Understanding Food Inflation in India

Sen Gupta, Abhijit and Bhattacharya, Rudrani and Rao, Narhari

National Institute for Public Finance and Policy, Asian Development Bank

May 2014

Understanding Food Inflation in India*

Rudrani Bhattacharya† Narhari Rao‡ Abhijit Sen Gupta§

Abstract

Persistently high food inflation has been one of the major concerns facing India over the last few years. With nearly a quarter of the population living below the poverty line, the persistence of food inflation at high levels is extremely undesirable. In this paper, we analyse the behaviour and determinants of food inflation over the recent past. We introduce structural breaks to identify the different phases of food inflation during the last three decades, and evaluate the persistence of food and core inflation across these phases. There is increase in persistence in food inflation over the periods implying it has become more persistent, and any positive shock will have a longer impact on it. Various components of food inflation including cereals, pulses, fruits, vegetables, meat and fish, have been significant contributors to food inflation at different points in time, indicating a broad nature of the problem. In analysing the key drivers of food inflation, we find limited role of international prices, with the co-movements between domestic and international prices being lower for cereals and dairy products, and higher for tradables like edible oils and meat. Using household consumer expenditure data we empirically estimate aggregate demand for key food products, and find demand has consistently outstripped supply in the case of cereals, pulses, meat and fish, and the extent of mismatch has widened in recent years. The rise in food prices is also a reaction of the rise in price of various inputs, including price of fuel and agricultural wages. We also find certain policy decisions such as large increases in minimum support prices have been associated with much higher increase in wholesale prices of these commodities in the corresponding period. Finally, we find significant evidence of transmission of food inflation to non-food inflation and aggregate inflation.

JEL Classification: E31; E37 and Q11

Keywords: Food Inflation, Engel Curves, QUAIDS Model, SVEC Model, FEVD Analysis

---

* This paper was originally published as ADB South Asia Working Paper No. 26.

† Assistant Professor, National Institute of Public Finance and Policy, New Delhi (Email:rudrani@nipfp.org.in)

‡ Deputy Country Director, India Resident Mission, Asian Development Bank, New Delhi (Email: nrao@adb.org)

§ Senior Economics Officer, India Resident Mission, Asian Development Bank, New Delhi (Email: asengupta@adb.org)

I. INTRODUCTION

Persistently high inflation rate has been a major concern facing India over the last few years. Since 2008, the Wholesale Price Index (WPI) based inflation has averaged 7.5% while Consumer Price Index (CPI) inflation was around 9.9% for industrial workers and 10.3% for agricultural workers.

According to IMF (2012), India's CPI inflation between 2008 and 2012 was the second highest in Developing Asia, behind only Vietnam. The high inflation rates witnessed since 2008 come in the backdrop of a long period of price stability. During 1997-98 to 2007-08, the monthly inflation rate, based on the WPI was less than 5%. Between April 1997 and March 2008, the monthly WPI inflation rate breached the 8% mark on only three occasions, or 2.1% of the entire period. In contrast, since April 2008, the 8% mark has been violated on 27 occasions or nearly half of the period.

A major distressing feature of the recent episode of high inflation is the sharp increase in food prices. Food inflation entered double digits in April 2009 and crossed the 20% level in December 2009. While it has moderated over the last couple of years, it still continues to remain high. Considering that almost 22% of the population continue to live below the poverty line the persistence of food inflation at high levels is extremely undesirable in a country like India. This section already spends a large proportion of their income on food and would be unable to divert additional expenditure on food to neutralize the effect of food inflation. Thus, persistent food inflation would aggravate food and nutrition deficiency in India, which, according to Deaton and Dreze (2009) already is at a very high level.

In this paper, we analyse the behavior and determinants of food inflation over the recent past. Since 2008 food inflation has persistently been higher than non-food inflation leading to an increase in the relative price of food. This is in contrast with the earlier period when the relative price of food witnessed much greater fluctuation. Moreover, various components of food inflation including cereals, pulses, fruits, vegetables, meat and fish, have been significant contributors to food inflation at different points in time, thereby indicating a broad nature of the problem. The degree of persistence of food as well as non-food inflation has increased in the post 2008 period implying that the factors influencing food and non-food inflation are getting more entrenched. Thus any shock to inflation takes a much longer time to die down.

In analyzing the key drivers of food inflation, we find limited role of international prices, although the influence varies a great deal across commodities. The extent of co-movement between domestic and international prices tends to be lower for cereals and dairy products, and higher for tradeables like edible oils and meat. Moreover, periods of low international prices are associated with higher correlation between domestic and international prices, indicating less pass-through during periods of high international prices.

Rising demand for certain products has been cited as a major driver of food inflation. Using household consumer expenditure data we find support for both Engel's Law, which argues that food expenditures are an increasing function of income, but food budget shares decrease with income, as well as Bennet's law whereby starchy staples in the food basket are displaced by protein-rich foods (Fuglie (2004)). To evaluate the role of demand supply mismatch in explaining food inflation, we estimate aggregate demand using household consumption expenditure data and data on seed, feed and wastage. For cereals, supply has persistently lagged demand, and the gap has widened in years of drought. Similarly, in case of pulses, meat and fish the demand has consistently outstripped supply. In the case of milk, demand outpaced supply in the late

2000s. Interestingly, in case of fruits and vegetables, the supply has been higher than the demand. However, these products are subject to large scale wastage, which reduces the amount available for final consumption. At the same time, the supply response has been inadequate with the yield of major food products has stagnating due to inefficient investment in technology and agriculture infrastructure.

The rise in food prices is also a reaction of the rise in price of various inputs. The price of fuel, a key input in agriculture, has risen in the past few years. Our empirical analysis indicates that a 1% rise in fuel inflation will lead to a 0.13% rise in food inflation with the effect slowly declining through the next 12 months. Similarly, production of oilseeds, a major input for oilcakes, which is used as livestock feed, has fluctuated considerably leading to a sharp increase in price of oilcakes. The introduction of the Nutrition Based Subsidy scheme in 2010 resulted in a shift from fixed-price floating-subsidy' regime to fixed-subsidy floating price' regime, leading to a sharp increase in some fertilizer prices. Finally, rapid increases in agricultural wages have also contributed to rising prices. While until 2007, wages grew in line with CPI inflation, since then the rise in rural wages have exceeded the inflation rate. Moreover, within rural wages, agricultural wages have risen at a faster pace than non-agricultural wages with all agricultural occupations witnessing a structural break in the growth rate of wages around 2009 and 2010.

We evaluate the role of policies in exacerbating food inflation. The large hikes in minimum support prices since 2007 have been associated with much higher increase in wholesale prices in the corresponding period. Furthermore, India adopted an expansionary fiscal stance prior to the advent of the global financial crisis in 2008, and followed it up with additional measures after the crisis impacted India. Most of these measures were aimed at boosting consumption rather than investment, and thereby exacerbated demand supply mismatch. The tightening of monetary policy also had limited impact in restraining aggregate demand as it lagged the rise in inflation, leading to real interest rate remaining negative through most of this period.

Finally, we find evidence of transmission of food inflation to non-food and aggregate inflation. A rise in food inflation has an instantaneous impact on non-food inflation and raises aggregate inflation after two months, with the both the impacts being quite persistent. The empirical analysis also shows that after a month more than half of variation in non-food inflation is due to variation in food inflation where as food inflation contributes nearly half of the variation in aggregate inflation. While the variation in non-food inflation cause d by food inflation decreases slightly after almost a year, the variation in aggregate inflation caused by food inflation rises considerably.

In the remaining paper, Section 2 focuses on the trend and structure of the food inflation in India in recent years. In Section 3, we evaluate the various factors that have contributed to food inflation. These range from rising demand supply mismatches to rise in price of inputs to government policies. Section 4 evaluates the extent to which food prices have influenced non-food prices. Finally, Section 5 concludes with the main takeaways of the paper.

II. FOOD INFLATION: TREND AND STRUCTURE

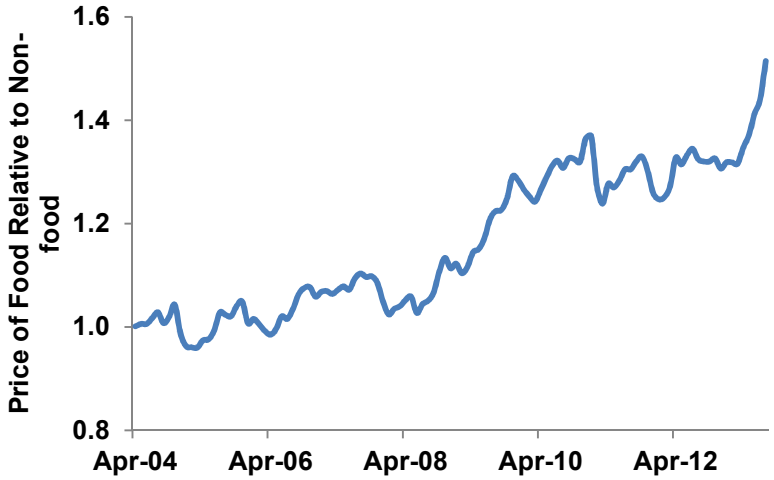
In India, inflation is calculated using two broad indices based on consumer and wholesale prices. While, the WPI is based on the average selling prices received by domestic producers and retailers of goods, the CPI measures average prices from the consumer's perspective. Sellers' and retailers' prices can differ from consumers' prices due to factors such as taxes, subsidies, and distribution costs. The WPI is the most commonly used price index and the weights are revised every decade. Apart from the WPI, there are four different consumer price

indices, which correspond to different segments of the population - industrial workers (CPI-IW), agricultural labourers (CPI-AL), rural labourers (CPI-RL) and urban non-manual employees (CPI-UNME). Since 2011, a countrywide measure of CPI has become available. A major difference between the various CPIs and the WPI is the weight accorded to food articles, which tends to be much higher in the former, and hence the CPIs capture more accurately the recent surge in food prices. However, the CPIs are much less disaggregated than the WPI, which contains nearly 700 items. Moreover, historically comparable data on the CPIs do not exist and it is primarily the WPI that is used to guide policy.

Furthermore, while local factors tend to play an important role in influencing the prices of various commodities, there has been a great deal of co-movement in the prices of a particular commodity across various zones. Table A1 highlights the zone wise correlation between the prices of key agricultural products between 2009 and 2012. In more than 84% of the cases the correlation coefficient is in excess of 0.75 indicating high degree of co-movement. Thus it seems that apart from local factors there are structural factors common to the whole country that is driving the increase in food prices, thereby justifying the use of national prices in our analysis.

Food inflation witnessed a sharp increase between April 2005 and April 2007, reaching a peak of 14.7%. The increase in non-food inflation was much more modest, with a peak of 6.7%. Subsequently, both food and non-food inflation witnessed some moderation till the end of 2007. However, from January 2008 onwards food and non-food inflation experienced disparate movements.

Figure 1: Relative Price of Food



Source: Office of the Economic Advisor, Ministry of Commerce, and Authors' Estimates

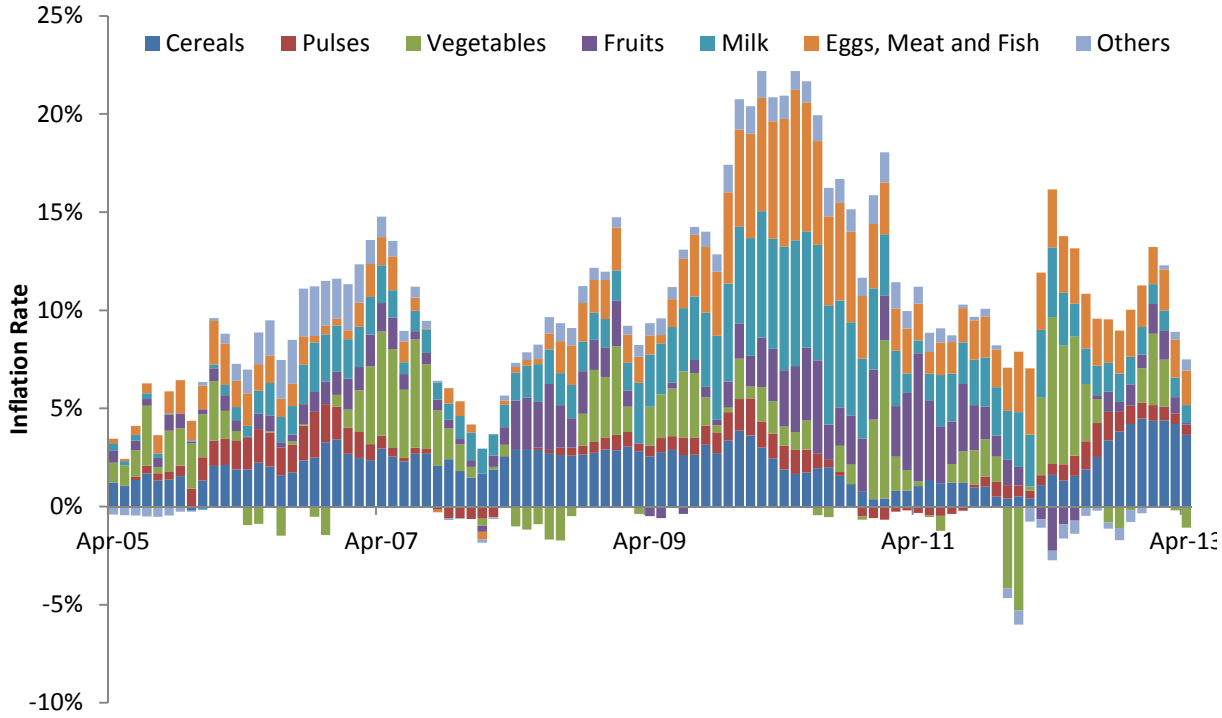
While there was again a sharp increase in prices of food, with the food inflation breaching the 20% mark in December 2009, non-food inflation continued to remain relatively benign. This resulted in a sharp spike in the relative price of food vis-à-vis non-food (Figure 1). The relative price of food is computed as the ratio of the WPI component for food products and articles to an index of non-food prices computed from WPI data. Food inflation dropped below the 20% level only in July 2010, and though has moderated since then, it still continues to hover around 10%.

Figure 2 identifies the key drivers of food inflation. While the initial surge in food inflation since January 2008 was driven by cereals and fruits, vegetables added to the inflationary pressures

since October 2008. The subsequent surge in food inflation from May 2009 was driven mainly by a rise in the prices of protein rich commodities such as eggs, meat, fish and milk.

Next, we evaluate the persistence of food inflation in recent years and compare it with both historical levels and non-food inflation. We estimate a simple auto-regressive process involving monthly data, where food and non-food inflation are regressed on their lags. The optimal lag length is selected by using the Schwarz Bayesian Information Criterion (SBIC). The results are reported in Table 1. The sum of the auto-regressive coefficients is a commonly used measure of persistence. For historical comparison, we look at the data since 1990. We also divide the sample into three periods – April 1990 to March 1996, when inflation was high, April 1997 to March 2008, when inflation experienced great degree of moderation and April 2008 to September 2012, when there was a resurgence of inflationary pressures.

