us to consider different sources of inflation, and many studies have used this methodology. See Kinda (2013), Durevall, Loening, Birru (2013), Durevall and Njuguna (2001) and Juselius (1992), for example. The approach is very general; it embeds several specific models of inflation; and it also allows us to consider the circumstances (e.g. deviations from long-run equilibrium conditions) particular to India. Our central finding is that the error correction term from the external food sector has a significant impact on domestic inflation.

4.1 The General Error Correction Model

The deviations from the long-run relationships (estimated for the five sectors and based on Equations 1-5 in Section 3), along with the first differences of the variables used in Equations 1-3, are all considered for inclusion in the 3 separate single-equation error correction models (all based on Equation 6). In addition, we consider a few other factors specific to India that might have affected inflation: the minimum support price for rice and wheat, the implementation of Mahatma Gandhi National Rural Employment Guarantee Scheme, and the fiscal deficit. Global factors such as world energy prices and world fertilizer prices could also affect inflation in India, and we consider these factors, too. Note, however, that we follow a general-to-specific modelling approach. So, the exact specification of the ECM is allowed to differ across the three inflation measures, as we explain below. The general single-equation ECM for inflation is

\[ \Delta p_t = \alpha + \beta_1 (EC_{ext\text{food}})_{t-1} + \beta_2 (EC_{ext\text{non-food}})_{t-1} + \beta_3 (EC_{money})_{t-1} + \beta_4 \text{devag}_{t-1} + \beta_5 \text{devnon-ag}_{t-1} + \sum_{i=0}^{k-1} \Delta x_{t-i} y_{1i} + \sum_{i=0}^{q} D_{t-i} y_{2i} + u_t \] (6)

where, \( \Delta \) is the first difference operator. The variable \( \Delta p_t \) is the first difference of the logarithm of the inflation measure (food, non-food, or overall CPI inflation) in quarter \( t \). The variables \( EC_{ext\text{food}}_{t-1}, \)
\( EC_{ext\text{non-food}}_{t-1}, \) and \( EC_{money} \) are estimates of the deviations (error corrections lagged one period) in the external food, non-food, and domestic money markets, and \( \text{devag}_{t-1} \) and \( \text{devnon-ag}_{t-1} \) are the agricultural and non-agricultural output gaps (lagged one period). The vector \( \Delta x_{t-i} \) includes the lags of the first

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7 The Mahatma Gandhi employment program guarantees at least 100 days of employment per year to each rural household if its adult members are willing to do unskilled manual work at a fixed minimum wage rate. It was first implemented in 200 districts in 2006 and then extended to an additional 130 districts in 2007. The remaining 285 districts gained coverage in 2008. The program may have increased the demand for food (Rakshit 2011).
differences of the control variables: the rupee-US dollar exchange rate depreciation \((er)\), global food inflation \((wfp)\), non-food inflation \((wnfp)\), domestic money supply \((m-p)\), real GDP \((y)\), the interest rate \((i)\), the annual percentage change in the rupee-US dollar exchange rate \((\Delta_{12}er)\), gold price inflation \((goldp)\), past inflation \((\Delta p)\), world energy price inflation \((wenergy)\), world fertilizer price inflation \((wferti)\), the minimum support price \((msp)\) for rice and wheat, and the fiscal deficit \((fd)\). Vector \(D_t\) contains a set of seasonal dummies, and a dummy \((MGNREGS)\) to capture implementation of the Mahatma Gandhi employment scheme. We also include impulse dummies, as detailed below (so \(q\) varies across models). Appendix A further describes the variables and lists the data sources. The model includes 3 lags of the differenced variables \((k=4)\). However, the contemporaneous values of variables which are potentially endogenous such as \(er, m-p, i, \Delta_{12}er,\) and \(inf\) are not included to avoid simultaneity bias. All other variables are treated as exogenous and enter the equation in contemporaneous and lagged form. We estimate the model via ordinary Least Squares (OLS). Appendix B contains additional details on how we moved from the general regressions to the specific.

