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*Transmission of World Commodity Prices to Domestic Commodity Prices in India and China**

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Abstract

This paper examines the extent to which changes in global agricultural commodity price are transmitted to domestic prices in India and China. The focus is on short and medium-run adjustment processes using an error correction specification. In particular, we show that the extent of adjustment in the short and medium- run (from 0 to 3 years) is generally larger in China than in India. Second, the adjustment is larger for wheat, maize and rice than for fruits and vegetables in both India and China. In fact, the adjustment is the weakest for vegetables in both countries. Third, while most of the domestic commodity prices co-move with global prices, the transmission is *incomplete* presumably because of distortionary government interventions (e.g. subsidies for agricultural commodities) and failure to exploit spatial arbitrage. So potential benefits to farmers of higher food prices –especially in India-may be restricted, as also the supply response.

Keywords: agricultural commodities, prices, cointegration, error-correction model, adjustment

JEL Codes: C22, O13, Q11

I. Introduction

This paper examines the extent to which changes in global agricultural commodity prices are transmitted to domestic prices in India and China. The focus is on short and the medium-run adjustment processes, drawing upon Baffes and Gardner (2003) and Mundlak and Larson (1992). This is particularly important given the recent surge of oil and agricultural commodity prices. Among others, Imai, Gaiha and Thapa (2008) demonstrate that some price shocks are likely to persist for a long time[1].

As emphasised in a recent OECD-FAO report (2008), while some of the reasons for spiraling prices are transitory (e.g. drought in Australia), there are also structural factors underpinning prices that will sustain them at higher average levels than in the past. The latter include steady growth in demand for food and other commodities linked to population and income growth as well as dietary changes in emerging economies (notably China and India). But there are also some sources of uncertainty: energy prices, the diversion of land and crops for bio-energy and climate change.

The next section describes the data and methodology.

II. Data and Methodology

Data

The present study draws upon annual commodity price data series both at the global and country levels for India and China from 1966 to 2005,[2] given in FAO-STAT and UNCTAD commodity price statistics.[3, 4] We have used the price data for wheat, maize, rice, fruits and vegetables for the world, India and China, respectively.

Methodologies

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[1] Other recent contributions include IFPRI(2007), and Sarris (2008).
[2] See Imai, Gaiha, and Thapa (2008) for details.
[3] The new version of FAO-STAT data (from 1990 to 2005) is available on http://faostat.fao.org/site/570/DesktopDefault.aspx?PageID=570 and the old version (since 1966) is on http://faostat.fao.org/site/408/DesktopDefault.aspx?PageID=408 (both accessed on 27th November 2007).
[4] A discontinuity is found between 1990 and 1991 for most of the commodity prices for China in FAO-STAT data series. The reason for the discontinuity is not clear because FAO simply makes available the old data prior to 1990 which the Chinese government reported without giving any explanation for the change of the criteria. We have rescaled the data using the change of CPI from 1990 to 1991 to make the two series comparable. A cautious interpretation of the results is thus necessary.

The methodology is based on Baffes and Gardner (2003) and Mundlak and Larson (1992). First of all, in order to see if the price data for the world, India and China are stationary, we carry out a variant of the augmented Dickey-Fuller test in which the time-series is transformed via a Generalised Least Squares (GLS) regression based on Elliot, Rothenberg, and Stock (1996). This has significantly higher power than the previous versions of the augmented Dickey-Fuller test. We perform unit root tests for both levels and logarithms of price series.

The most straightforward test of price transmission is to run the OLS regression for equation (1), as in Mundlak and Larson (1992).

$$p^d{}_t = \alpha + \beta\, p^w{}_t + e_t \qquad (1)$$

where $p^d{}_t$ is the annual domestic agricultural commodity price for India or China and $p^w{}_t$ is the world agricultural commodity price, and e_t is an error term. The coefficient β reflects the change of $p^d{}_t$ in response to one unit change of $p^w{}_t$. R^2 for (1) (or t value for the coefficient estimate of β) shows how much variation in $p^d{}_t$ is expressed by $p^w{}_t$. From this specification, we can test the hypothesis that the coefficient β is unity and the intercept is zero, that is:

$$H_0 : \alpha + 1 = \beta = 1$$

Under H_0 the deterministic part of (1) becomes $p^d{}_t = p^w{}_t$, in turn implying that the price differential, $p^d{}_t - p^w{}_t$, is white noise, although it is unlikely this will hold due to state interventions in commodity markets or other factors inhibiting spatial arbitrage. It is also noted that the regression results based on (1) are spurious if $p^w{}_t$ and/or $p^d{}_t$ are non-stationary (Baffes and Gardner, 2003). Consequently, the regression results are no more than a first approximation to the results based on the error-correction specification in Baffes and Gardner (2003).