Figure 2: Decomposition of Food Inflation



Source: Office of the Economic Advisor and Authors' Estimates

Next, we evaluate the persistence of food inflation in recent years and compare it with both historical levels and non-food inflation. We estimate a simple auto-regressive process involving monthly data, where food and non-food inflation are regressed on their lags. The optimal lag length is selected by using the Schwarz Bayesian Information Criterion (SBIC). The results are reported in Table 1. The sum of the auto-regressive coefficients is a commonly used measure of persistence. For historical comparison, we look at the data since 1990. We also divide the sample into three periods – April 1990 to March 1996, when inflation was high, April 1997 to March 2008, when inflation experienced great degree of moderation and April 2008 to September 2012, when there was a resurgence of inflationary pressures.

The sum of auto-regressive coefficients shows that for the entire sample, food inflation has exhibited less persistence than non-food inflation with the sum of auto-regressive coefficient taking a lower value for food inflation. The sub-sample analysis indicates that this result mainly

holds in the post-1997 period. Moreover, there has been a sharp increase in the persistence of both food and non-food inflation in the most recent period, indicating the factors influencing food and non-food inflation are getting increasingly entrenched. The rise in persistence implies that any positive shock to inflation will continue to have an impact for a much longer time.

Table 1: Persistence of Food and Non Food

	Food Inflation				Non Food Inflation			
	Apr-90 to Sep-12	Apr-90 to Mar-96	Apr-97 to Mar-08	Apr-08 to Sep-12	Apr-90 to Sep-12	Apr-90 to Mar-96	Apr-97 to Mar-08	Apr-08 to Sep-12
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 month lag	1.095***	1.059***	1.042***	1.196***	1.139***	1.059***	1.112***	1.286***
	[16.644]	[10.440]	[10.223]	[8.207]	[9.723]	[7.219]	[12.167]	[7.516]
2 month lag	-0.365***	-0.195**	-0.382***	-0.569***	-0.068*	-0.050*	-0.023*	-0.253*
	[-4.027]	[-1.961]	[-2.685]	[-3.232]	[-1.699]	[-1.899]	[1.911]	[-1.962]
3 month lag	0.279***	0.176**	0.255**	0.554***	0.052*	0.044*	0.080*	0.159*
	[3.208]	[1.982]	[1.968]	[2.786]	[1.734]	[1.710]	[1.887]	[1.769]
4 month lag	-0.092*	-0.115**	-0.051*	-0.232*	-0.168***	-0.152**	-0.279***	-0.230**
	[-1.605]	[-1.814]	[-1.682]	[-1.893]	[-3.436]	[-2.160]	[-3.449]	[-2.093]
No. of Observations	266	69	139	50	266	69	139	50
R-squared	0.852	0.879	0.766	0.789	0.953	0.863	0.947	0.96
Sum of Autoregressive Coefficients'	0.917	0.925	0.864	0.949	0.955	0.901	0.89	0.962

Note: Robust standard errors in parenthesis. ***, ** and * indicate significance at 1%, 5% and 10% level.
Source: Authors' estimates

III. FACTORS AFFECTING FOOD INFLATION

In this section we evaluate the major factors influencing food inflation since the mid-2000s. We focus on the impact of international prices, factors that have exacerbated the demand supply mismatch, importance of rise in prices of key inputs as well as impact of policies.

A. International Prices and Trade Policy

Changes in international prices of food articles exert a direct and indirect influence on domestic food prices both through international trade as well as through adjustment in domestic policies. The link with international prices becomes important in the backdrop of sharp increase in international prices of food commodities in 2008, and again in 2010. Developments in international markets have an important implication for domestic prices as the share of

agriculture trade to agriculture GDP has increased steadily from 5% in 1990-91 to over 18% in 2011-12. The surge in global prices in 2007 and 2008 resulted in exports turning out to be much more lucrative than domestic sales. This is evident from the fact that the share of exports in agriculture production increased from 6.2% during 2003-04 to 2005-06 to more than 10% during 2006-07 to 2008-09 (Chand (2010)).

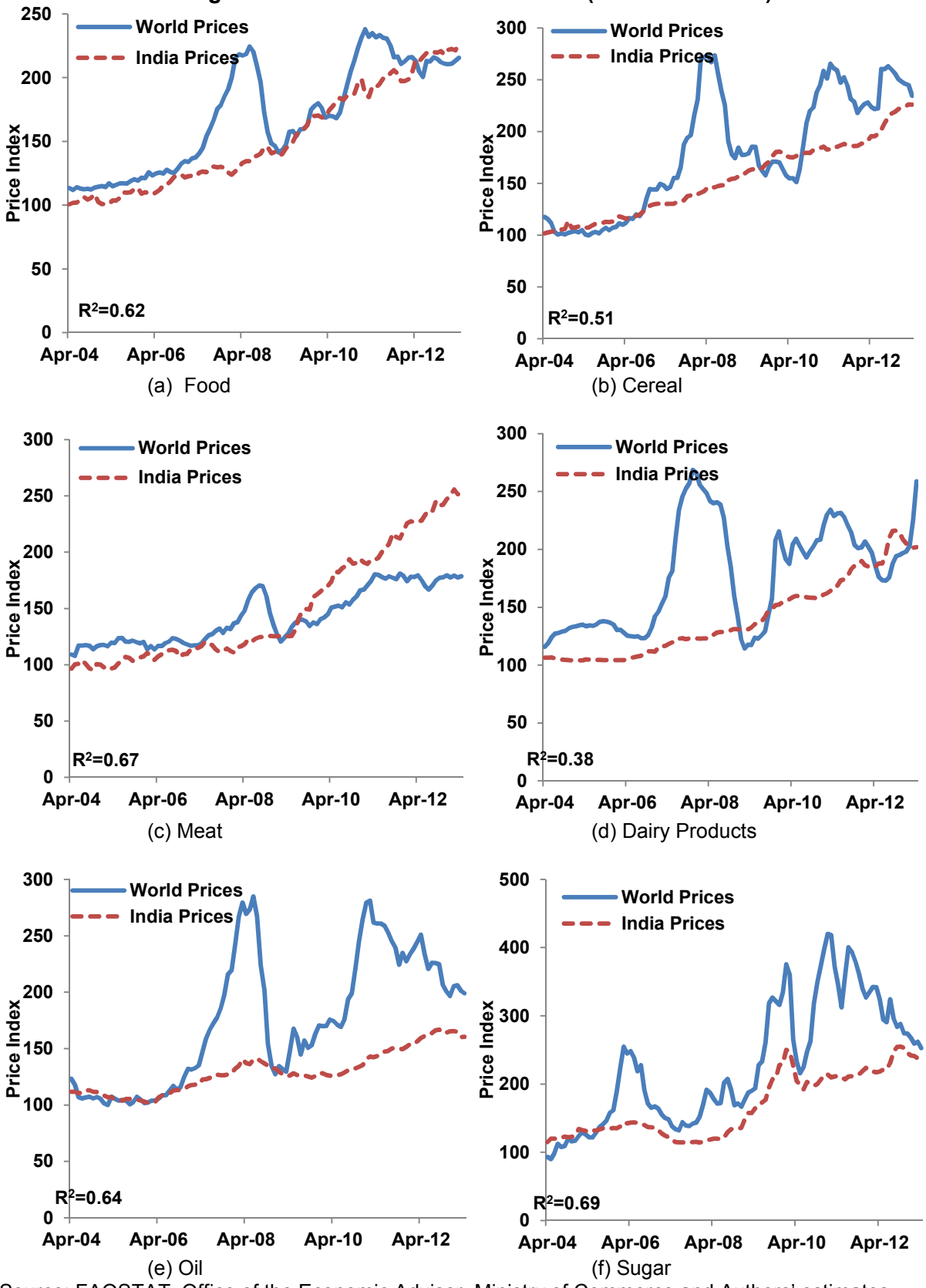
Using annual data for 1995-96 to 2012-13, Gulati et al. (2013b) find that 1% rise in global food prices is associated with 0.3% increase in domestic food prices. Similarly, in the case of wheat prices, Dasgupta et al. (2011) find that global prices exert a significant positive influence on domestic prices. However, this influence varies greatly across commodities. In our analysis data on global food prices, since April 2004, are sourced from the Food and Agricultural Organization (FAO) database. Apart from a composite food price index, data is available for the different subcomponents including meat, dairy, oils and fat, cereals and sugar. We construct a comparable dataset for Indian prices based on the Wholesale Price Index and its components.

Figure 3 shows that at the aggregate level there is a moderate correlation between domestic and international food price inflation. However, there is a great deal of variation at the commodity-level. Typically, the co-movement between domestic and international prices tends to be lower for staples like cereals as well as dairy products. This could be driven by government's reluctance to allow any significant pass through from international to domestic prices in the case of cereals, and low degree of tradability for dairy products. Higher degree of co-movement is observed in more tradable products like edible oils and meat.

We also find that periods of low international prices are associated with higher correlation between domestic and international prices, indicating less pass-through during periods of high international prices. In particular, for all commodities, barring sugar, the degree of co-movement is higher when international prices are below the median compared to when they are above the median value. The low degree of correlation between domestic and international prices during periods of high international prices could be an outcome of the agriculture trade policy adopted. As pointed in Gulati et al. (2013a), India has adopted a cautious approach towards agricultural trade permitting exports only after ensuring that it would not have adverse impact on domestic prices. In the case of cereals, India has emerged a large exporter of rice while in case of wheat, India has been an occasional exporter as well as importer depending upon the domestic demand-supply situation. The rise in international prices of rice and wheat in 2007 prompted the government to impose an export ban on common rice and wheat, which continued till 2011. India is a large importer of pulse, and since 2006, imports are permitted at zero duty. However, exports of pulses are prohibited, except for some specific pulses. The import duty on crude and refined edible oil has been brought down to zero and 7.5%, respectively, although import of oilseeds continues to be restricted with an import duty of 30%. Exports of edible oils, barring some minor constituents, continue to remain banned since March 2008. Finally, during the last ten years, India has been a net exporter of sugar, although there have been constant government interventions in external trade of sugar with intermittent ban on exports.

Interestingly, recent empirical analyses such as Dasgupta et al. (2011) have found export bans to be associated with higher food prices. This could be driven by the fact that export bans are imposed when domestic prices are already high.

Figure 3: Domestic vs. Global Prices (2002-2004 = 100)



Source: FAOSTAT, Office of the Economic Advisor, Ministry of Commerce and Authors' estimates

Table 2: Degree of Co-movement between Global and Domestic Prices

Food Item	Below the Median Value	Above the Median Value
Food	0.935	0.349
Cereals	0.864	0.195
Meat	0.691	0.642
Dairy Products	0.603	-0.498
Oils and Fat	0.87	0.517
Sugar	0.432	0.77

Source: FAOSTAT, Office of the Economic Advisor, Ministry of Commerce and Authors' estimates

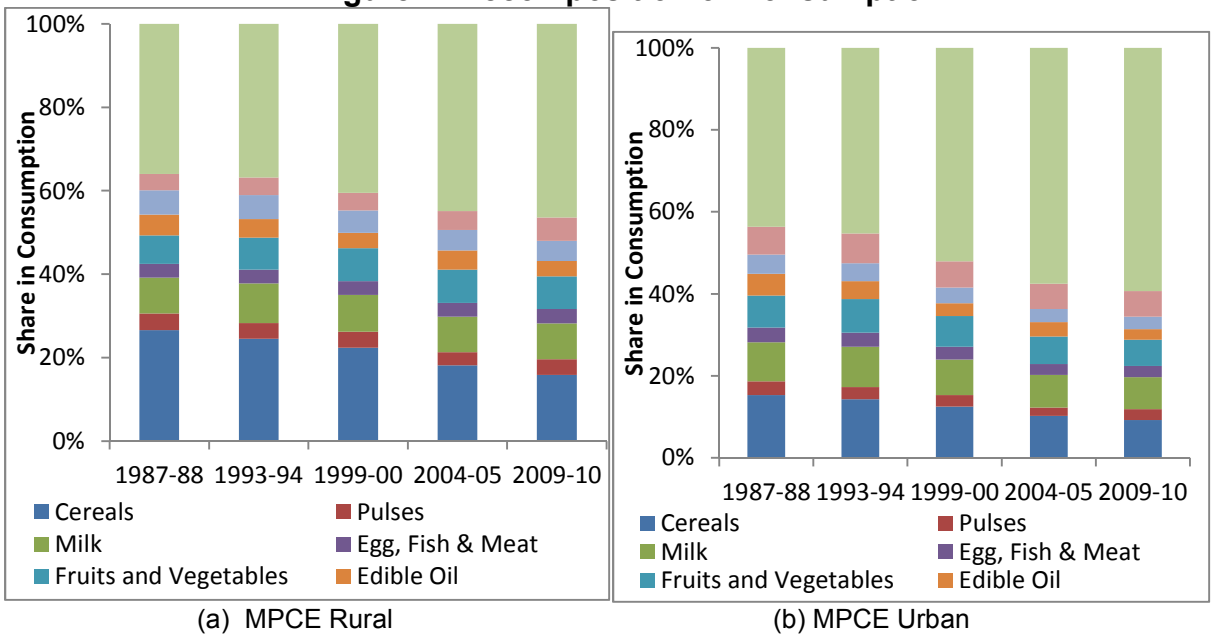
B. Rising Demand Supply Mismatch

1. Estimating Demand of Key Food Items

An often cited reason for high food inflation in recent years is that rising per capita income and diversification of Indian diets has increased the demand for high-value food products like milk, eggs, meat, fish, pulses, vegetables and fruits. With the supply response for these food products being weak, prices of these commodities have continued to remain high thereby providing a structural character to food inflation.

A most enduring empirical relationship is the Engel's Law, which argues that food expenditures are an increasing function of income or expenditure and of family size, but that food budget shares decrease with income. In India also we find evidence of similar shifts. According to the household consumer expenditure survey conducted by the National Sample Survey Office (NSSO) on a quinquennial basis, monthly per capita expenditure (MPCE) (base 1987-88) increased from Rs.158.1 in 1987-88 to Rs.187.8 in 2009-10 in rural areas and Rs.249.9 to Rs.355.0 in urban areas. As shown in Figure 4, the rise in MPCE has been associated with a decline in proportion of expenditure on food from 64% in 1987-88 to 53.6% in 2009-10 in rural areas, and from 56.4% to 40.7% in urban areas.