Equation (6) includes both short-run and long-run determinants of inflation. The three error correction terms capture how the long-run deviations in the food (Equation 1), non-food (Equation 2), and money (Equation 3) markets affect inflation. The coefficients \(\beta_1, \beta_2,\) and \(\beta_3\) measure the strength of the adjustment to the deviations. The short-run is captured by the agricultural and non-agricultural output gaps (Equations 4 and 5), the first differences of all the variables included in Equations (1)-(3), and the India specific variables (such as \(msp, MGNREGS,\) and \(fd\)) and the global factors such as \(wenergy\) and \(wferti\) discussed above.

We primarily focus on the deviations in the external food sector (Equation 1) and the impact on inflation due to foreign food prices (and the exchange rate). If foreign food prices and the rupee-US dollar exchange rate affect domestic CPI, then we expect the coefficient on the external food sector deviation \(\beta_1\) to be negative (and statistically significant). Further, if foreign food prices and the rupee-US dollar exchange rate help to determine domestic food prices, then the coefficient on the external food sector deviation, \(\beta_1\) in the modified Equation 6 for food inflation, should be negative (and significant). Finally, if CPI inflation is primarily due to food inflation, then the magnitude of \(\beta_1\) in the overall CPI inflation equation should be close to the \(\beta_1\) in the food inflation equation. Next, we show that our estimates largely correspond with these expectations, indicating that foreign food prices play a large role in determining domestic inflation in India.

4.2 Estimates of the Single Equation Inflation Models

As mentioned, we employ a general-to-specific modelling procedure to find parsimonious representations of inflation (single equation ECMs) based on Equation 6. Appendix B gives more details on the process of moving from the general model to the specific. Table 2 reports the estimated coefficients for the resulting models, and we discuss the final model specifications and findings for each measure of inflation below.
Table 2: Parsimonious Inflation Models for India

<table>
<thead>
<tr>
<th></th>
<th>Model 1: Food</th>
<th>Model 2: Non-food</th>
<th>Model 3: CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC (External food sector)_{t-1}</td>
<td>$\beta_1$</td>
<td>-0.082*** (0.0818)</td>
<td>---</td>
</tr>
<tr>
<td>EC-(External non-food sector)_{t-1}</td>
<td>$\beta_2$</td>
<td>--</td>
<td>-0.073*** (0.0293)</td>
</tr>
<tr>
<td>EC (Domestic monetary sector)_{t-1}</td>
<td>$\beta_3$</td>
<td>0.056** (0.0278)</td>
<td>0.039*** (0.0146)</td>
</tr>
<tr>
<td>Non-agricultural output gap_{t-1}</td>
<td>$\beta_4$</td>
<td>0.266 (0.1601)</td>
<td>0.097 (0.0641)</td>
</tr>
<tr>
<td>Agricultural output gap_{t-1}</td>
<td>$\beta_5$</td>
<td>-0.068 (0.0701)</td>
<td>-0.014 (0.0281)</td>
</tr>
<tr>
<td>Lagged world non-food inflation</td>
<td>$\Delta w_{nf, t-1}$</td>
<td>-0.266*** (0.0571)</td>
<td></td>
</tr>
<tr>
<td>Lagged world non-food inflation</td>
<td>$\Delta w_{nf, t-3}$</td>
<td>-0.0266*** (0.0571)</td>
<td></td>
</tr>
<tr>
<td>World food inflation</td>
<td>$\Delta w_{fp, t}$</td>
<td>0.0544* (0.0292)</td>
<td></td>
</tr>
<tr>
<td>Lagged annual percentage change in Rupee-US dollar exchange rate</td>
<td>$\Delta \Delta \text{12er}_{t-1}$</td>
<td>-0.00007* (0.0004)</td>
<td></td>
</tr>
<tr>
<td>Lagged annual percentage change in Rupee-US dollar exchange rate</td>
<td>$\Delta \Delta \text{12er}_{t-3}$</td>
<td>0.0004** (0.0002)</td>
<td></td>
</tr>
<tr>
<td>Lagged world gold price inflation</td>
<td>$\Delta g_{goldp, t-1}$</td>
<td>0.0004* (0.0002)</td>
<td>0.0004** (0.0001)</td>
</tr>
<tr>
<td>Lagged annual percentage change in Rupee-US dollar exchange rate</td>
<td>$\Delta \Delta \text{12er}_{t-2}$</td>
<td>0.131*** (0.0488)</td>
<td></td>
</tr>
<tr>
<td>Domestic non-food inflation</td>
<td>$\Delta \text{dnfp, t-2}$</td>
<td>0.615*** (0.0911)</td>
<td></td>
</tr>
<tr>
<td>World energy inflation</td>
<td>$\Delta w_{energy, t}$</td>
<td>-0.019** (0.0074)</td>
<td>-0.037*** (0.0137)</td>
</tr>
<tr>
<td>Lagged world energy inflation</td>
<td>$\Delta w_{energy, t-1}$</td>
<td>0.025*** (0.0075)</td>
<td>0.056*** (0.0206)</td>
</tr>
<tr>
<td>SC1</td>
<td>$\beta_{SC1}$</td>
<td>-0.032*** (0.0053)</td>
<td>-0.001 (0.0024)</td>
</tr>
<tr>
<td>SC2</td>
<td>$\beta_{SC2}$</td>
<td>-0.002 (0.0052)</td>
<td>-0.005** (0.0023)</td>
</tr>
<tr>
<td>SC3</td>
<td>$\beta_{SC3}$</td>
<td>0.011** (0.0052)</td>
<td>0.009*** (0.0030)</td>
</tr>
<tr>
<td>Constant</td>
<td>$\beta_0$</td>
<td>0.367** (0.1803)</td>
<td>0.258*** (0.0947)</td>
</tr>
</tbody>
</table>