A logarithmic transformation of (1) is:

$$\log p^d{}_t = \alpha' + \beta' \log p^w{}_t + \varepsilon_t \qquad (1)'$$

In this case, β' expresses the percentage change of $p^d{}_t$ in response to one percentage change of $p^w{}_t$, that is, the elasticity of domestic commodity price with respect to the world price. The caveat for (1) stated earlier applies to (1)' as well.

We could restrict the parameters of (1) or (1)' according to H_0. That is, under H_0, (1) or (1)' is equivalent to testing for unit root in the following equations.

$$\left(p^{d}{}_{t} - p^{w}{}_{t}\right) \sim \ I(0) \qquad (2)$$

or $$\left(\log p^{d}{}_{t} - \log p^{w}{}_{t}\right) \sim \ I(0) \qquad (2)'$$

We will perform the unit root tests based on a Generalised Least Squares (GLS) regression. If the price difference is stationary, then one can conclude that domestic prices would follow the world price in the long run (Baffes and Gardner, 2003).

To test more precisely the short and long- run adjustments, we need to introduce lags of $p^{d}{}_{t}$ and $p^{w}{}_{t}$ in estimating $p^{d}{}_{t}$ from the error correction model (ibid. 2003). That is,

$$p^{d}{}_{t} = \alpha + \beta_1 p^{w}{}_{t} + \beta_2 p^{d}{}_{t-1} + \beta_3 p^{w}{}_{t-1} + e_t \qquad (3)$$

We impose homogeneity restriction on (3) (Hendry et al. 1984); that is, restrict the slope parameters β_i to sum to unity. Suppose $\beta_3 = 1 - \beta_1 - \beta_2 \equiv \beta$ and $1 - \beta_2 \equiv \gamma$

Then equation (3) can be expressed as-

$$\left(p^{d}{}_{t} - p^{d}{}_{t-1}\right) = \alpha + \gamma\left(p^{w}{}_{t-1} - p^{d}{}_{t-1}\right) + \beta\left(p^{w}{}_{t} - p^{w}{}_{t-1}\right) + e_t \qquad (4)$$

Equation (4) in logs takes the form:

$$\left(\log p^{d}{}_{t} - \log p^{d}{}_{t-1}\right) = \alpha + \gamma\left(\log p^{w}{}_{t-1} - \log p^{d}{}_{t-1}\right) + \beta\left(\log p^{w}{}_{t} - \log p^{w}{}_{t-1}\right) + e_t \qquad (4)'$$

If domestic and world prices are difference stationary and the difference of domestic price and world price is stationary, as in equation (2), all series in (4)' are stationary. Because of the one-to-one correspondence between the existence of cointegration and an error correction specification (Engle and Granger, 1987), examining stationarity of (2) or (2)' is equivalent to testing the restrictions imposed on (3), yielding (4) or (4)' (Baffes and Gardner, 2003).

In equation (4) or (4)', β shows short-term adjustment, that is, how much of the price change in world price series in the current period is transmitted to the price change in domestic price series. γ is the adjustment coefficient; that is, how much of the difference between the world and domestic prices in the previous period would affect the price change from the previous period to the current period. For example, a positive coefficient implies that if the world price was higher than the domestic price in the previous period (e.g. a surge in oil price raises global commodity price), the domestic price tends to rise with a lag.

An important question is how long does it take for the domestic commodity price to adjust to the international commodity price. Let k be the extent of adjustment which takes place in *n* periods where the current period is defined as *n* =0 and the next period is *n* =1. Baffes and Gardner (2003) show that k is given by

$$k = 1 - (1-\beta)(1-\gamma)^n \qquad (5)$$

For brevity, we report below the adjustments in one, two and three years in each case.

III. Econometric Results

In this section we will summarise the econometric results based on the model described earlier. First, we carried out DF-GLS tests for price series in logs and not in logs. Table 1 shows that most of the price series in logarithm for the world, India and China are

I (1) except the world rice price and maize price for India (I(0)). The results are consistent with graphical representations of log commodity prices shown in Appendix 1 -Appendix 4. We obtained similar results for prices not in logs, that is, most of the price series are I(1) except world prices for wheat, rice and maize (Table 2). Also, most of the price series in logarithm for the world, India and China are I(1) except world rice price and maize price for India (I(0)).