Figure 4: Decomposition of Consumption

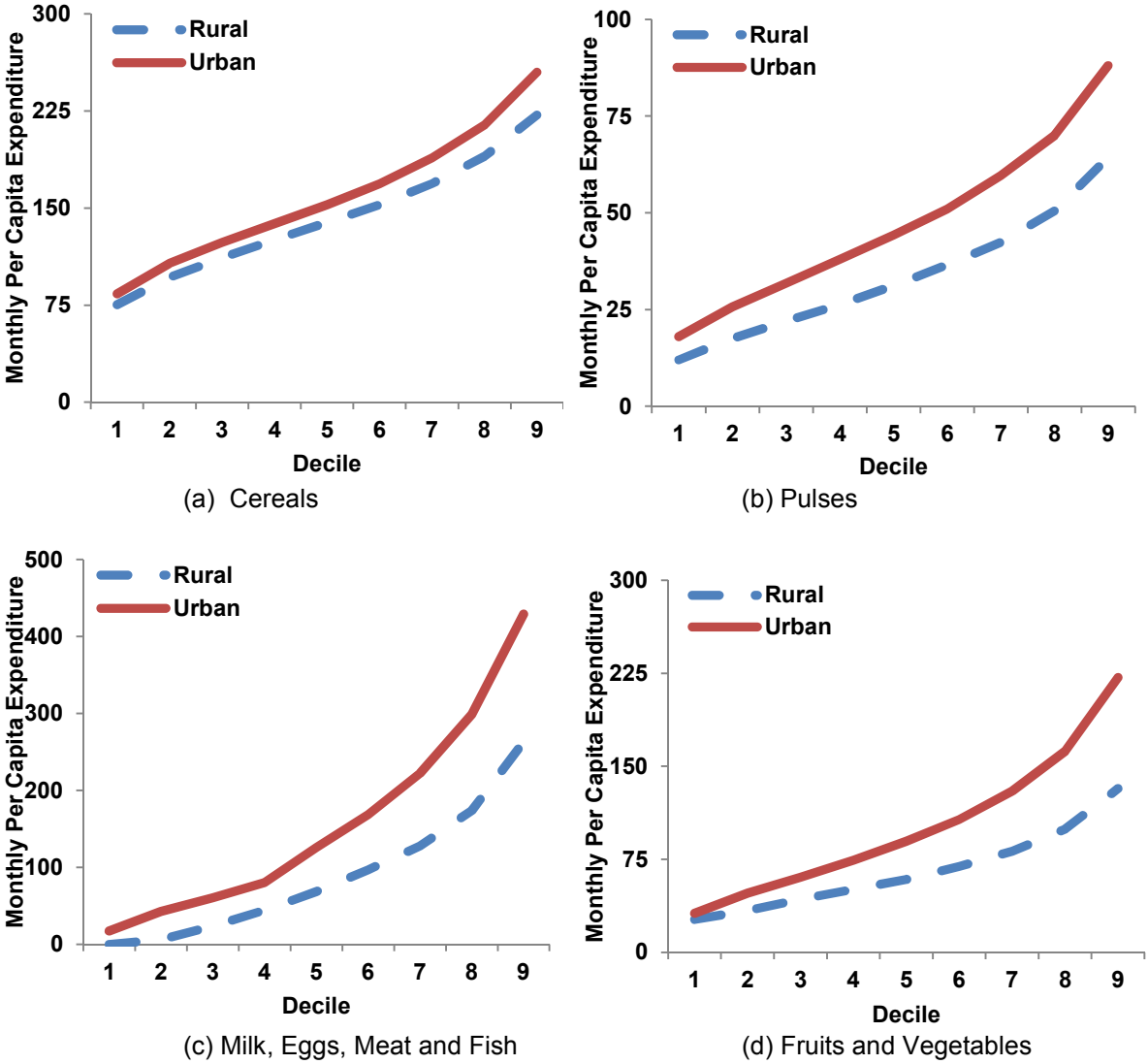


(a) MPCE Rural (b) MPCE Urban

Source: NSSO various rounds & Authors' Estimates

At the same time, food consumption has also obeyed Bennet's law with starchy staples in the food basket being displaced by protein-rich foods. Between 2004-05 and 2009-10, there has been an increase in the share of most protein-rich commodities, such as milk, egg, fish, meat and vegetables in total MPCE. The National Sample Survey Organization (NSSO) data shows that while per capita annual consumption of pulses came down from 8.64 kg in 2004-05 to 7.92 kg in 2009-10 in rural areas and 9.98 kg to 9.60 kg in urban areas, annual consumption of milk increased from 47 litres to 50 litres in rural areas and 62 litres to 65 litres in urban areas. Per capita annual consumption of eggs has increased from 12 to 21 in rural while it dropped in urban areas from 25 to 21 per capita. Finally, meat consumption between 2004-05 and 2009-10 was more or less stable both in rural and urban areas but it doubled in the case of chicken meat.

Figure 5: Rural and Urban Engel Curves



Source: Various National Sample Survey Organisation and Authors' estimates

To investigate the relationship between income and expenditure on a particular commodity we calculate the Engel Curves for four main food categories – (i) cereals, (ii) pulses, (iii) milk, egg, meat, and fish, and (iv) fruits and vegetables in Figure 5. The Engel Curves outline the change in consumption for a given change in income (proxied here by MPCE). The steeper the curve,

the higher is the elasticity. Thus, Figure 5(a) shows that for the urban population, the ratio of expenditure on cereals by the highest income decile to that by the second lowest income decile is about 2.0. In contrast, Figures 5(c) and 5(d) show that the ratio is close to 7.0 for milk, eggs, meat, fish and 3.4 for fruits and vegetables. Thus, as household incomes increase, the incremental expenditure on milk, eggs, meat and fish is 3.5 times more than that on cereals, while incremental expenditure on fruits and vegetables is 1.7 times that of cereal. The pattern is similar for rural households with an even greater increase in expenditure on milk, eggs, meat and fish, compared to cereals.

Although the Engel Curves are based on cross-sectional data, they help to make inferences about consumer behaviour over time. From the above analysis, it can be argued that as households' income improves, their expenditure on food shifts towards proteins, fruits and vegetables, thereby exacerbating demand pressures.

Table 3: Monthly Average Per Capita Consumption of Food Items (kg) Across Income Groups for Rural and Urban India, 2009-10

	Rural				Urban				Rural Urban
	Percentile Class of MPCE				Percentile Class of MPCE				Combined
Item	0-30	30-70	70-100	Mean	0-30	30-70	70-100	Mean	Mean
Cereals	11.09	11.84	12.43	11.79	9.97	10.43	10.07	10.18	11.13
Pulse	0.52	0.69	0.98	0.73	0.56	0.81	1.08	0.82	0.76
Milk	1.83	4.24	8.03	4.66	2.34	5.29	8.85	5.47	4.99
Sugar	0.49	0.76	1.1	0.78	0.58	5.29	8.85	5.47	4.99
Edible	0.44	0.6	0.8	0.61	0.51	0.74	0.92	0.73	0.66
Fish	0.24	0.42	0.81	0.48	0.31	0.52	0.83	0.55	0.51
Vegetables	4.16	4.98	6.16	5.09	4.04	5.22	6.78	5.33	5.19
Fruit Fresh	0.12	0.21	0.46	0.26	0.12	0.33	0.82	0.41	0.32

Source: National Sample Survey Organisation and Authors' Estimates

The shift in the demand for lprotein rich items such as milk and milk products and fish and meat with increase in income can also be perceived from monthly average per capita consumption of different items by different income groups (proxied by MPCE). Table 3 depicts monthly average per capita consumption (MPC) of various food items across income groups for rural and urban India based on the 66th round NSSO Survey for 2009-10. While the ratio of average MPCE of cereals by a household below 30% of MPCE to that by a household with above 70% of MPCE is hardly over one in both rural and urban areas, such ratios for protein rich items such as milk and fish and meat are 4 and 3 respectively. Thus shift in demand towards luxury items in the face of rising household income may partly explain the recent inflationary pressure on these commodities.

Having corroborated a dietary shift towards products which have contributed significantly to the food inflation in recent years we turn our focus to the change in aggregate demand resulting from this shift in diet. We estimate expenditure elasticity of a few selected food items using the 66^{th} round of household consumption expenditure survey by NSSO for 2009-10. The selected items, namely cereals, pulses and pulse products, milk and milk products, vegetables, fish and meat, and fresh fruits constitute 76% of average monthly per capita expenditure on food as shown in Table 4.

Table 4: Share of Food Items in Total Per Capita Expenditure on Food, 2009-10

Item	Share
Cereal	**29.95**
Cereal Substitute	0.13
Pulse and Pulse Product	**7.56**
Milk and Milk Product	**15.92**
Sugar	4.34
Salt	0.47
Edible Oil	7.22
Egg	0.79
Fish and Meat	**7.70**
Vegetables	**12.59**
Fruit Fresh	**2.40**
Fruit Dry	0.75
Spices	4.33
Beverages	3.87
Pan	0.22
Tobacco	0.36
Intoxicant	1.40

Source: National Sample Survey Organization and Authors' Estimates

We compute aggregate demand as the sum of aggregate household demand and indirect demand requirements from industries using these food items as inputs (seed, feed and wastage [SFW]). We estimate per capita household demand and associated expenditure elasticities for the selected food items using the Quadratic Almost Ideal Demand System (QUAIDS) following Banks et al. (1997). The QUAIDS are specified with expenditure shares as the dependent variable. A household's expenditure share for good i is defined as $w_i = \frac{p_i q_i}{m}$, where p_i is the unit price of good i and q_i is the quantity of good i purchased or consumed and m is the total expenditure on all goods in the demand system. With this definition of m, $\sum_{i=1}^{K} w_i = 1$, where K is the number of goods in the system. The functional form of the expenditure share under QUAIDS is as follows:

$$w_i = \alpha_i + \sum_{j=1}^{K} \gamma_{ij} \ln p_j + \beta_i \ln\left\{\frac{m}{P(p)}\right\} + \frac{\lambda_i}{b(p)}\left[\left\{\frac{m}{P(p)}\right\}\right]^2 \quad (1)$$

where p is the vector of all prices and $b(p)$ is defined as $b(p) = \prod_{i=1}^{K} p_i^{\beta_i}$. The aggregate price index is defined as

$$\ln P(p) = \alpha_0 + \sum_{i=1}^{K} \alpha_i \ln p_i + \frac{1}{2}\sum_{i}^{K}\sum_{j}^{K} \gamma_{ij} \ln p_i \ln p_j \quad (2)$$

The parameters are subject to the following restrictions

$$\sum_{i}^{K} \alpha_i = 1;\ \sum_{i}^{K} \beta_i = 0;\ \sum_{i}^{K} \gamma_{ij} = 0\ \forall j; \quad (3)$$

and Slutsky symmetry implies that $\gamma_{ij} = \gamma_{ji}$.

The estimated expenditure elasticities for the selected food items are given in Table 5 along with the values from various existing studies.

Table 5: Expenditure Elasticity

	Mittal (2010)	Kumar et al (2011)	Present Study
Cereals	0.165	0.187	0.226
Pulses	0.59	0.716	0.515
Fruits and Vegetables	0.72	0.817	
Vegetables			1.535
Fruits			2.21
Milk and Milk Products			2.185
Milk	1.19	1.64	
Eggs, Meat and Fish	1.3		
Meat and Fish			0.796

Source: Mittal (2010), Kumar et al. (2011) & Authors' estimates

Table 5 shows that expenditure elasticities for selected major food items are found to be positive, suggesting a rise in total household expenditure would lead to stronger demand for these items. Expenditure elasticities for milk and milk products, vegetables and fruits are over unity, suggesting that a 1% increase in household expenditure on food would lead to a more than 1% increase in the demand for these items. The elasticity for meat and fish, although below unity, is high enough to cause significant rise in demand for these items as total expenditure on food increases. Positive and high expenditure elasticity may partly indicate the role of demand side factors in driving food inflation.

We compute aggregate household demand using the following equation:

$$D_{i,t}^{H} = d_{i,0} N_t \prod_{n=1}^{t} \left(1 + g_n * e_i\right) \tag{4}$$

where $D_{i,t}^{H}$ is the aggregate household demand for commodity i in year t, $d_{i,0}$ is the per capita demand for commodity i in the base year, N_t is the population in year t , g_n is the per capita income growth rate in year n where n goes from 1 to t, and e_i is the expenditure elasticity for the commodity i. We generate a historical household demand series for the period from 2004-05 to 2012-13.[1]

We compute aggregate demand using the following equation:

$$D_{i,t} = \frac{D_{i,t}^{H}}{1 - x_i} \tag{5}$$

where $D_{i,t}$ is the aggregate demand for commodity i in year t and x_i is the share of indirect demand in total demand for commodity i. The share of indirect demand in total demand for the

[1] Since our base year per capita household demand $d_{i,0}$ is estimated for 2009-10, we generate the historical household demand series from 2004-05 till 2012-13 by iterating equation (4) backward and forward with respect to $d_{i,0}$. The data for GDP at factor cost at constant 2004-05 prices and population are sourced from RBI.

selected food products are sourced from the Report of Planning Commission Working Group on Crop Husbandry, Agricultural Inputs, Demand and Supply Projections And Agricultural Statistics for the Twelfth Five Year plan (2012-2017) and are presented in Table 6. The report provides estimates of indirect demand for 2004-05 and 2011-12. We take an average of the estimates for these two periods to compute total demand for 2004-2013. In addition, an average of the indirect demand estimates for rice and wheat given in the report is used as a proxy for indirect demand for cereals.