Notes: The dependent variable for each of the three models is listed in row 1. The table reports the coefficient estimates from the specific inflation models based on Equation 6. The error correction terms and output gaps are based on Equations 1-5. Values in parentheses are standard errors and ***, **, and * denote significance at the 1, 5, and 10% level.

Before discussing each specific model, we have collected a set of model diagnostic tests in Table 3. Across, the three models, we note the high R2 values (ranging from 0.65 to 0.76) despite the relatively low number of explanatory variables. The F-statistic, which measures the joint significance of all the controls, is also relatively high, especially for the food and non-food inflation models. The remaining diagnostic statistics show that the specifications pass the usual battery of tests (serial correlation, functional form, heteroscedasticity, and normality).
Table 3: Model Diagnostic Tests

<table>
<thead>
<tr>
<th></th>
<th>Model 1: Food</th>
<th>Model 2: Non-food</th>
<th>Model 3: CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Square=</td>
<td>0.70</td>
<td>0.76</td>
<td>0.65</td>
</tr>
<tr>
<td>F Statistic=</td>
<td>F(11, 62)=13.70 [0.00]</td>
<td>F(15, 56)=12.03 [0.00]</td>
<td>F(14, 59)=8.00 [0.00]</td>
</tr>
<tr>
<td>Serial Correlation=</td>
<td>F(4, 58)=0.98 [0.42]</td>
<td>F(4, 52)=1.13 [0.35]</td>
<td>F(4, 55)=0.33 [0.86]</td>
</tr>
<tr>
<td>Functional Form=</td>
<td>F(1, 61)=0.17 [0.67]</td>
<td>F(1, 55)=19.60 [0.00]</td>
<td>F(1, 55)=0.05 [0.82]</td>
</tr>
<tr>
<td>Normality=</td>
<td>$\chi^2(2)=3.95 [0.13]$</td>
<td>$\chi^2(2)=1.36 [0.50]$</td>
<td>$\chi^2(2)=1.19 [0.55]$</td>
</tr>
<tr>
<td>Heteroscedasticity=</td>
<td>F(1, 72)=0.39 [0.53]</td>
<td>F(1, 71)=2.37 [0.12]</td>
<td>F(1, 72)=2.49 [0.12]</td>
</tr>
</tbody>
</table>

Notes: Serial correlation test is the LaGrange multiplier test of residual serial correlation using four lags. Functional form is the Ramsey’s RESET test using the square of the fitted values. Normality is based on a test of skewness and kurtosis of the residuals. Heteroscedasticity is based on the regression of squared residuals on squared fitted values.