Table 3 gives the results based on the error correction model corresponding to equations (4) and (4)' for India. The adjustments in 1, 2 and 3 years, based on equation (5), are shown in the last three columns. Short-run effect denotes instant adjustment or in year 0. This is then modified by the adjustment coefficient in subsequent years. The adjustment patterns are similar for wheat, maize, and rice. Specifically, the short-run effects of 23% for log prices and 30% to 34% for unlogged prices are adjusted upwards in 3 years to 45%-62% for logged prices and 63% to 78% for non- log prices. The adjustment effects for fruits and vegetables are weaker. The initial adjustment of 13% for log price of fruit (or 10% for non- log price) rises to 47% (or 35%) in 3 years. In the case of vegetables, the initial effects are, however, negative and are adjusted to 18% for logged price (or 9% for unlogged price).

Table 1 Unit Root Test (DF-GLS test) for log of agricultural commodity prices, World, India and China

World — DF-GLS Test

	With Trend				Without Trend			
	Test Statistics [a, b]		Lags [c]		Test Statistics [a, b]		Lags [c]	
I. Price -Levels								
log (Wheat)	-3.022		1	I(1)	-1.781		1	I(1)
log (Maize)	-1.964		1	NA	-1.771		1	I(1)
log (Rice)	-3.463	*	1	I(0)	-2.841	*	1	I(0)
log (Fruit)	-1.912		1	I(1)	-0.271		1	I(1)
log (Vegetable)	-2.919		1	I(1)	-1.164		2	I(1)
Price- First Differences								
Dlog (Wheat)	-6.886	**	1		-6.806	**	1	
Dlog (Maize)	-2.557		1		-2.492	**	1	
Dlog (Rice)	-5.982	**	1		-4.786	**	1	
Dlog (Fruit)	-5.078	**	1		-5.599	**	1	
Dlog (Vegetable)	-8.211	**	1		-7.739	**	1	

India — DF-GLS Test

	With Trend				Without Trend			
	Test Statistics [a, b]		Lags [c]		Test Statistics [a, b]		Lags [c]	
I. Price -Levels								
log (Wheat)	-2.631		1	I(1)	-1.143		2	NA
log (Maize)	-3.339	*	1	I(0)	-3.753	**	1	I(0)
log (Rice)	-1.724		1	I(1)	-1.371		1	I(1)
log (Fruit)	-2.229		1	I(1)	-0.157		1	I(1)
log (Vegetable)	-1.570		1	I(1)	-0.281		1	I(1)
Price- First Differences								
Dlog (Wheat)	-5.633	**	1		-0.632		6	
Dlog (Maize)	-5.476	**	1		-2.424	*	2	
Dlog (Rice)	-5.809	**	1		-5.413	**	1	
Dlog (Fruit)	-3.287	*	1		-2.231	*	1	
Dlog (Vegetable)	-3.509	*	1		-3.294	*	1	

China — DF-GLS Test

	With Trend				Without Trend			
	Test Statistics [a, b]		Lags [c]		Test Statistics [a, b]		Lags [c]	
I. Price -Levels								
log (Wheat)	-2.121		1	I(1)	-1.803		1	I(1)
log (Maize)	-1.356		1	I(1)	-1.183		1	I(1)
log (Rice)	-1.617		1	I(1)	-1.148		1	I(1)
log (Fruit)	-1.452		1	I(1)	-0.873		1	I(1)
log (Vegetable)	-1.532		1	I(1)	-0.959		1	I(1)
Price- First Differences								
Dlog (Wheat)	-3.800	**	1		-3.744	**	1	
Dlog (Maize)	-4.328	**	1		-4.211	**	1	
Dlog (Rice)	-4.508	**	1		-4.336	**	0	
Dlog (Fruit)	-4.463	**	1		-3.987	**	1	
Dlog (Vegetable)	-4.304	**	1		-4.197	**	1	

Notes [a.] ** = significant at 1% level. * = significant at 5% level. + = significant at 10 % level.

[b.] Critical Values are based on Elliot et al. (1996): With trend: 1% 3.48, 5% 2.89, Without trend: 1% 2.58, 5% 1.95.

[c.] Lag length is determined by SC test statistics.