Table 6: Indirect demand for food items in India (% of total demand)

Commodity	2004-05	2011-12	Average
Rice	12.97	13.43	13.20
Wheat	17.08	17.69	17.39
Cereals	15.03	15.56	15.29
Pulses	37.00	41.71	39.36
Milk	40.58	41.58	41.08
Fish and Meat	39.45	40.83	40.14
Vegetables	37.76	38.43	38.10
Fruits	81.47	82.90	82.19

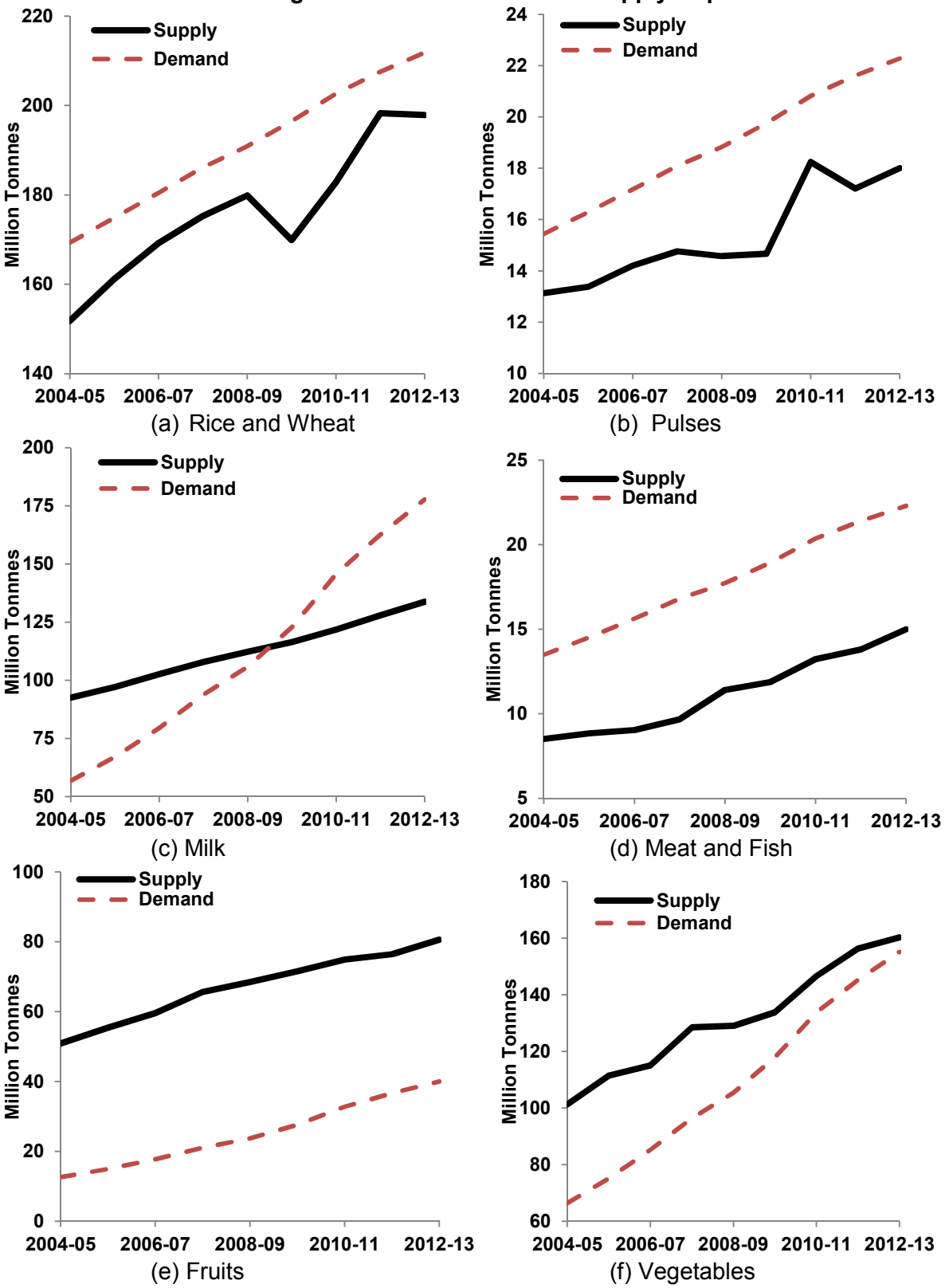
Source: Planning Commission

In Figure 6, we compare the estimated aggregate demand for the selected commodities with the domestic production during the period 2004-05 to 2012-13 to evaluate the demand-supply mismatch. Exports and imports are not explicitly considered because our objective is to assess the likely gap between domestic demand and domestic supply, which will be bridged by trade.

For cereals, we find supply has been lagging demand leading to a persistent demand supply gap. Moreover, the gap widened significantly in 2009 due to severe drought in that year. In the case of pulses too, the demand has consistently outstripped supply, and the gap has widened in recent years. This gap has been met to some extent through import of these commodities, which in turn makes the domestic price vulnerable to changes in international prices. In the case of protein rich commodities, milk as well as meat and fish, we find an increasing divergence between demand and supply. While the demand for milk and milk products outstripped supply in 2008-09, meat and fish depict a positive demand-supply gap prevailing from 2004-05.

Interestingly, in case of fruits and vegetables, the supply is higher than the demand. However, these products are subject to large scale wastage which could reduce the amount available for consumption. While there are several estimates of the extent of wastage in these products, a study by Central Institute of Post-Harvest Engineering and Technology (CIPHET) pegs the wastage of fruits at 6% to 18% and vegetables at 6% to 12.5%.

Figure 6: Estimated Demand Supply Gap



Source: National Sample Survey Organisation and Authors' Estimates

2. Stagnant Productivity

It is evident from Section 3.2.1 that the rise in demand across a number of food products such as cereals, pulses, milk, meat and fish has not been associated with a commensurate supply response. At the macro level, agriculture growth has considerably lagged behind the growth of the rest of the economy. While between 2000-01 and 2012-13, the agriculture output grew by 2.96%, non-agricultural GDP witnessed a growth of 7.95%, resulting in share of agriculture in GDP declining from 18.8% to below 12% during this period. At a more granular level, production of some of key food products has witnessed a slowdown during the last decade. Table 7 highlights the average decadal growth rate of major food products. The average growth rate of rice production declined from 1.8% in 1990s to 0.9% in 2000s.[2] Wheat production witnessed a much more dramatic decline in growth rate from 4.4% to 0.6%. The trends were slightly healthier for fruits and vegetables as they experienced a moderate increase in growth rate in the 2000s. It was only in the case of pulses where the growth rate of production witnessed some improvements.

Table 7: Average Annual Growth Rate of Production and Yields

	Production		Yields	
	1990s	2000s	1990s	2000s
Rice	1.79%	0.87%	1.40%	1.50%
Wheat	4.36%	0.57%	2.90%	1.10%
Pulses	-0.39%	1.88%	1.80%	1.20%
Fruits	4.20%	5.80%	0.70%	0.70%
Vegetables	4.20%	5.40%	3.20%	1.70%

Source: Handbook of Agricultural Statistics

Apart from sluggish production, most of the agricultural products were characterized by stagnating or declining growth of yields in 2000s. While the growth rate of yield more than halved for wheat, it fell sharply in case of pulses and vegetables, and was stagnant for fruits. Only in case of rice, there was a marginal increase in the growth of yield. The weak growth in yield during the 2000s has meant that India has failed to keep pace with the major producers of the world. In the case of both wheat and paddy, where India is second largest producer, the productivity levels are well below most international comparators.

Table 8 shows that People's Republic of China (PRC), which was the largest producer of wheat and paddy in 2012 recorded yields that were 88% higher than India in the case of paddy, and 57% higher in the case of wheat.

Similarly, though India is the largest producer of pulses, its yield continues to remain a fraction of other major producers. The yields were 66% lower than Canada and even 52% lower than neighbouring Myanmar.

[2] To account for annual fluctuations in production the growth rates are based on three year averages of production.

Table 8: Cross Country Comparison of Yield (2012)

Rice			Wheat			Pulses		
Countries	Share	Yield	Countries	Share	Yield	Countries	Share	Yield
PRC	28.70%	6744.3	PRC	17.87%	4995.2	India	23.12%	641.8
India	21.20%	3590.6	India	14.06%	3173.2	Myanmar	7.58%	1323.7
Indonesia	9.60%	5136	USA	9.15%	3114.8	Canada	6.71%	1892.6
Viet Nam	6.10%	5631.5	France	5.97%	7599.2	China	6.05%	1431.9
Thailand	5.30%	3000	Russia	5.59%	1772.7	Australia	5.53%	1677
Bangladesh	4.80%	2923.1	Australia	4.43%	2151.1	Brazil	4.04%	1027.7

Source: Food and Agricultural Organization and Authors' Estimates

India's low productivity in agriculture can be explained by the pattern of expenditure on the agriculture sector. While the overall capital formation in the agriculture sector increased from around 6% of agriculture GDP in 1993-94 to 17% in 2010-11, the entire increase in capital formation was driven by the private sector. The share of public sector capital formation has remained stagnant around to 2% to 3% during the entire period. In contrast there has been a sharp increase in subsidies provided by the public sector. Gulati (2012) points out that by 2009-10 nearly 80% of the public sector spending was in the form of subsidies. While power subsidies have remained around 5% of agricultural GDP from mid 1990s to late 2000s, fertilizer subsidies have increased sharply from 2006-07.[3] According to Kumar and Chandra (2010), fertilizer subsidy jumped from around 1.7% of GDP during the first half of 2000s to around 8% in 2007-08 and 2008-09. Some of these subsidies have also had unintended costs. In many areas, the power subsidies have distorted decisions over power consumption and groundwater extraction and induce individuals to grow more water intensive crops in regions that are not amenable to such cropping patterns.

Moreover, technology has played a limited role in improving agricultural yields. The National Commission on Farmers indicates that there is a large knowledge gap between the yields in research stations and actual yields obtained by farmers. The yield gaps range from 5% to 300% depending on the crop and state.[4] The Green Revolution, which took place during the 1960s, had a limited coverage both in terms of crops and states. It focused only on rice and wheat and was concentrated in the states of Punjab and Haryana. Moreover, as argued in Carrasco and Mukhopadhyay (2013) the rise in yield under the Green Revolution has come at the cost of heavy and inappropriate use of fertilisers and pesticides, irrigation practices leading to salt build-up, and depleting ground water balance in areas where more water was pumped for irrigation.

The `Bringing Green Revolution to Eastern India' initiative is in initial phases and needs to be persisted with. However, it needs to be suitably altered to align with ecosystem prevalent in these states. The initiative needs to be accompanied with improvement of marketing and procurement infrastructure, which continues to be inadequate in these states and has resulted in distress to farmers despite record production.

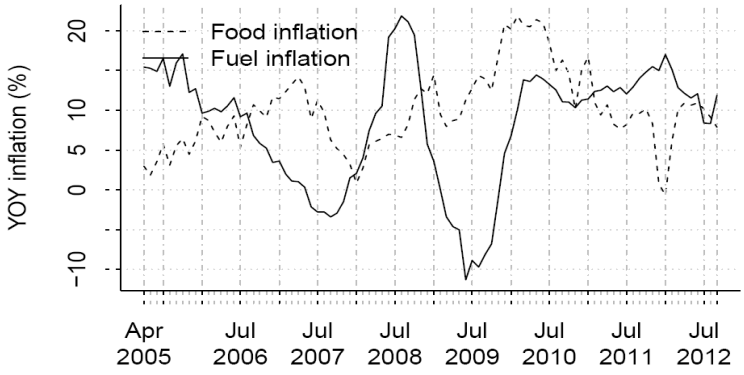
C. Rising Cost of Inputs

1. Fuel Prices

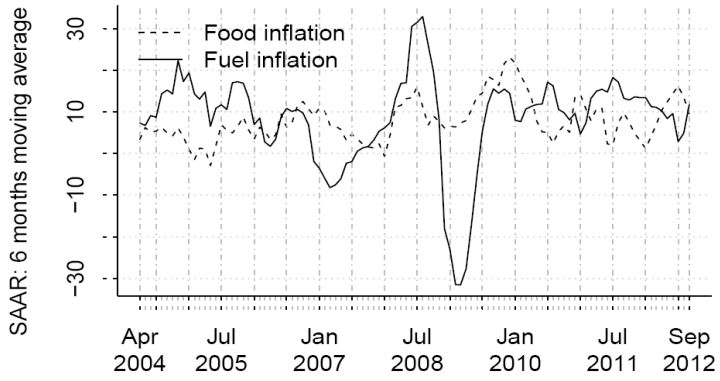
Fuel prices play an important part in influencing food prices through several channels. Fuel is used to transport the produce from the producer to the consumer, and hence a rise in fuel price widens the gap between farm gate price and retail price. Moreover, fuel is used to power several machines used in agriculture such as tubewells, tractors etc.

[3] Electricity subsidy data is sourced from Narayanan and Hussain (2013)
[4] Estimates from the Planning Commission.

Figure 7: Fuel and Food Inflation



(a) Year on Year Inflation



(b) SAAR 6 Months Moving Average

Source: Authors' estimates

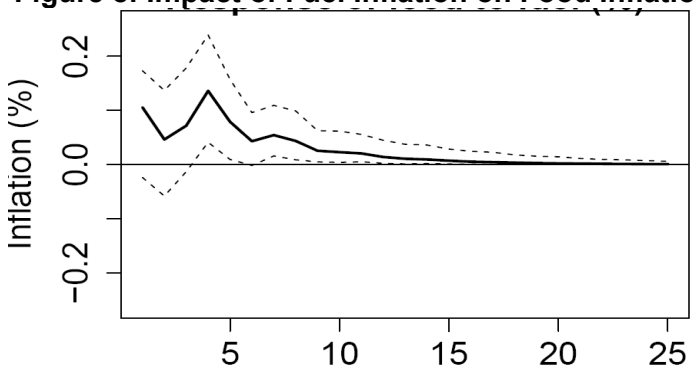
In India, fuel prices have been administered to a large extent. However, integration of oil prices with market forces is presently on the reform agenda and there have been a few episodes of adjusting fuel prices according to the movement in crude oil prices in the world market. We find a lead-lag dynamics between fuel and food inflation from mid-2006, except for a few episodes as depicted by Figure 7.[5] The first panel in Figure 7 shows movements of YOY inflation in fuel and food prices from mid-2005, whereas the second panel depicts 6-months moving average of annualised point-on-point (POP) rate in fuel and food prices.[6] We find that both food and fuel price levels are I(1) and POP inflation rates are I(0). We do not find any co-integration relation among food and fuel price levels. Hence, we analyse the relationship among POP inflation in fuel and food prices using a two variable Vector Auto Regression (VAR) framework.[7] Our analysis spans the period from April, 1994 to September, 2012. We include number of lags =3 in the VAR framework following Akaike Information Criteria and Final Prediction Error criteria.

[5] The price series are WPI monthly series from Office of the Economic Adviser, Ministry of Commerce and Industry. WPI series at bases 1993-94 and at 2004-05 are linked. Food price is proxied by the weighted sum of WPI food articles and WPI food products, while fuel price is proxied by WPI fuel, power, light and lubricants.

[6] Food prices are seasonally adjusted using x-12 ARIMA of U.S. Census Bureau. Fuel prices are not adjusted for seasonality since the series is not a candidate for adjustment due to weak seasonal pattern in it.

[7] The unit root test of price levels and inflation rates and the co-integration test results are given in Tables A2, A3, and A4 (or 14, 15 and 16) in Appendix I.

Figure 8: Impact of Fuel Inflation on Food Inflation



Source: Authors' estimates

We do find evidence of substantial pass through from fuel inflation to food inflation. As shown by the orthogonal impulse response analysis in Figure 8, a shock, which raises fuel inflation by 1% will lead to a 0.13% rise in food inflation and the effect slowly declines through the next 12 months.