4.2.1 Food Inflation

The specific model for food inflation ($\Delta p$=first difference of log dfp) includes a constant, three centered seasonal dummy variables, domestic money market and external food sector error correction terms, and agricultural and non-agricultural output gaps lagged one period.\(^8\) The variables in first differences are the rupee-US dollar exchange rate, the world food price, the real money supply, real GDP, the interest rate, the percent change in the rupee-US dollar exchange rate, the gold price, the domestic food price, the non-food price, the world energy price, the world fertilizer price, the annual percentage change in average minimum support price of rice and wheat, and the central government fiscal deficit. The contemporaneous values of the rupee-US dollar exchange rate, real money supply, interest rate, and the percent change in the rupee dollar exchange rate are not included to avoid simultaneity bias. We also include a dummy variable to capture the impact of the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). The MGNREGS dummy equals 0 prior to 2006 and 1 after 2006.

There was a sharp fall in food prices in 1999q1. We include a dummy variable that takes the value of 1 for 1999q1 and 0 otherwise. The specific model (Model 1) is reported in Table 2 and diagnostic test statistics of the model are reported in column 1 of Table 3.

The plot of the Cumulative Sum of Squares (CUSUM) and Cumulative Sum of Squares (CUMSUMSQ) of our food inflation specification against the critical bound of the 5% level of significance show that the specification is stable over time, as there is no evidence of a structural break (see Figure 3 and 5).\(^9\) The recursive estimates of the key coefficients of interest (the error correction terms from the money market and the external food market, the non-agricultural output gap, and the constant) compared against the critical bound of the 5% level of significance show that the parameter estimates are also remarkably stable over time (see Figure 5).

\(^8\) We do not report the general models for the sake of brevity.  
\(^9\) The CUSUM and CUSUM statistics are based on the one step ahead prediction errors, i.e., the differences between $\Delta$dfp and its predicted value based on the parameters estimated at time $t$-1.
Figure 3: CUSUM Test for Food Inflation (model 1)

Figure 4: CUSUMSQ Test for Food Inflation (model 1)
The estimated coefficient for the external food sector error correction term ($\beta_1 = -0.082$) is negative and highly statistically significant ($t = -4.38$). This result suggests that the domestic food price is very dependent on global food prices. On average, dfp increases by 0.99 percent due to 1 percent increase in wfp in the long-run. The exchange rate is equally important; a 1 percent increase in er increases dfp by 1.16 percent in the long-run. When the actual domestic food price deviates from the equilibrium food price, which is determined by the rupee-US dollar exchange rate and global food prices, the domestic food price responds to the deviation. Our estimates imply that 8% of the disequilibrium is corrected each quarter by changes in domestic food prices. In other words, it takes about 1.5 years for changes in domestic food prices to halve the disequilibrium.

Our model indicates that about 3 percentage points of the increase in food inflation observed during the global food crisis was the result of the high international food prices. We arrive at this estimate by multiplying the coefficient on the external food sector error term (-0.0818) by the change in the deviation (-0.3662) during the global food crisis.
The estimated coefficient on the money market error correction term ($\beta_3$) is positive and statistically significant ($t=2.00$). The estimate suggests that when there is disequilibrium in the domestic monetary sector, about 6% of the disequilibrium is corrected every quarter by changes in food prices. In other words, it takes about 2 years to halve the disequilibrium in the money market through changes in the food market. This finding suggests that the domestic food price helps to close the gap between actual and equilibrium real balances (as determined by the fundamentals in the money market).

The non-agricultural output gap also affects domestic food prices. A 10% increase in the non-agricultural output gap (i.e. actual agricultural output is 10% above trend) leads to an increase in food price inflation of about 2.7% a quarter later. This estimate is consistent with the idea that an increase in non-agricultural activities above trend leads to an increase in income and an increased demand for food items (i.e. food is a normal good), which, in turn, increases food prices.

Interestingly, the agricultural output gap does not have a significant effect on food price inflation. This non-relationship might be because the government quickly acts to stabilize food price inflation in response to supply shocks. When an adverse supply shock occurs (potentially turning the agricultural output gap negative), the Indian government has often taken several measures, such as export restrictions, import relaxations, and releasing food items from its buffer stock. These measures might stabilize domestic food inflation, reducing the correlation between the agricultural output gap and food inflation.