Table 2 Unit Root Test (DF-GLS test) for levels of agricultural commodity prices (unlogged), World, India and China

	World								India								China							
	DF-GLS Test								DF-GLS Test								DF-GLS Test							
	With Trend				Without Trend				With Trend				Without Trend				With Trend				Without Trend			
	Test Statistics [a, b]		Lags [c]		Test Statistics [a, b]		Lags [c]		Test Statistics [a, b]		Lags [c]		Test Statistics [a, b]		Lags [c]		Test Statistics [a, b]		Lags [c]		Test Statistics [a, b]		Lags [c]	
I. Price -Levels																								
Wheat	-3.495	**	1	I(0)	-2.22	*	1	I(0)	-2.610		1	I(1)	-1.815		2	I(1)	-2.372		1	I(1)	-2.074	*	1	I(0)
Maize	-2.452		1	I(1)	-0.327		1	I(1)	-3.439	*	1	I(0)	-3.740	**	1	I(0)	-1.747		1	I(1)	-0.661		1	I(1)
Rice	-3.476	*	1	I(0)	-2.990	*	1	I(0)	-1.863		1	I(1)	-1.553		1	I(1)	-1.884		1	I(1)	-0.928		1	I(1)
Fruit	-1.548		2	I(1)	-0.140		2	I(1)	-2.381		1	I(1)	0.071		1	I(1)	-1.881		1	I(1)	-1.349		1	I(1)
Vegetable	-1.919		2	I(1)	-1.448		2	I(1)	-1.711		1	I(1)	0.726		1	I(1)	-2.004		1	I(1)	-0.787		1	I(1)
Price- First Differences																								
D.Wheat	-6.149	**	1		-6.137	**	1		-5.696	**	1		-3.432	**	1		-3.907	**	1		-3.875	**	1	
D.Maize	-3.292	*	1		-3.219	**	1		-5.728	**	1		-2.550	*	2		-3.785	**	1		-3.745	**	1	
D.Rice	-5.888	**	1		-5.302	**	1		-5.606	**	1		-5.363	**	1		-4.684	**	3		-3.714	**	1	
D.Fruit	-6.636	**	1		-7.022	**	1		-3.249	*	1		-2.570	*	1		-4.679	**	1		-4.494	**	1	
D.Vegetable	-7.133	**	1		-6.969	**	1		-3.687	*	1		-3.633	**	1		-3.092	+	1		-3.095	**	1	

Notes [a.] ** = significant at 1% level. * = significant at 5% level. + = significant at 10 % level.

[b.] Critical Values are based on Elliot et al. (1996): With trend: 1% 3.48, 5% 2.89, Without trend: 1% 2.58, 5% 1.95.

[c.] Lag length is determined by SC test statistics.

Table 3 Error Correction Model for agricultural commodity prices for India and World price series

		Constant (t value)	Adjustment Coefficient (t value)	Short-run Effect (t value)	Adj-R^2	DW	No. of obs.	Joint Significant F Test Prob > F	1 year Adjustment	2 years Adjustment	3 years Adjustment
India											
log	log(Wheat)	0.511	**0.140**	**0.229**	0.140	2.290	39	4.16*	**0.337**	**0.430**	**0.510**
		(1.95)	**(2.14)***	**(2.42)***				0.024			
	log(Maize)	0.028	**0.099**	**0.246**	-0.001	2.001	35	0.980	**0.321**	**0.388**	**0.448**
		(0.88)	**(0.76)**	**(1.40)**				0.387			
	log(Rice)	0.021	**0.189**	**0.293**	0.282	2.075	39	8.47**	**0.427**	**0.535**	**0.623**
		(1.18)	**(2.34)***	**(4.00)****				0.001			
	log(Fruit)	0.089	**0.152**	**0.132**	0.041	1.620	39	1.820	**0.264**	**0.376**	**0.471**
		(2.30)	**(1.86)+**	**(1.08)**				0.177			
	log(Vegetable)	0.024	**0.130**	**-0.242**	0.172	2.117	39	4.94*	**-0.081**	**0.059**	**0.181**
		(0.61)	**(2.72)****	**(-1.54)**				0.013			
Unlogged	Wheat	11.890	**0.307**	**0.335**	0.140	2.290	39	8.47**	**0.539**	**0.681**	**0.779**
		(2.90)	**(3.11)****	**(2.96)****				0.001			
	Maize	4.456	**0.186**	**0.307**	0.032	1.879	35	1.570	**0.435**	**0.540**	**0.626**
		(1.17)	**(1.39)**	**(1.60)**				0.224			
	Rice	2.526	**0.256**	**0.298**	0.353	2.179	39	11.36**	**0.477**	**0.611**	**0.711**
		(1.06)	**(3.23)****	**(4.42)****				0.000			
	Fruit	7.905	**0.103**	**0.097**	-0.034	1.491	39	0.380	**0.190**	**0.274**	**0.349**
		(1.41)	**(0.84)**	**(0.57)**				0.687			
	Vegetable	4.496	**0.060**	**-0.100**	0.065	2.144	39	2.330	**-0.034**	**0.028**	**0.087**
		(1.95)	**(1.42)**	**(-1.31)**				0.112			

Note [a.] ** = significant at 1% level. * = significant at 5% level. + = significant at 10 % level.