Table 9: FEVD Analysis for Fuel and Food Inflation

	Horizon	Fuel	Food
FEVD for Fuel Inflation	1	100.000	0.000
	5	95.776	4.224
	10	94.872	5.128
FEVD for Food Inflation	1	1.096	98.904
	5	3.387	96.613
	10	3.938	96.062

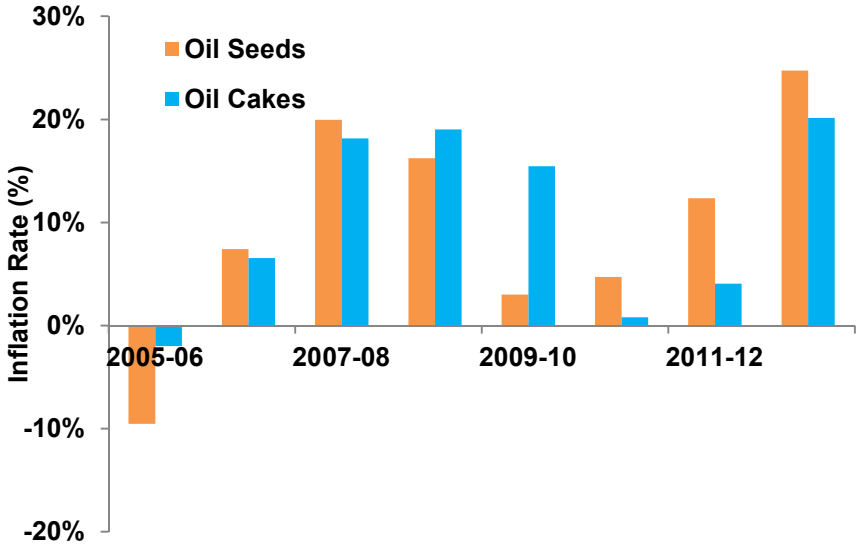
Source: Authors' estimates

Finally, the results of Forecast Error Variance Decomposition Analysis (FEVD) complement the results from the impulse response analysis. The FEVD analysis tells us the proportion of the movements in a sequence due to its "own" shocks versus shocks to the other variables. Table 9 reports the FEVD results. It shows that 10 months out, 3.94% variation in food inflation is due to variation in fuel inflation.

2. Price of Oilcakes

In India a major part of livestock feed is made up of oil cakes. The primary source of oil cake production is oil seeds. The production of oil seeds has witnessed significant fluctuations in recent years. Oil seeds' output contracted in four out of the six preceding years. It contracted by 13.2% in 2006-07, 6.8% in 2008-09, 10.2% in 2009-10 and 7.6% in 2011-12. This resulted in oil seeds' prices increasing in at an average rate of 13.5% between 2007-08 and 2012-13. The sharp increase in oil seeds' prices resulted in prices of oil cakes rising at 13% during this period (Figure 9). Actually, if one excludes the low inflation years of 2010-11 and 2011-12, the average increase in prices of oil cakes is around 18%. High oil cakes prices, in turn, passed rapidly through to the prices of milk and dairy products.

Figure 9: Inflation in Oil Seeds and Oil Cakes

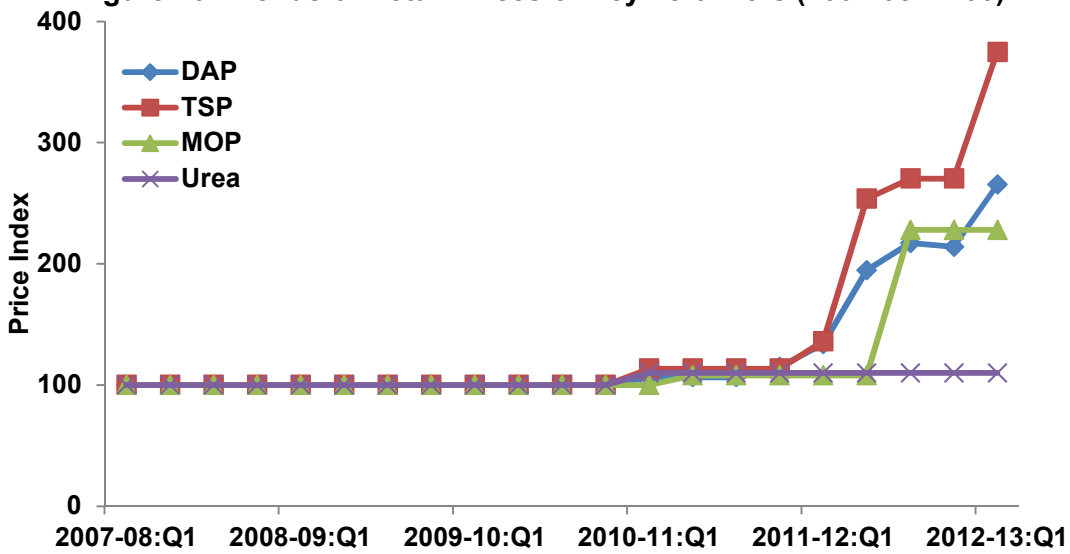


Source: Office of the Economic Advisor, Ministry of Commerce and Authors' Estimates

3. Fertilizer Prices

To encourage the use of fertilizers to improve agricultural productivity and farm income, fertilizers continue to be subsidized by the government. The government in 1977 introduced the Retention Pricing Scheme (RPS) in which the government fixed prices on nitrogen, phosphorus and potash fertilizers and compensated companies for costs. However, this resulted in bloating up of costs, mistargeting of subsidies and skewed usage of nitrogen-based fertilizers since these were more heavily subsidized. This resulted in a sharp increase in the subsidy bill. While in absolute terms, fertilizer subsidy increased by 6.5 times between 2003-04 and 2008-09, its share in GDP increased from 0.42% to 1.36% over the same period.

Figure 10: Trends of Retail Prices of Key Fertilizers (2007-08 = 100)



Note: DAP: Diammonium Phosphate; MOP: Muriate of Potash and TSP: Trisodium Phosphate
Source: Department of Fertilizers and Authors' Estimates

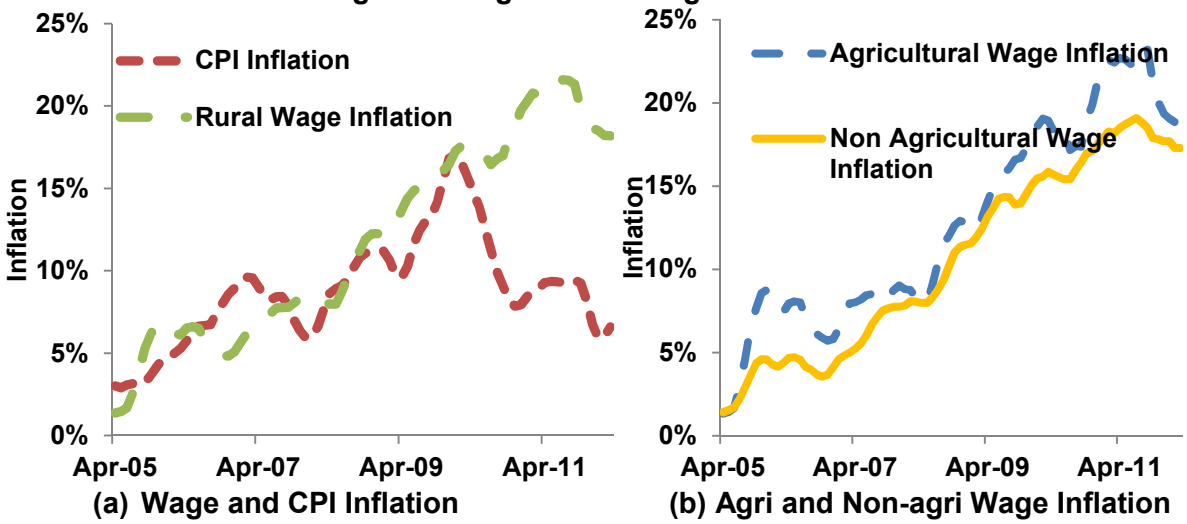
In a bid to ease the fiscal burden arising on account of fertilizers subsidies, the government replaced the RPS with the Nutrient Based Subsidy (NBS) Policy from April 1, 2010 for phosphatic, potassic and complex fertilizers and from May 1, 2010 for Single Super Phosphate (SSP). The NBS deregulated the prices of non-urea fertilizer, although the price of urea, the most dominant fertilizer, continues to be government controlled.

Under the NBS, the market price is determined based on supply and demand factors and government pays a fixed subsidy per nutrient irrespective of the cost of production. These changes were aimed to correct the over-use of nitrogenous fertilizers and pass on the responsibility to companies or end user to absorb price increases. The fertilizer companies are required to print Maximum Retail Price (MRP) along with applicable subsidy on the fertilizer bags. Figure 10 shows that the retail price of DAP and MOP remained constant in pre-NBS period. However, the subsidy kept on changing depending on cost of production and import parity prices. After introduction of NBS policy in April 2010, which moved from "fixed-price floating subsidy" regime to "fixed-subsidy-floating price", the prices of phosphatic and potassic fertilizers registered a sharp increase particularly during the last one year. For example, as shown in Figure 10, price of DAP almost tripled between March 2010 and June 2012 and MOP prices increased by 360% during this period. These two fertilizers account for nearly 30% of the total fertilizer consumed in India, and the sharp increase in their prices have contributed to rise in food prices.

4. Rural Wages

A key factor influencing the prices of food products is the wages of the agricultural workers. As can be seen from Figure 11, while until 2007, wages grew in line with CPI inflation, since then rural wages have risen at a pace far in excess of the inflation rate. Furthermore, within rural wages, agricultural wages have risen at a faster pace than non-agricultural wages.[8] Higher agriculture wages raise the input cost for agriculture while at the same time, greater income in the hand of workers lead to increased demand for food, especially those with high income elasticity and exacerbated the demand supply mismatch.

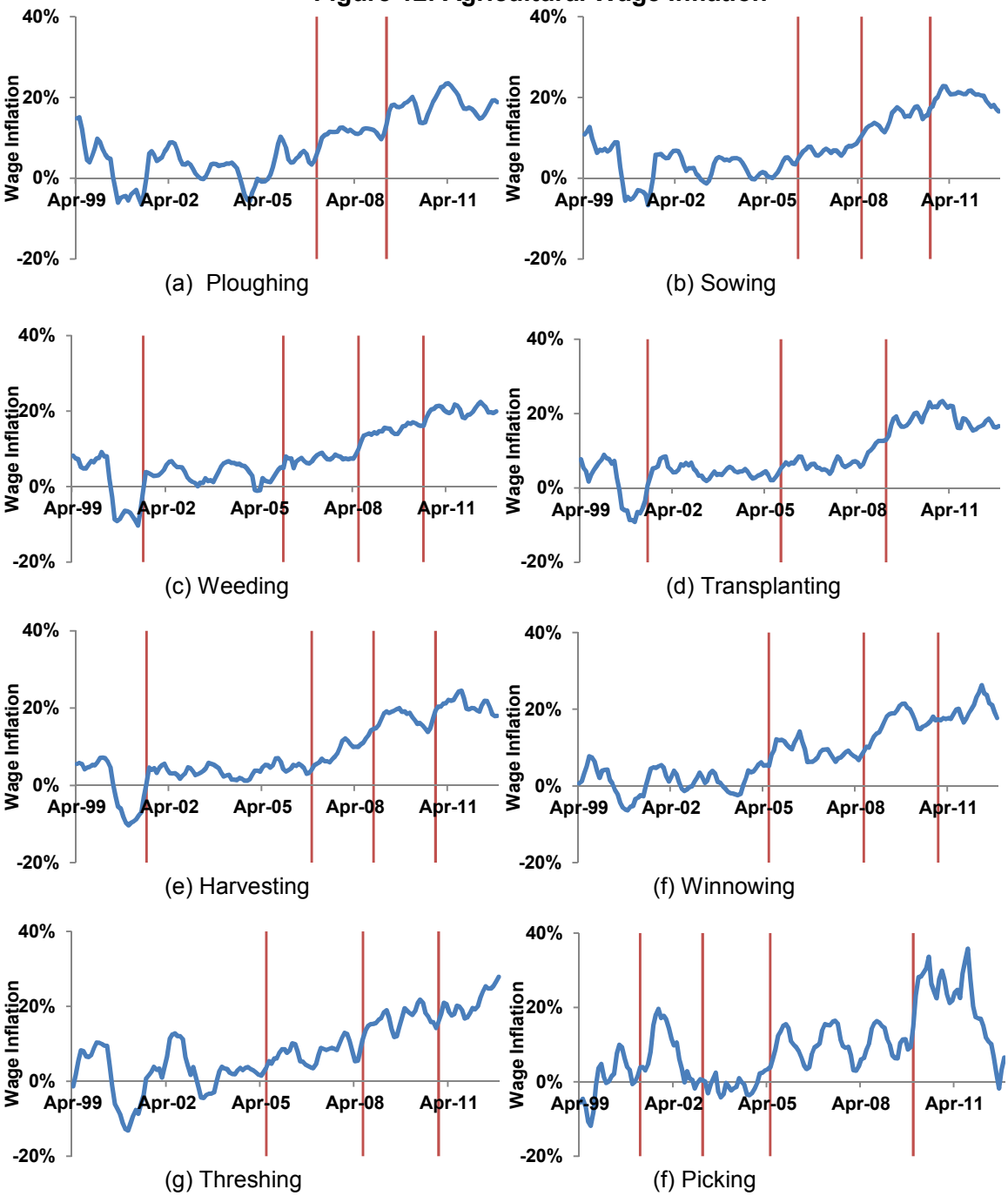
Figure 11: Agriculture Wages and Inflation



Source: Labour Bureau, Reserve Bank of India and Authors' Estimates

[8] Agricultural activities include ploughing, sowing, weeding, transplanting, harvesting, winnowing, threshing and picking, while non-agricultural activities involve herdsman, well digging, cane crushing, carpenter, blacksmith, cobbler, mason, tractor driver, sweeper and unskilled labourers.

Figure 12: Agricultural Wage Inflation



Source: Reserve Bank of India and Authors' Estimates

To understand better the evolution of agricultural wages, we focus on the individual agricultural activities and the evolution of wages in these activities in Figure 12. As evident, the pace of increase in agricultural wages in the various activities has been different, although there has been a general upward trend in wage inflation.

We employ the Bai and Perron (1998) structural break test to determine the presence of structural breaks in the various wage series. The test, in principle assess the deviations from stability in the classical linear regression model with m breaks (m + 1 regimes).

$$y_t = x_t'\beta + z_t'\delta_j + \mu_t,\ \left(t = T_{j-1}+1,.....T_j;\ j = 1,.....m+1\right)$$

where j is the segment index. Here y_t is the dependent variable at time t; $x_t\,(p\times 1)$ and $z_t\,(q\times 1)$ are the vectors of explanatory variables. The parameters β and $\delta_j\left(j = 1,.....m+1\right)$ are the corresponding vectors of coefficients respectively. Here the coefficients δ_j associated with explanatory variables z_t are subject to structural breaks, while the other set of regression coefficients β is assumed to be constant over the entire sample period. The disturbances are denoted by u_t . The indices $\left(T_1.....T_m, T_0 = 0, T_{m+1} = T\right)$ are the unknown breakpoints to be estimated along with the unknown regression coefficients using the T observations on $\left(y_t; x_t; z_t\right)$. For each m segment of $\left(T_1.....T_m\right)$; the associated least-square estimates of δ and β are obtained by minimising the sum of residual squares.