The other variables that enter the short-run part of the model are the contemporaneous value of world food inflation, the percentage change in the rupee-US dollar exchange rate, and gold price inflation lagged one period. World food inflation and gold price inflation have positive signs and the percentage change in rupee-US dollar exchange rate has a negative sign. However, the magnitudes of the latter two are small. World energy price inflation does not enter the model, possibly because energy related inputs used in agricultural production are often subsidized. Similarly, world fertilizer prices do not affect food inflation significantly, and fertilizer prices in India are also subsidized. The sign on the seasonal dummy variables suggests that, on average, food inflation is the lowest during the first quarter (January-March) and the highest during the third quarter (July-September).

The minimum support price does not appear as a significant variable in the food inflation regression. Possibly, this is because the support price and world food prices are related; the Commission for Agricultural Costs and Prices, which recommends the support price, takes the international prices of rice and wheat into account (see Acharya et al (2012) for more on this relationship). Other domestic factors such as the fiscal deficit and MGNREGS also do not appear to affect food inflation significantly. This does not mean that they are unimportant. These factors might have affected food inflation indirectly.

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10 Alternatively, we have used the difference between actual and trend rainfall lagged one, two, and three periods in place of the agricultural output gap. None of the lagged coefficients are statistically significant.
11 The price of diesel, for example, was subsidized for most of our study period, as it was deregulated in October 2014.
12 In 2015-16, the government of India budgeted about 0.5 percent of GDP for fertilizer subsidies. Nearly 70 percent of this amount was allocated to urea, the most commonly used fertilizer. It is the largest subsidy after food.
13 The annual average growth rate in the minimum support price (of both paddy common rice and wheat) increased by 20% during 2007-2010.
by increasing the non-agricultural output gap. Lagged food inflation is also not statistically significant, implying that there exists little inertia in food inflation.

Overall, we conclude that world food prices, the domestic excess money supply, and the exchange rate are primary drivers of domestic food prices in the long run. The non-agricultural and agricultural output gaps played little role in determining food prices in India during the study period. We stress the importance of the global factors. In particular, world food prices have had a large impact on domestic food prices. This dependence of the domestic food prices in India on global factors has been underappreciated by researchers and policymakers, alike. Moreover, as we show below, changes in global food prices are transmitted to economy-wide domestic price levels.

4.2.2 Non-Food Inflation

The specific model for non-food inflation \( (\Delta p = \text{first difference of log dnfp}) \) includes a constant, three centered seasonal dummy variables, the domestic money market and external non-food sector error correction terms, and the agricultural and non-agricultural output gaps lagged one period. The variables in first differences are the rupee-US dollar exchange rate, the world non-food price, the real money supply, real GDP, the interest rate, the percentage change in the rupee-US dollar exchange rate, the gold price, the domestic food price, the domestic non-food price, the world energy price, and the central government fiscal deficit. The contemporaneous values of the rupee-US dollar exchange rate, the real money supply, the interest rate, and the percentage change in the rupee-dollar exchange rate are not included to avoid simultaneity bias.

There are outliers in 1999q1 and 2009q4 in which there was a sharp fall in non-food prices. So, we include two dummy variables for these sharp changes. Column 2 of Table 2 (Model 2) reports the estimated coefficients and the diagnostic test statistics are reported in column 2 of Table 3, which indicates that the model is well specified.

The estimated coefficient for the external non-food sector error correction term \( (\beta_2 = -0.073) \) is negative and statistically significant \( (t=-2.47) \). This estimate implies that a disequilibrium in the external non-food sector is corrected by 7 percent each quarter. The error correction term for the money market is positive and significant \( (t=2.66) \). This estimate implies that 4 percent of a disequilibrium is corrected every quarter.