Table 4 contains the results for China. The results show that the short-term adjustment coefficient for China is higher than that for India in most of the cases except unlogged rice prices, which suggests that price transmission is quicker in China than in India.[5] The amount as well as the speed of adjustment differs considerably across different commodities. For example, the extent of adjustment of log of wheat price increases from 51% to 56% from 0 to 3 years, while the complete adjustment occurs instantly for unlogged wheat price. The price adjustment for maize increases from 51% to 89% for logged price and 40% to 86% for unlogged price. The results of rice price for China are similar to those for India. Price adjustment for rice changes from 30% to 64% for logged price and from 20% to 64% for unlogged price. Both fruit and vegetable prices for China, however, adjust faster. The initial adjustment of 35% for logged fruit price (or 36% for unlogged price) increases to 86% (or 94%) in 3 years. Adjustment for vegetable price is the smallest among all commodity prices. The initial adjustment is 19% for logged price (or 9% for unlogged price) and increases to 54% (or 32%).[6]

[5] This is illustrated in the graphs in Appendices 3 and 4. For example, the first differences of log price of wheat, maize and fruit for China move more closely with the corresponding world price than those for India.

[6] In case the difference of domestic price and world price is I(1), the results in Table 3 or Table 4 have to be interpreted with caution. For example, difference of logged prices of wheat, fruit or vegetable and logged world price for India is I(1), as shown in Table 5. For both logged/unlogged prices for China, price difference is I(1) for wheat and fruit, as shown in Table 6.

Table 4 Error Correction Model for agricultural commodity prices for China and World price series

		Constant (t value)	Adjustment Coefficient (t value)	Short-run Effect (t value)	Adj-R^2	DW	No. of obs.	Joint Significant F Test Prob > F	1 year Adjustment	2 years Adjustment	3 years Adjustment
China											
Log	log(Wheat)	0.003	0.035	0.505	0.204	1.751	39	5.86**	0.523	0.539	0.555
		(0.08)	(0.61)	(3.42)**				0.006			
	log(Maize)	-0.034	0.396	0.505	0.297	2.278	35	8.19**	0.701	0.819	0.891
		(-1.06)	(3.00)**	(3.32)**				0.001			
	log(Rice)	0.010	0.200	0.295	0.207	2.511	39	8.04**	0.436	0.549	0.640
		(0.34)	(3.22)**	(2.62)*				0.001			
	log(Fruit)	0.045	0.392	0.353	0.127	2.076	39	3.75*	0.607	0.761	0.855
		(1.15)	(2.73)**	(1.16)				0.033			
	log(Vegetable)	-0.029	0.157	0.191	0.111	1.679	39	3.37*	0.318	0.426	0.516
		(-0.84)	(2.04)*	(2.21)*				0.045			
Unlogged	Wheat	6.483	0.115	1.084	0.197	1.590	39	5.67**	1.000	1.000	1.000
		(0.71)	(1.42)	(3.18)**				0.007			
	Maize	-3.198	0.386	0.396	0.196	2.278	35	5.15**	0.629	0.772	0.860
		(-1.00)	(2.66)*	(2.67)*				0.012			
	Rice	0.135	0.236	0.195	0.196	2.469	39	5.62**	0.384	0.529	0.640
		(0.04)	(3.06)**	(1.98)+				0.008			
	Fruit	4.650	0.540	0.362	0.208	2.139	39	5.99**	0.707	0.865	0.938
		(0.99)	(3.45)**	(1.02)				0.006			
	Vegetable	-1.168	0.092	0.092	0.0002	1.678	39	1.000	0.175	0.250	0.319
		(-0.33)	(1.19)	(1.26)				0.376			

Note [a.] ** = significant at 1% level. * = significant at 5% level. + = significant at 10 % level.

Following Baffes and Gardner (2003), we present the regression results, based on equations (1) and (1)’, and the results of unit root tests for (2) and (2)’ in Table 5 for India and in Table 6 for China. As most of the price series are I(1), the regression results have to be interpreted with caution.