The regression coefficients for each segment and the unknown breakpoints are simultaneously estimated using the algorithm described in (Bai and Perron, 2003). In our context, the structural breaks in each currency deviation series are estimated in single regression framework, where the covariate is a constant. This framework helps us in understanding possible level shifts in a series.

These breaks and the corresponding phases, along with the average inflation rates are highlighted in Figure 12 and Table 10. There has been a sustained increase in the average wage inflation rate across all the agricultural activities. The average wage inflation rate was close to, or exceeded 20% during the last phase for all activities. In case of all these activities, the average wage inflation rate entered the double digits around 2007-2008.

It has been hypothesized that one of the major factors behind the surge in agricultural wages is the public works programme, Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). The main objective of this program is to enhance livelihood security of the households in rural areas of the country by providing at least 100 days of guaranteed wage employment to every household in unskilled manual work. The scheme was introduced in 2006 and extended to all the districts in India by 2008 in three distinct phases.

Recent studies have found that programs such as MGNREGS can influence equilibrium wage rates in rural areas, by raising the reservation wage. Imbert and Papp (2012) focus on the impact of MGNREGS on wages and employment using NSSO data. They conclude that MGNREGS raises public works employment by 0.3 person days per month and casual wage income increases by 4:5%. Another study, Berg et al. (2012), use wage data from Agricultural Wages in India (AWI) instead of earnings from casual employment from NSS, and find that on average MGNREGS boosts the real daily agricultural wage rates by 5:3% and it takes 6 to 11 months for an MGNREG intensity shock to feed into higher wages.[9] Gulati et al. (2013b) also find that 10% increase in employment pushed agriculture wages by 0.3% to 0.5%, although they

[9] MGNREGS intensity is calculated as the number of person days of work provided by MGNREGS per rural inhabitant in a district as a measure of programme intensity.

also find “pull' factors such as growth in the economy, agriculture sector and construction sector have also contributed to increase in farm wage.

Table 10: Phases of Agriculture Wage Inflation

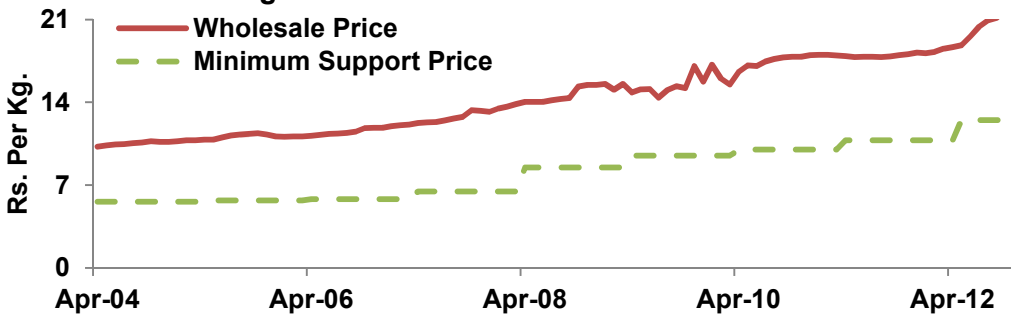
Activity	Phases	Average Inflation Rate
Ploughing	Phase I: Apr 1999 to Jan 2007	2.97%
	Phase II: Feb 2007 to Apr 2009	11.37%
	Phase III: Apr 2009 onwards	18.35%
Sowing	Phase I: Apr 1999 to Apr 2006	2.92%
	Phase II: May 2006 to May 2008	7.17%
	Phase III: Jun 2008 to Aug 2010	14.86%
	Phase IV: Sep 2010 onwards	20.27%
Weeding	Phase I: Apr 1999 to Jul 2001	0.28%
	Phase II: Aug 2001 to Jan 2006	3.51%
	Phase III: Feb 2006 to Jun 2008	7.52%
	Phase IV: Jul 2008 to Jul 2010	15.08%
	Phase V: Aug 2010 onwards	20.25%
Transplanting	Phase I: Apr 1999 to Jun 2001	0.77%
	Phase II: Jul 2001 to Oct 2005	4.48%
	Phase III: Nov 2005 to Mar 2009	7.42%
	Phase IV: Apr 2009 onwards	18.65%
Harvesting	Phase I: Apr 1999 to Jul 2001	-0.28%
	Phase II: Aug 2001 to Nov 2006	3.83%
	Phase III: Dec 2006 to Nov 2008	6.87%
	Phase IV: Dec 2008 to Nov 2010	17.48%
	Phase V: Dec 2010 onwards	20.90%
Winnowing	Phase I: Apr 1999 to Jan 2005	1.03%
	Phase II: Feb 2005 to Dec 2008	8.98%
	Phase III: Jan 2009 onwards	18.87%
Threshing	Phase I: Apr 1999 to Jun 2005	1.93%
	Phase II: Jul 2005 to Jul 2008	7.69%
	Phase III: Aug 2008 to Dec 2010	16.69%
	Phase IV: Jan 2011 onwards	21.14%
Picking	Phase I: Apr 1999 to Mar 2001	0.40%
	Phase II: Apr 2001 to Mar 2003	7.67%
	Phase III: Apr 2003 to May 2005	-0.57%
	Phase IV: Jun 2005 to Dec 2009	10.34%
	Phase V: Jan 2010 onwards	21.09%

Source: Reserve Bank of India and Authors' Estimates

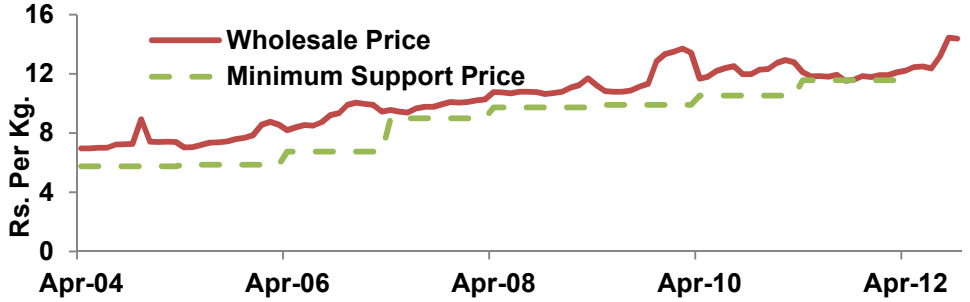
D. Minimum Support Prices

The government fixes the Minimum Support Price (MSP) of foodgrains at which foodgrains are procured from the farmers. The Central Issue Price (CIP) of foodgrains at which foodgrains are sold under different government welfare schemes are also fixed by the government. The difference between the Economic Cost, which includes MSP, procurement costs/incidentals and distribution costs and the CIP is reimbursed by the Government as subsidy to the Food Corporation of India (FCI).

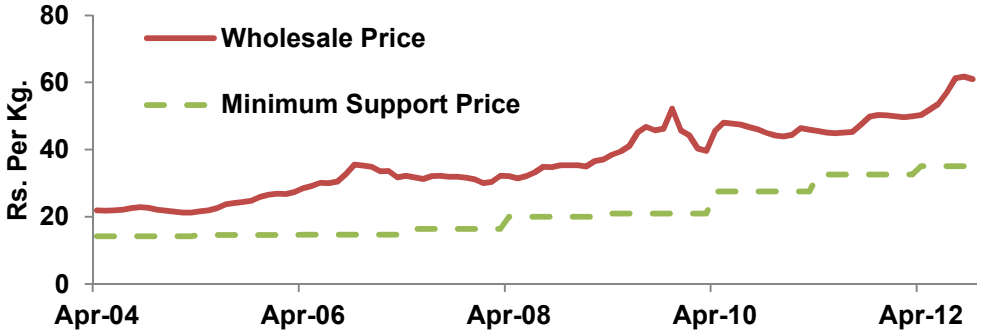
Figure 13: MSPs and Wholesale Prices



(a) Rice



(b) Wheat



(c) Pulses

Source: Ministry of Agriculture, Government of India and Authors' Estimates

A rise in MSP fuels food inflation through a number of channels. Firstly, there is a direct impact of a rise in MSP on WPI as the 25 commodities on which MSP are announced constitute nearly 7.3% of the WPI basket. Secondly, the MSP forms a floor price for various crops as it is the “minimum" price at which the government stands to procure crops from farmers. The wholesale prices are typically higher than these floor prices, and if the floor price keeps rising, as has been the case in India, then it leads to a rise in wholesale prices as well. As shown in Figure 13 this is indeed the case for rice, wheat and other pulses where wholesale prices have been rising in line with rising MSPs.[10] Finally, as pointed out in Bhalla (2013) an increase in MSP of major crops is associated with a rise in prices of various factors of production like land and labour. Kapur (2012) found that a 10% MSP increase raises headline WPI inflation in the short term by 100 basis points with a quarters lag, and by 200 basis points in the long run. Similarly, Bhalla et al. (2011) conclude that for every 10% increase in procurement prices, CPI inflation rises by 3.0%.

[10] For pulses, the MSP and the wholesale prices are calculated as the weighted average of gram, tur, urad, moong and masur prices, with the weights based on the WPI basket.

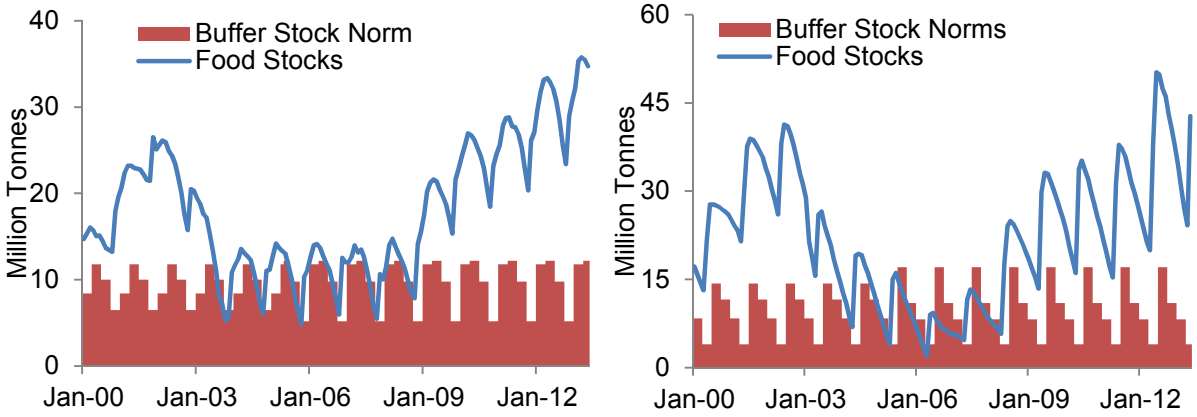
Table 11: Growth Rate of MSPs and Wholesale Prices

Commodity		Average Annual Growth Rate	
		2001-02 to 2006-07	2007-08 to 2012-13
Rice	MSP	3.52%	10.90%
	WPI	1.21%	9.40%
Wheat	MSP	2.46%	9.69%
	WPI	3.55%	6.66%
Coarse Cereals	MSP	2.18%	15.35%
	WPI	5.49%	11.22%
Pulses	MSP	3.04%	16.37%
	WPI	6.68%	8.49%

Source: Ministry of Agriculture, Department of Commerce and Authors' Estimates

It is also evident from Figure 13 that there has been a sharp increase in the amount by which MSPs for rice, wheat and pulses have been raised since 2006. In fact, compared to the period 2001-02 to 2006-07, the rate of growth of MSP during 2007-08 to 2012-13 was significantly higher for all major foodgrains. Not surprisingly, the later period witnessed substantial increase in wholesale prices of these foodgrains (Table 11).

Figure 14: Stock of Foodgrains and Buffer Stock Norms



Note: The buffer stocks are required to feed Targeted Public Distribution System and other welfare schemes, ensure food security during the periods when production is short of demand, and stabilize prices during such periods. The buffer stock norms are devised for every quarter.c
Source: Food Corporation India & Authors' Estimates

The high level of MSPs was a major contributing factor in keeping cereal inflation in double digits in five out of the previous eight years. While rice inflation averaged 8.8% between 2005-06 and 2012-13, wheat inflation was even higher at 9.0%. This was inexplicable as barring 2009-10, production of rice in all other years exceeded 90 million tonnes, which had been achieved only once previously in 2001-02. Similarly, in the case of wheat, the production increased steadily from 69 million tonnes in 2005-06 to over 94 million tonnes in 2012-13.

Moreover, the quantum of foodgrains procured by the Food Corporation of India has also remained quite healthy in recent years as a result of which the stocks available with the FCI have been well over the buffer stock norms. The key objective of the buffer stock include providing foodgrains under the Targeted Public Distribution System (TPDS), ensure food security during the periods when production is short of normal demand during bad agricultural years and stabilize prices during period of production shortfall through open market sales. While

the buffer stock has been used for the TPDS, it is evident that the government did not resort to enough open market sales to reign in spike in prices due to demand and supply imbalances, despite holding stocks well above the buffer stock norms.

The supply response of MSP policy has been quite asymmetric. In the case of grains, India has emerged from a situation of massive shortages, to a grain surplus country with self-reliance in food grains. At the same time, the policy by being skewed mainly towards the production of rice and wheat at the cost of cultivation of pulses, oilseeds and other crops, has created serious imbalances in demand and supply of many principal crops in the country. Despite moderate increase in annual growth rate of production of pulses in the 2000s, India has been facing massive shortages of pulses as well as edible oils, and now has to meet about 10% of its demand for pulses and close to 50% of the demand for edible oil from import, thereby being vulnerable to international price fluctuations. .

E. Impact of Policies

The inflationary potential of the fiscal deficit is generally analyzed by looking at its impact on reserve money, which via the money multiplier, leads to an increase in money supply, which in turn leads to inflation. The first channel is through money creation or seignorage. Sargent and Wallace (1981) argue that fiscally dominant governments, which run persistent deficits will sooner or later turn to finance these deficits with money creation, thereby leading to inflation. This `fiscal view' of inflation has been especially prominent in developing countries, which tend to be characterized by less efficient tax collection, political instability, and more limited access to external borrowings. These lower the relative cost of seignorage and increase the dependence on the inflation tax (Alesina and Drazen (1991) and Cukierman et al. (1992)). Thus in many of these economies, rapid monetary growth is often driven by fiscal imbalances, implying that rapid inflation is always a fiscal phenomenon.