The short-run effects (i.e. lagged changes in the rupee-US dollar exchange rate, domestic food inflation, non-food inflation, and lagged world energy inflation) affect domestic non-food inflation positively. The impact of lagged food inflation on non-food inflation suggests that food prices put pressure on prices and wages in non-food sectors via higher food inflation expectations. The positive coefficient \( (0.62) \) on lagged domestic non-food inflation captures the persistence in non-food prices. Lagged world non-food inflation also affects domestic non-food inflation, but it is difficult to interpret, as the estimated coefficient is negative.
4.2.3 CPI Inflation

The final model for CPI inflation ($\Delta p =$ first difference of log CPI) includes the domestic money market, external food, and external non-food error correction terms, and the agricultural and non-agricultural output gaps lagged one period. It also includes lagged CPI inflation, but not lagged food and non-food inflation. The contemporaneous values of the rupee-US dollar exchange rate, the real money supply, the interest rate, the percent change in the rupee-dollar exchange rate, and inflation are not included to avoid simultaneity bias. Column 3 in Table 2 summarizes the estimated model (Model 3) and the diagnostic test statistics are in column 3 of Table 3, which indicate that the model is well specified.

The estimated coefficient for the external food sector error correction term ($\beta_1 = -0.068$) is negative and highly statistically significant ($t = -5.25$). This implies that when the actual food price deviates from the equilibrium food price (there is disequilibrium), the CPI responds to the deviation. For example, on average, about 7 percent of a disequilibrium in the external food sector is corrected each quarter. Our model indicates that about 2.5 percentage points of the increase in CPI inflation observed during the global food crisis was the result of high international food prices. We arrive at this estimate by multiplying the coefficient on the external food sector error term (-0.0678) by the change in the deviation occurring during the global food crisis (-0.3662).

The coefficient on the external non-food sector error correction term is negative (as one might expect) although not highly statistically significant. This implies that CPI inflation in India is also, partly, determined by global food prices and the rupee-US dollar exchange rate in the long-run. Further, the magnitude of the coefficient on the food sector error correcting term in the CPI inflation model (-0.068) is close to the magnitude of the coefficient in the food model (-0.082), suggesting that in India CPI inflation is closely related to food inflation.

The coefficient on the money market error correction term is positive and significant. According to this estimate, when a disequilibrium exists in the domestic monetary sector, about 6 percent of the disequilibrium is corrected by changes in CPI inflation one quarter later. The non-agricultural output gap also affects domestic prices in the short-run. A 10 percent increase in the non-agricultural output gap (i.e. agricultural output 10 percent above trend) leads to an increase in CPI inflation of 3 percent. This finding is consistent with the notion that an increase in non-agricultural activities above trend increases wages, which, in turn, leads to an increase in CPI inflation.\footnote{We have alternatively included the real GDP gap lagged one period instead of $ag_{t-1}$ and non-$ag_{t-1}$ in the food, non-food, and overall inflation equations. The GDP gap is not statistically significant in any of the three. The GDP gap coefficients (and corresponding $t$-statistics) are $0.033 (0.229)$, $0.011 (0.181)$, and $0.073 (0.672)$, respectively. We calculated the GDP gap using the same method as for the agricultural and non-agricultural output gaps.}

The other variables that enter the short-run part of the model are the contemporaneous value of world food inflation, lagged world gold price inflation, and contemporaneous and lagged world energy inflation. The world energy inflation affects CPI inflation positively. Lagged world non-food inflation and the lagged percentage change in the exchange rate also affect CPI inflation, but the signs are negative, which we find difficult to explain. The signs of the seasonal dummy variables suggest that, on average, CPI
inflation is lowest during the first quarter (January-March) and the highest during in the third quarter (July-September). So, again, the third quarter is the highest inflationary period.

As with the other inflation measures, the CUSUM and CUSUMSQ plots for the CPI model suggest model stability over time. The recursive estimates for the coefficients on the money market and external food market error correction terms and the non-agricultural output gap (the key coefficients) and the constant are also remarkably stable over time. There is no evidence of structural breaks.\(^{15}\)

As a robustness check, we also have estimated the models for food and non-food inflation excluding the impulse dummy variables and instead using heteroscedastic and autocorrelation consistent (HAC) standard errors. The results remain largely unchanged.