Somewhat surprisingly, the patterns of the results across different commodities in Tables 5& 6 are different from those in Tables 3 & 4. For India (in Table 5) we find relatively higher coefficient for fruits (0.67 for logged price and 1.11 for unlogged price) or vegetable price series (1.72 for logged price and 0.69 for unlogged price) than the other price series. Consistent with these results, Appendix 1 shows that prices of fruits or vegetable for China appear to move more closely with world price than other price series. For wheat, maize, and rice the coefficient estimates range from 0.35-0.50 for logged prices (or 0.30-0.50 for unlogged prices), denoting the extent of adjustment in 1 year (Table 3).

We have carried out cointegration tests (i.e. DF-GLS tests) for the difference of domestic commodity prices and world commodity prices. For India, most of the price series are cointegrated, implying that domestic and world commodity prices are integrated except logged prices for fruits and vegetables.

Table 6 shows the results, based on Mundlak and Larson (1992) or equation (1) or (1)’, for China. In this case a relatively low coefficient, 0.16, is obtained for logged wheat price (0.66 for unlogged wheat price). Higher coefficient estimates ranged from 0.91 to 1.13 for logged prices of other commodities (namely, maize, rice fruit and vegetable). This is consistent with graphs of commodity prices for China in Appendix 2. For unlogged prices of these commodities, coefficient estimates range from 0.52 to 0.85. The reason for the variation in coefficient estimates is not obvious, and the results must be interpreted with caution as most of the series are non-stationary. It is not easy to generalise from these results, but the evidence suggests that commodity prices in China are more deeply integrated with global prices.

We have carried out DF-GLS tests for the differences of domestic commodity prices in China and world prices. Most of the cases show that the price differences are I(1) except vegetable price for which the difference is I(0), suggesting that domestic vegetable price is cointegrated with world vegetable price.

There are a number of potential reasons why commodity prices in China are more closely aligned to global prices than in India. One of them would be the difference in infrastructural development in two countries, as better infrastructure (e.g. road or railway networks) will more easily connect regional markets scattered across the country and facilitate the price transmission process –especially because of the huge areas of these two countries. Table 7 summarises evidence on the growth of food trade and infrastructural development in India and China. The first two columns of the upper panel of Table 7 show that food trade, in particular food import, expanded rapidly during 1992-2002 in both countries. Infrastructure, in particular roads, also developed, but not as quickly as food trade. The share of paved roads was only 47.4% in India and 78.3% in China in 2002. The lower panel shows the correlation between annual food trade and infrastructure over the period of 1992-2002. Both food export and imports are more closely correlated with infrastructure, namely rail lines and roads, in China and than in India. Table 7 thus sheds some light on why China with better infrastructure (e.g. paved roads) is more deeply integrated with the global market.

Table 5 OLS for agricultural commodity prices for India and World price series

		Constant (t value)	Adjustment Coefficient (t value)	Adj-R^2	DW	Joint Significant F Test Prob > F		DF-GLS Test for ($\log p^d - \log p^w$) [or ($p^d - p^w$)] with Trend	lags		DF-GLS Test for ($\log p^d - \log p^w$) [or ($p^d - p^w$)] without Trend	lags	No. of obs.
India log	log(Wheat)	3.337	**0.347**	0.606	1.177	60.88**	I(1)	level -3.00	1	I(1)	level -1.98	1	40
								first dif.			first dif.		
		(16.18)	**(7.80)****			0.000		-7.16**	1		-5.86**	1	
	log(Maize)	3.263	**0.335**	0.197	0.878	9.58**	I(0)	level -3.48*	1	I(0)	level -2.50*	1	36
								first dif.			first dif.		
		(6.45)	**(3.10)****			0.004		-5.01**	1		-4.63**	1	
	log(Rice)	2.501	**0.501**	0.528	0.691	44.68**	I(0)	level -4.39**	1	I(0)	level -4.39**	1	40
								first dif.			first dif.		
		(6.86)	**(6.68)****			0.000		-6.04**	1		-4.88**	1	
	log(Fruit)	1.873	**0.676**	0.833	0.878	195.43**	I(1)	level -2.59	1	I(1)	level -1.68	1	40
								first dif.			first dif.		
		(8.80)	**(13.98)****			0.000		-5.79**	1		-3.96**	1	
	log(Vegetable)	-3.806	**1.720**	0.399	0.495	26.85**	I(1)	level -2.78	1	I(1)	level -0.98	1	40
								first dif.			first dif.		
		(-2.39)	**(5.18)****			0.000		-6.01**	1		-6.02**	1	
Unlogged	Wheat	91.436	**0.503**	0.538	1.033	46.43**	I(0)	level -3.61**	1	I(0)	level -2.96**	1	40
								first dif.			first dif.		
		(10.65)	**(6.81)****			0.000		-6.62**	1		-4.93**	1	
	Maize	93.927	**0.300**	0.084	0.826	4.22**	I(0)	level -3.09+	1	I(0)	level -2.58*	1	36
								first dif.			first dif.		
		(5.74)	**(2.05)***			0.048		-5.01**	1		-4.71**	1	
	Rice	75.408	**0.495**	0.479	0.720	36.84**	I(0)	level -3.97**	1	I(0)	level -3.98**	1	40
								first dif.			first dif.		
		(6.52)	**(6.07)****			0.000		-6.04**	1		-5.49**	1	
	Fruit	36.058	**1.105**	0.774	0.936	134.89**	I(0)	level -2.91+	1	I(0)	level -2.50*	1	40
								first dif.			first dif.		
		(4.07)	**(11.61)****			0.000		-5.17**	1		-4.24**	1	
	Vegetable	23.468	**0.693**	0.177	0.495	9.36**	I(0)	level -3.29*	1	I(1)	level -1.46	1	40
								first dif.			first dif.		
		(0.78)	**(3.06)****			0.004		-6.33**	1		-6.39**	1	