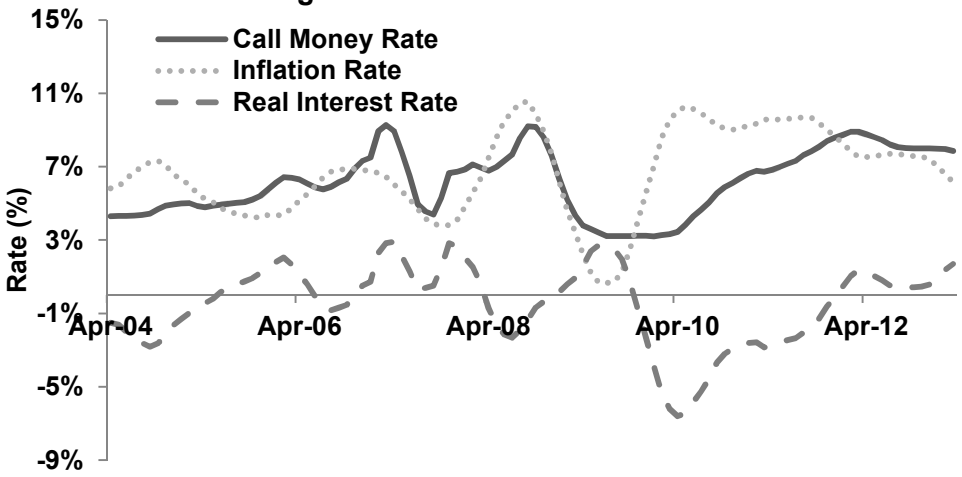
Secondly, fiscal deficit can have a direct impact on inflation through increase in aggregate demand. Even in this case, the increase in aggregate demand due to a fiscal deficit would automatically result in higher money supply by raising the demand for money. In the Liquidity Adjustment Facility (LAF) framework followed in India, a rise in demand for money associated with a higher fiscal deficit will have to be accommodated to keep the call money rate within the LAF corridor (repo and reverse repo rate) of interest rates. As per the LAF based operating procedure of monetary policy, money supply is endogenous and demand driven. Thus in either case the extent to which a rise in fiscal deficit results in an increase in money supply, the associated inflation risk must be considered as a fiscal, and not a monetary, phenomenon.

India had moved towards a path of fiscal consolidation with the adoption of the Fiscal Responsibility and Budget Management Act (FRBMA) in 2003. Consequently, the consolidated state and central government fiscal deficit dropped from 9.6% of GDP in 2002-03 to 4.1% in 2007-08 while the revenue deficit dropped from 6.6% to 0.2% over the same period. However, the situation changed significantly since then with the consolidated fiscal and revenue deficits worsening to 9.4% and 5.7%, respectively in 2009-10. These estimates are on the conservative side as they excluded the off-budget energy subsidies. While the deficit has moderated somewhat in recent years, it continues to remain high compared to most other emerging economies as well as historical levels observed between 2003 and 2007.

The worsening of the fiscal deficit was driven to an extent by the policy response to the global financial crisis of 2008. As the impact of the crisis reached Indian shores in September 2008, a slew of fiscal stimulus measures consisting of tax cuts and additional spending were announced over the next few months to prevent a severe recession. Dasgupta and Sen Gupta (2011)

estimate the post crisis stimulus offered by the central government in late 2008 and early 2009 amounted to 1.7% of GDP. While this was in line with what many other developed and emerging economies were providing there were two major differences. First, well before the advent of the crisis, India introduced a series of stimulus measures in early 2008 in the form of farm debt waiver, expanding the coverage of MGNREG scheme and liberal increases in the salaries of public sector employees under the Sixth Pay Commission. These pre-crisis stimulus measures amounted to close to 2% of GDP. Secondly, most of the pre- and post-crisis stimulus measures were aimed at boosting consumption. The share of capital expenditure in overall expenditure declined from an average of 17.5% during 2003-04 to 2007-08 dropped to 11.6% over the period 2008-09 to 2012-13. This was in contrast to PRC, where a substantial portion of the stimulus package of 2008-09 was in the form of extra outlays on infrastructure, particularly in the transport and energy subsectors. This holds true for the agriculture sector as well as pointed out in Section 3.2.2.Government spending in agriculture being increasingly skewed towards subsidies and away from public capital formation and development of new technology. This has contributed to low yields as well as high post-harvest loss, thereby exacerbating the demand supply gap.

Figure 15: Real Interest Rates



Source: Database on the Indian Economy

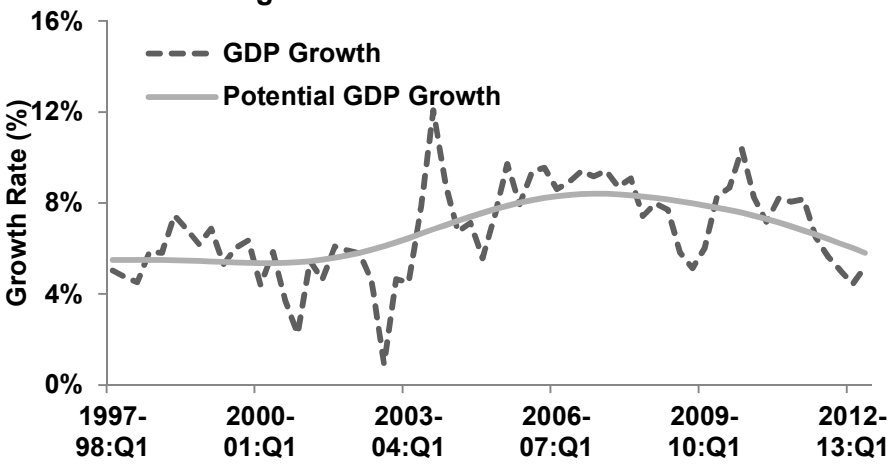
The empirical evidence on the impact of the fiscal deficit on inflation in recent years is mixed. Gulati and Saini (2013) find fiscal deficit to be the biggest contributor to inflation with 1% increase in fiscal deficit raising headline inflation by 0.45% and food inflation by 0.47% in the following year. Using the data over a longer term period Khundrakpam and Pattanaik (2010) find that there is a cointegrating relationship between the price level and seigniorage financing of deficit as well as between fiscal deficit and price level. In both cases the price level appears to be determined by seigniorage or fiscal deficit, not the other way round. Furthermore, while the role of seigniorage in the inflation process may be declining over time, particularly in recent years, the impact of fiscal deficit on inflation through aggregate demand might have increased. In fact one percentage point increase in the level of fiscal deficit is estimated to cause as much as 0.6 percentage point increase in WPI, suggesting the possibility of high fiscal deficit affecting inflation expectations.

In contrast, Khundrakpam and Pattanaik (2010) point out that while the fiscal stimulus during 2008 and 2009 led to increase in the fiscal deficit level, it did not have much of a contributing role in fueling inflation as the overall private demand remained depressed during this period. The fiscal expansion only aimed at partially offsetting the impact of deceleration in the growth of

private consumption and investment demand on economic growth, and large borrowing programme of the Government did not lead to high money growth, since the growth in demand for credit from the private sector exhibited significant deceleration. Thus, the conventional channels through which fiscal deficit could cause inflation, i.e., by exerting pressure on aggregate demand in relation to potential output and by leading to excessive expansion in money growth were almost absent.

The rise in WPI based inflation since middle of the 2009 forced the RBI to hike the key interest rates. Between March 2010 and October 2011, the repo rate was raised 13 times resulting in a cumulative increase of 375 basis points. However, most of this was done in small steps as a result of which inflationary expectations became unhinged. As can be seen from Figure 15, throughout the entire period of monetary tightening, real interest rates continued to remain negative, and thereby did not have the desired impact on aggregate demand. The real rates turned positive, only in early 2012, when there was a decline in inflation rates. In fact, a contemporaneous correlation between the weighted average overnight call money rate and the monthly inflation rate produces a R2 = 0:48, whereas the correlation between the call money rate and six month lagged inflation rate produces a higher R^2 = 0.65, indicating that interest rates were responding with a lag to inflation rates.

Figure 16: Potential Growth Rate



Source: Database on the Indian Economy, Reserve Bank of India

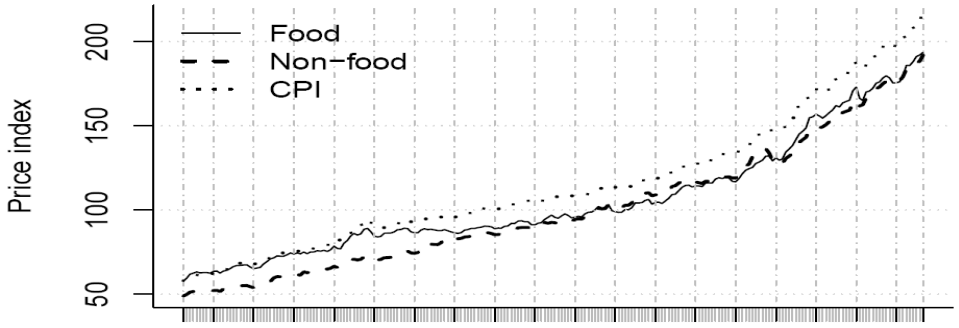
The gradual increase in interest rates was pursued with the belief that inflation was driven by supply constraints. These constraints along with the global slowdown and the policy and regulatory logjam in 2010 and 2011 lowered the potential growth rate. Figure 16 shows that the potential growth rate dropped from a peak of 8.6% in 2006-07 to below 6% in 2012-13.

IV. TRANSMISSION FROM FOOD TO NON FOOD AND AGGREGATE INFLATION

In the backdrop of persisting high food inflation in India, it is important to gauge the transmission of food inflation to non-food inflation and finally to the aggregate inflation for the effective implementation of policies in the economy. It is commonly argued that rising food inflation shifts demand from food to non-food items, causing upward pressure on non-food inflation via substitution effect. While food inflation has a direct impact on the aggregate inflation, the latter may experience further rise due to the second round effect caused by inflationary pressure on non-food articles.

In our analysis, the non-food and non-oil component of WPI is used as the proxy for non-food prices.[11] We use Consumer Price Index for industrial workers (CPI-IW) as a proxy for the aggregate inflationary scenario.[12] Figure 17 depicts the movements in food, non-food and aggregate prices over time. The figure shows a clear co-moving pattern among all the three price levels. We investigate time series properties of food, non-food and aggregate prices and possible co-integrating relation among the three.[13] Our analysis spans the period from January, 1999 to September, 2012. The price series in logs are found to be I(1) as we cannot reject the null of existence of unit root at 1, 5, and 10% level of significance. The first difference of logged price series, i.e., month-on-month inflation are found to be stationary as the null of unit root is rejected at 1, 5 and 10% level of significance. The results of the unit root tests are given in Tables A3, and A4 in the Appendix.

Figure 17: Trend in Food, Non-Food and CPI Price Levels



Source: Authors' Estimates

The trace test under Johansen co-integration test reveals one co-integrating relation among the price series at 5% and 10% level of significance. However, under the maximal eigenvalue test, the null hypothesis that there is no co-integration relation among the price series against the alternative that there is one co-integrating relation, cannot be rejected at 1%, 5% and 10% level of significance. The results are reported in Table A5 and A6 in the Appendix.[14] We estimate a Structural Vector Error Correction Model (SVECM) among food, non-food and aggregate prices. The ordering of the variables follows from food prices to non-food prices and finally to the aggregate price index captured by CPI. The short run shock structure assumes that food price instantaneously affects non-food and aggregate prices but not vice versa. While, non-food price affects aggregate price instantaneously but not vice versa. The SVECM model estimated for food, non-food and aggregate prices is as follows:

$$\Delta y_t = \mu + \alpha\beta y_t + A_1 \Delta y_{t-1} + \cdots + A_{p-1} \Delta y_{t-p+1} + u_t$$

where,

[11] The non-food price series is obtained using the following formula:

$$\text{Non-food price} = \frac{\text{WPI-}w_{fa}\text{WPI food articles} - w_{fm}\text{WPI food products} - w_{fu}\text{WPI fuel}}{1 - w_{fa} - w_{fm} - w_{fu}}$$

where the weights used in the above formula are given in Appendix Table A2.

[12] CPI-IW with base year 2001 is sourced from the Labour Bureau.

[13] CPI, food non-food prices are seasonally adjusted using x-12 ARIMA of U.S. Census Bureau.

[14] The Johansen co-integration trace test statistic tests the null hypothesis: there are at most r co-integrating relations" against the alternative of m co-integrating relations, $m = 0,1,2 \ldots . m - 1$

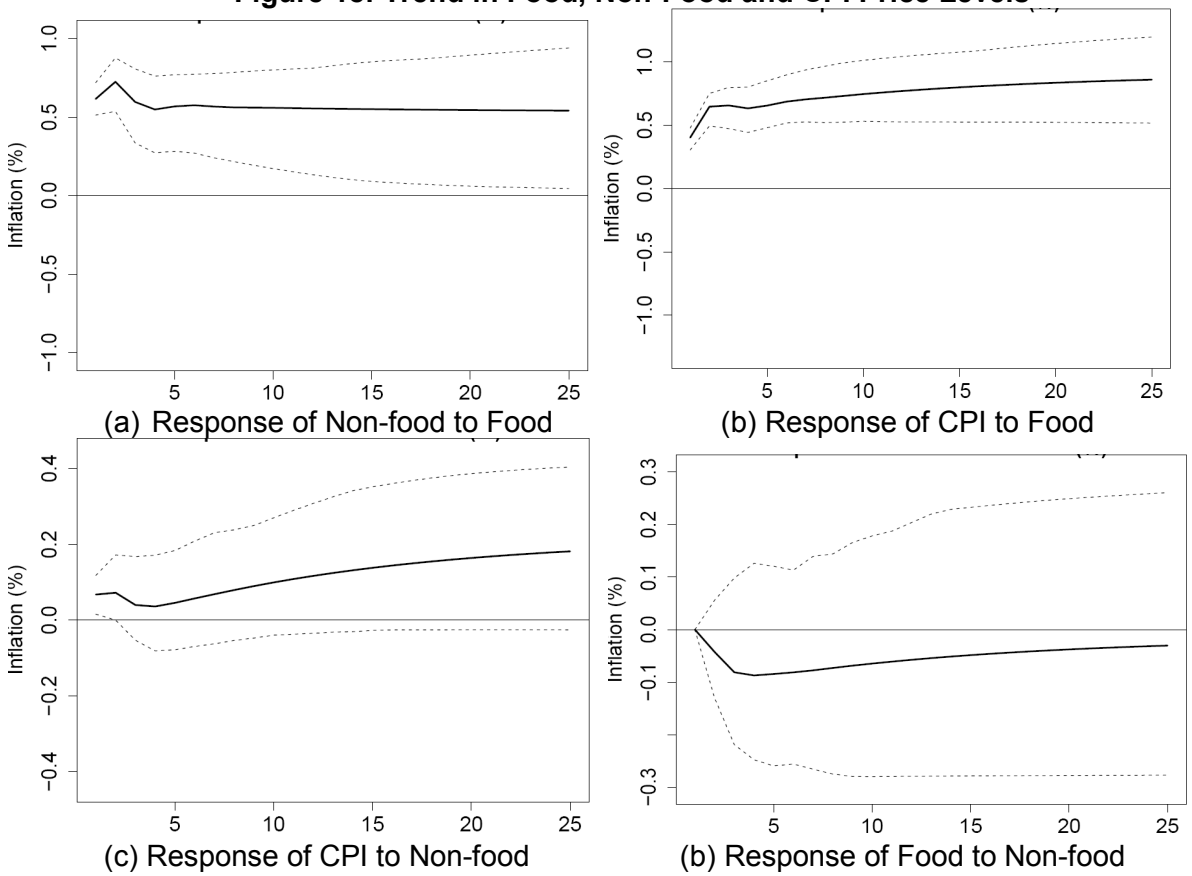
$$y_t = \begin{pmatrix} \ln(\text{food})_t \\ \ln(\text{non-food})_t \\ \ln(\text{cpi})_t \end{pmatrix}$$

$$\begin{bmatrix} u_t^{\text{food}} \\ u_t^{\text{non-food}} \\ u_t^{\text{cpi}} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ b_{\text{non-food}}^{\text{food}} & 1 & 0 \\ b_{\text{cpi}}^{\text{food}} & b_{\text{cpi}}^{\text{non-food}} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_t^{\text{food}} \\ \varepsilon_t^{\text{non-food}} \\ \varepsilon_t^{\text{cpi}} \end{bmatrix}$$

where u_t is the reduced form error and ε_t denotes the structural error.