We end this section by again considering how high global food prices can be transmitted to domestic food prices and overall inflation. First, the world food price could be transmitted through arbitrage. In 2006-08, the increase in relative food price (see figure C1 in appendix) increased competitiveness of domestic food items. As a result, the net export of food from India increased, which might have created a domestic shortage and contributed to the increase in overall food prices despite a favourable harvest.\(^{16}\) Second, domestic food prices might have increased due to the rise in imports of select food items. India is heavily dependent on the foreign market for some products such as pulses and edible oils. The net imports of these items (and wheat) increased significantly during 2006-08, which might have been passed on to the consumers by increasing retail prices.\(^{17}\) Third, the world food price might have transmitted to the domestic food price through the minimum support price of rice and wheat. The Commission for Agricultural Costs and Prices recommends the minimum support price based on various factors, including international prices of rice and wheat\(^{18}\). Acharya et al. (2012) show that the minimum support price for rice and wheat are highly correlated with international prices.

Global food prices can affect domestic inflation in at least two ways. First, food accounts for a significant share of household expenditures. In India, cereals and other globally traded agricultural commodities make up a large component of food consumption. Therefore, global food prices impact overall CPI directly through domestic food prices. Second, global food prices might affect overall domestic CPI indirectly through non-food prices. Persistent domestic food inflation can spill over to wages, which can then affect the prices for non-food items. Our empirical estimates provide evidence in favour of both

\(^{15}\) The figures are not shown here for brevity, but they are available on request.

\(^{16}\) The net export of rice and sugar increased from 4.1 and 1 million tonnes in 2005-06 to 6.4 and 5.8 million tonnes in 2007-08. The net export of spices also increased from 0.29 million tonnes in 2005-06 to 0.55 tonnes in 2008-09. Rice production for the first time exceeded 90 million tonnes continually from 2005-06 to 2008-09 (while the government’s procurement was closer to the minimum norm of 39 million tonnes).

\(^{17}\) The net imports of edible oils and pulses increased from 4.1 and 1.24 million tonnes in 2005-06 to 7.6 and 3.3 million tonnes in 2009-10, respectively. The net export of sugar was reduced from 5.8 million tonnes in 2007-08 to 3.68 million tonnes in 2009-10.

\(^{18}\) The annual average growth rate of minimum support price (of both paddy common rice and wheat) increased by 20% during 2007-2010.
these channels, demonstrating that domestic inflation in India has been shaped by global factors, particularly international food prices.

5. Conclusions

In this paper, we show empirically that global food prices have a large impact on domestic food prices in India. The results are based on the Johansen (1991) cointegration method in conjunction with a single equation error correction model.

Our estimates indicate that a one percent increase in the global food price leads to an increase in domestic food prices by about one percent, in the long-run. Similarly, a one percent increase in the rupee-US dollar exchange rate leads to an increase in domestic food prices by just over one percent. In the short-run, if there is ‘disequilibrium’ in the global food market, domestic food prices change by about eight percent each quarter to correct the disequilibrium. If there is disequilibrium in the domestic money market, the domestic food price changes by about six percent each quarter to correct the disequilibrium. Further, our CPI single-equation error correction model indicates that total inflation in India changes by about seven percent per quarter when there is disequilibrium in the global food market and by six percent when there is disequilibrium in the domestic money market. Inflation does not respond to disequilibrium in the external non-food sector.

Our model estimates indicate that about 3 and 2.5 percentage points of the observed increases in food and CPI inflation during the global food crisis were the result of the high international food prices. Besides these main findings, the non-agricultural output gap, world food inflation, and seasonal factors also affect food and overall CPI inflation in the short-run. Both food and overall CPI inflation are found to be the lowest during the first quarter (January-March) and highest during the third quarter (July-September). Global energy inflation also drives CPI inflation, but not food inflation, in the short-run. Overall, our findings strongly suggest that the dynamics of overall CPI inflation in India closely follow food prices.

Our results highlight the importance of global food prices and exchange rates. These global factors should be included in the analysis of inflation in places where food is a major component of household expenditures, especially when food prices change rapidly. Although we did not consider specific policies, our findings should be of interest to policy makers. In an ever-more connected world, we have shown that global forces can have a dramatic impact on inflation, and especially on food prices. Sudden spikes in food prices can have disastrous consequences for some of the world’s most vulnerable populations. Future research should be aimed at understanding how to design monetary, exchange rate, trade, and other policies taking the relationship between local and global food prices into account.
References