Notes [a.] ** = significant at 1% level. * = significant at 5% level. + = significant at 10 % level.
[b.] Critical Values are based on Elliot et al. (1996): With trend: 1% 3.48, 5% 2.89, Without trend: 1% 2.58, 5% 1.95.
[c.] Lag length is determined by SC test statistics.

Table 6 OLS for agricultural commodity prices for China and World price series

		Constant (t value)	Adjustment Coefficient (t value)	Adj-R^2	DW	Joint Significant F Test Prob > F		DF-GLS Test for ($\log p^d - \log p^w$) [or ($p^d - p^w$)] with Trend	lags		DF-GLS Test for ($\log p^d - \log p^w$) [or ($p^d - p^w$)] without Trend	lags	No. of obs.
China log	log(Wheat)	4.410	**0.163**	0.001	0.208	1.030	I(1)	level -2.85	1	I(1)	level -1.18	1	40
		(5.85)	**(1.01)**			0.318		first dif. -4.31**	1		first dif. -4.31**	1	
	log(Maize)	-0.763	**1.134**	0.670	1.088	72.13**	I(1)	level -2.21	1	I(1)	level -1.58	1	36
		(-1.22)	**(8.49)****			0.000		first dif. -4.66**	1		first dif. -4.71**	1	
	log(Rice)	0.073	**0.955**	0.316	0.326	19.30**	I(1)	level -2.86	1	I(1)	level -0.75	1	40
		(0.07)	**(4.36)****			0.000		first dif. -5.71**	1		first dif. -4.75**	1	
	log(Fruit)	0.458	**0.906**	0.665	0.913	78.29**	I(1)	level -1.84	1	I(1)	level -1.59	1	40
		(1.02)	**(8.85)****			0.000		first dif. -5.10**	1		first dif. -3.94**	1	
	log(Vegetable)	-0.301	**0.984**	0.628	0.758	66.96**	I(0)	level -4.72**	1	I(0)	level -2.14+	1	40
		(-2.52)	**(8.18)****			0.000		first dif. -7.68**	1		first dif. -6.82**	1	
Unlogged	Wheat	115.668	**0.660**	0.041	0.254	2.680	I(1)	level -2.41	1	I(1)	level -1.77	1	40
		(2.47)	**(1.64)**			0.110		first dif. -3.69**	1		first dif. -3.67**	1	
	Maize	4.405	**0.850**	0.528	1.061	40.10**	I(1)	level -2.61	1	I(0)	level -2.53*	1	36
		(0.29)	**(6.33)****			0.000		first dif. -4.94**	1		first dif. -5.03**	1	
	Rice	53.561	**0.522**	0.209	0.439	11.30**	I(0)	level -3.76*	1	I(1)	level -2.00	1	40
		(2.43)	**(3.36)****			0.002		first dif. -5.95**	1		first dif. -5.32**	1	
	Fruit	21.455	**0.820**	0.425	1.181	29.82**	I(1)	level -2.32	1	I(1)	level -1.93	1	40
		(1.54)	**(5.46)****			0.000		first dif. -5.61**	1		first dif. -5.43**	1	
	Vegetable	16.851	**0.568**	0.470	0.700	35.51**	I(0)	level -4.48**	1	I(0)	level -3.65**	1	40
		(1.34)	**(5.96)****			0.000		first dif. -7.40**	1		first dif. -7.22**	1	

Notes [a.] ** = significant at 1% level. * = significant at 5% level. + = significant at 10 % level.
[b.] Critical Values are based on Elliot et al. (1996): With trend: 1% 3.48, 5% 2.89, Without trend: 1% 2.58, 5% 1.95.
[c.] Lag length is determined by SC test statistics.