The dynamic effects of a shock to food inflation on non-food and aggregate inflation are captured by the impulse response analysis. Since all three prices are endogenous to each other in a dynamic framework, a shock to food inflation at period t causes an impulse on non-food and aggregate inflation in period $t+1$, which in turn affects food, non-food and aggregate inflation in the subsequent periods via endogeneity among these prices over time. These dynamics of transmission mechanism are captured by impulse responses.

Figure 18: Trend in Food, Non-Food and CPI Price Levels



(a) Response of Non-food to Food

(b) Response of CPI to Food

(c) Response of CPI to Non-food

(b) Response of Food to Non-food

Source: Authors' Estimates

Figure 18 depicts results of impulse response analysis. One unit shock to food inflation which causes food inflation to increase by 1%, will raise non-food inflation by 0.61% immediately after the occurrence of the shock. The effect increases to 0.72% in the next period followed by a reduction to 0.55% that persists till 20 months after the shock.

One unit shock to food inflation that causes food inflation to increase by 1%, raises CPI by 0.65% after two months of the shock and exerts a persistent upward pressure on the aggregate inflation.

A 1% rise in non-food inflation exerts upward pressure on CPI inflation, but the effects are not statistically significant. Finally, we do not find any evidence of the second round impact on food inflation due to non-food inflation via rise in nominal income in non-food sector.

Finally, the results of Forecast Error Variance Decomposition (FEVD) analysis convey the variations in non-food and aggregate inflation due to food inflation. Table 12 reports the FEVD results.

Table 12: FEVD Analysis

	Horizon	Food	Non-food	CPI
FEVD for Food Inflation	1	100.000	0.000	0.000
	5	97.476	0.448	2.076
	10	97.729	0.477	1.794
FEVD for Non-Food Inflation	1	54.292	45.708	0
	5	48.834	50.923	0.242
	10	46.116	53.567	0.317
FEVD for CPI Inflation	1	46.013	1.284	52.702
	5	63.468	0.503	36.029
	10	72.099	0.761	27.14

Source: Authors' Estimates

The FEVD analysis shows that 1 month out, 54% of variation in non-food inflation is due to variation in food inflation, whereas food inflation contributes 46% variation in aggregate inflation after 1 month of the shock.

The variation in non-food inflation due to food inflation declines to 46% after 10 months. The variation in aggregate inflation caused by food inflation increases to 72% after 10 months of the shock.

V. CONCLUSION

The key objective of the paper was to analyze the various drivers of food inflation in India. With food inflation becoming increasingly persistent and broad based, it has become imperative to identify factors that are driving the rapid increase in prices. Our analysis indicates limited role of international prices, although the co-movement between domestic and international prices tends to be lower for cereals and dairy products, and higher for tradeables like edible oils and meat. The widening gap between demand and supply of major food groups is a significant contributor to food inflation. Our analysis indicates that that there demand has persistently outstripped supply in the case of cereals, pulses, meat and fish. India's yield in major food products has stagnated due to inefficient investment in technology and agriculture marketing infrastructure.

Rise in prices of key inputs have also impacted the prices of various commodities. The rapid increase in price of fuel in recent years is found to exert a strong influence in food prices. A part of the increase in price of meat is explained by a sharp increase in price of oilcakes, which is a major source of livestock feed. Introduction of the Nutrition Based Subsidy scheme also resulted in a rapid increase in some fertilizer prices. Finally, rapid growth in agricultural wages also contributed to food inflation as rural wages have risen at a pace in excess of the inflation rate since 2007, and in particular agricultural wages have risen at a much faster pace than non-agricultural wages.

Certain policy interventions have also contributed to food inflation by exacerbating the demand supply mismatch. The sharp rise in MSPs since 2007 have been associated with much higher increase in retail prices of some commodities. An expansionary fiscal policy, largely aimed at boosting consumption, also contributed to widening the demand supply mismatch. At the same time, while monetary policy was tightened, it was done in a gradual manner and lagged the rise in inflation as a result of which real interest rate remained negative through most of this period, and had little impact on aggregate demand.

Our analysis also indicated that there is a significant evidence of transmission of food inflation to non-food inflation and aggregate inflation. A rise in food inflation has an impact on non-food and aggregate inflation, with the effects being quite persistent. Moreover, in both the cases the impact turns out to be quite persistent and takes a long time die out Thus the key drivers of food inflation have been broad based, ranging from transmission from international prices in the case of selected commodities, demand supply mismatches across a broad range of products, rise in prices of key inputs and policy interventions. Thus long standing structural factors combined with emerging dietary changes and government responses have contributed to persistent high inflation. With the trend of rising demand driven by increasing per capita income and increase in key input prices likely to continue it is evident that a sustainable decline in food inflation will require a much improved supply side response. This can happen only with greater investment in agricultural infrastructure to improve production and marketing of agricultural commodities and availability of technology that will improve farm output in newer areas.

Overall, this paper attempts to undertake an initial exploratory analysis of the various factors driving food inflation in India. Further in depth research is warranted on the various channels identified in the paper above.

APPENDIXES

Table A1: Correlation between Price Movements of Various Food Products across Different Zones

	Rice	Wheat	Gram Dal	Tur Dal	Urad Dal	Moong Dal	Masoor Dal	Sugar
South Zone-West Zone	0.891	0.777	0.973	0.775	0.740	0.841	0.419	0.853
South Zone-North Zone	0.931	0.858	0.991	0.721	0.762	0.879	0.451	0.982
South Zone-East Zone	0.821	0.877	0.981	0.508	0.873	0.850	0.453	0.975
West Zone-North Zone	0.950	0.940	0.966	0.921	0.772	0.889	0.872	0.884
West Zone-East Zone	0.791	0.909	0.956	0.708	0.893	0.935	0.936	0.892
North Zone-East Zone	0.839	0.952	0.978	0.662	0.821	0.876	0.936	0.990

Table A1(contd.): Correlation between Price Movements of Various Food Products across Different Zones

	Groundnut Oil	Mustard Oil	Vanaspati Oil	Sunflower Oil	Soya Oil	Potato	Tomato	Onion
South Zone-West Zone	0.937	0.818	0.923	0.970	0.860	0.843	0.540	0.938
South Zone-North Zone	0.879	0.888	0.950	0.668	0.780	0.882	0.792	0.988
South Zone-East Zone	0.902	0.907	0.912	0.942	0.884	0.802	0.676	0.982
West Zone-North Zone	0.837	0.792	0.926	0.731	0.955	0.747	0.856	0.944
West Zone-East Zone	0.833	0.750	0.894	0.929	0.966	0.597	0.919	0.936
North Zone-East Zone	0.940	0.955	0.930	0.591	0.930	0.852	0.884	0.983

Table A2: Weights in sub-components of WPI

Weights	**Weights**	**1993-94 base**	**2004-05 base**
Weight of WPI food articles	w_{fa}	15.40246	14.33709
Weight of WPI food products	w_{fm}	11.53781	9.97396
Weight of WPI fuel	w_{fu}	14.22624	14.91021

Source: Authors' Estimates

Table A3: Results of Unit Root Test in Price Levels

	Test Statistic	1%	5%	10%
		-3.46	-2.88	-2.57
Fuel	-0.32			
Food (SA)	0.94			
Non-food (SA)	0.56			
CPI-IW (SA)	0.45			

Source: Authors' Estimates

Table A4: Results of Unit Root Test in POP Inflation Rates

	Test Statistic	1%	5%	10%
		-3.46	-2.88	-2.57
Fuel	-9.14			
Food (SA)	-12.05			
Non-food (SA)	-10.29			
CPI-IW (SA)	-9.28			

Source: Authors' Estimates

Table A5: Johansen Co-integration Tests for Fuel and Food Price Levels

		Test Statistics	10%	5%	1%
Trace Test	r ≤ 1	1.36	6.5	8.18	11.65
	r = 0	6.82	15.66	17.95	23.52
Eigen value Test	r ≤ 1	1.36	6.5	8.18	11.65
	r = 0	5.46	12.91	14.9	19.19

Source: Authors' Estimates

Table A6: Johansen Co-integration Test for Food, Non-food and CPI-IW Price Levels

		Test Statistics	10%	5%	1%
Trace Test	r ≤ 2	5.85	6.5	8.18	11.65
	r ≤ 1	15.68	15.66	17.95	23.92
	r = 0	32.56	28.71	31.52	37.22
Eigen value Test	r ≤ 2	5.85	6.5	8.18	11.65
	r ≤ 1	9.83	12.91	14.9	19.19
	r = 0	16.89	18.9	21.07	25.75

Source: Authors' Estimates

REFERENCES

Alesina, Alberto, and Drazen, Allan (1991), “Why Are Stabilizations Delayed?", *American Economic Review*, 81 (5), pp. 1170-88

Bai, Jushan, and Perron, Pierre (1998), “Estimating and Testing Linear Models with Multiple Structural Changes", *Econometrica*, 66 (1), pp. 47-78

Bai, Jushan, and Perron, Pierre (2003), “Computation and Analysis of Multiple Structural Change Models", *Journal of Applied Econometrics*, 18 (1), pp. 1-22.

Banks, James, Blundell, Richard, and Lewbel, Arthur (1997), “Quadratic Engel Curves and Consumer Demand", *The Review of Economics and Statistics*, 79 (4), pp. 527-539.

Berg, Erlend, Bhattacharyya, Sambit, Durgam, Rajasekhar, and Ramachandra, Manjula (2012), “Can Rural Public Works Affect Agricultural Wages? Evidence from India", CSAE Working Paper Series 2012-05, Centre for the Study of African Economies, University of Oxford.

Bhalla, Surjit S. (2013), “Puzzle of High CPI Inflation”, Indian Express, November 23, 2013

Bhalla, Surjit S., Choudhary, Ankur, and Mohan, Nikhil (2011), “Indian Inflation: Populism, Politics and Procurement Prices", Developing Trends: Oxus Research Report.

Carrasco, Bruno and Mukhopadhyay, Hiranya (2012) “Food Price Escalation in South Asia”, *Economic and Political Weekly*, 47(46), pp. 59-70.

Chand, Ramesh (2010), “Understanding the Nature and Causes of Food Inflation", *Economic and Political Weekly*, 45 (9), pp. 10-13.

Cukierman, Alex, Edwards, Sebastian, and Tabellini, Guido (1992), “Seigniorage and Political Instability", *American Economic Review*, 82 (3), pp. 537-55.

Dasgupta, Dipak, Dubey, R. N., and Sathish, R. (2011), “Domestic Wheat Price Formation and Food Inflation in India:", Department of Economic Affairs Working Paper No.2/2011.

Dasgupta, Dipak, and Sen Gupta, Abhijit (2011), “India: Rapid Recovery and Stronger Growth after the Crisis", in The Great Recession and Developing Countries, (editor) Mustapha K. Nabli, World Bank, pp. 235-302.

Deaton, Angus, and Dreze, Jean (2009), \Food and Nutrition in India: Facts and Interpretations", *Economic and Political Weekly*, 44 (7), pp. 42-64.

Fuglie, Keith O., (2004). “Challenging Bennet's law: The New Economics of Starchy Staples in Asia," *Food Policy*, Vol. 29(2), pages 187-202, April.

Gulati, Ashok (2012), “Switch from Farm Subsidy to Farm Investment", Economic Times, August 6, 2012.

Gulati, Ashok, Jain, Surbhi, and Hoda, Anwarul (2013a), “Farm Trade: Tapping the Hidden Potential", Commission for Agricultural Costs and Prices Discussion Paper No. 3.

Gulati, Ashok, Jain, Surbhi, and Satija, Nidhi (2013b), “Rising Farm Wages in India: The Pull and Push Factors", Commission for Agricultural Costs and Prices Discussion Paper No. 5.

Gulati, Ashok, and Saini, Shweta (2013), “Taming Food Inflation in India", Commission for Agricultural Costs and Prices Discussion Paper No. 4.

Imbert, Clement, and Papp, John (2012), “Equilibrium Distributional Impacts of Government Employment Programs: Evidence from India’s Employment Guarantee", Mimeo.

IMF (2012), “World Economic Outlook: Coping with High Debt and Sluggish Growth", International Monetary Fund.

Kapur, Muneesh (2012), “Inflation Forecasting: Issues and Challenges in India", Reserve Bank of India Working Paper No. 01/2012.

Khundrakpam, Jeevan Kumar, and Pattanaik, Sitikantha (2010), “Fiscal Stimulus and Potential Inflationary Risks: An Empirical Assessment of Fiscal Deficit and Inflation Relationship in India", *Journal of Economic Integration*, 25, pp. 703-721.

Kumar, Praduman, Kumar, Anjani, Parappurathu, Shinoj, and Raju, SS (2011), “Estimation of Demand Elasticity for Food Commodities in India", Agricultural Economics and Research Review, 24, pp. 1-14.

Kumar, Surender, and Chandra, Nandini (2010), “Sustainability Concerns in Indian Agriculture: An Analysis of Subsidies and Investment", Available at SSRN.

Mittal, Surabhi (2010), “Application of the QUAIDS Model to the Food Sector in India", Journal of Quantitative Economics, 8 (1), pp. 42-54.

Narayanan, Sudha, and Hussain, Azhar (2013), “Revisiting Fertilizer and Power Subsidies to Agriculture in India", IGIDR Working Paper, Forthcoming.

Sargent, Thomas J., and Wallace, Neil (1981), “Some Unpleasant Monetarist Arithmetic", Quarterly Review, 5 (3), pp. 1-17.9