Table 7 OLS for agricultural commodity prices for China and World price series

Growth of Food Trade and Infrastructure Development in China and India

India	Food Export (current 109US$)	Food Import (current 109US$)	Rail lines (total route-km)	Roads (total network-km)	% of paved roads in total roads
1992	3.18	0.9	62486	2021441	51.9
2002	6.06	3.27	63140	3383344	47.4
Average annual growth rate (%)	6.45	12.90	0.10	5.15	-0.91
China	Food Export (current 109US$)	Food Import (current 109US$)	Rail lines (total route-km)	Roads (total network-km)	% of paved roads in total roads
1992	9.62	3.94	53566	1265916	NA
2002	16.1	10.4	59530	1765222	78.3
Average annual growth rate (%)	5.15	9.71	1.06	3.32	NA

Correlation Matrices of Annual Food Export and Import, Rail lines and Roads in China and India (1992-2002)

India	Food Export (current US$)	Food Import (current US$)	Rail lines (total route-km)	Roads (total network-km)
Food Export	1			
Food Import	0.857	1		
Rail lines	0.7099	0.8178	1	
Roads	0.6098	0.7359	0.5743	1
China	Food Export (current US$)	Food Import (current US$)	Rail lines (total route-km)	Roads (total network-km)
Food Export	1			
Food Import	0.937	1		
Rail lines	0.9159	0.8983	1	
Roads	0.8812	0.8273	0.7986	1

IV. Conclusions

This paper examined the *extent* to which changes in global agricultural commodity prices are transmitted to domestic prices in India and China. The focus was on the short and medium-run adjustment processes, drawing upon an error correction model specified by Baffes and Gardner (2003). As under certain conditions, the regression results may be spurious, we relied mostly on the error correction results. First, the extent of adjustment of domestic to global prices in the short to the medium- run (from 0 to 3 years) is generally larger in China than in India. Second, the larger adjustment is found for wheat, maize and rice prices than for fruits and vegetables in both India and China. In particular, the adjustment is the weakest for vegetables in both India and China. Third, while most of the domestic commodity prices co-move with global prices, the transmission is in general incomplete presumably due to distortionary government policies, such as subsidies for domestic agricultural commodities and failure to exploit spatial arbitrage. From this perspective, the potential benefits to farmers and a larger supply response are likely to be somewhat restricted.

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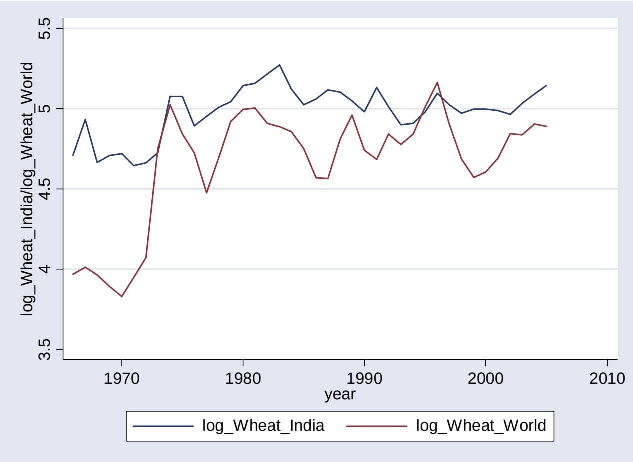
Appendix 1. Graphs of log agricultural commodity prices- World and India



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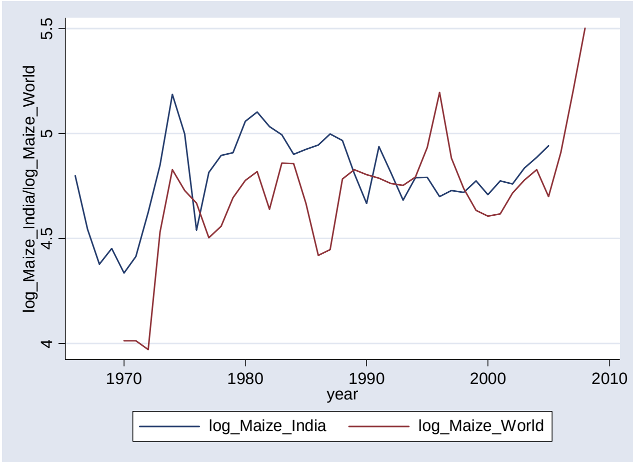
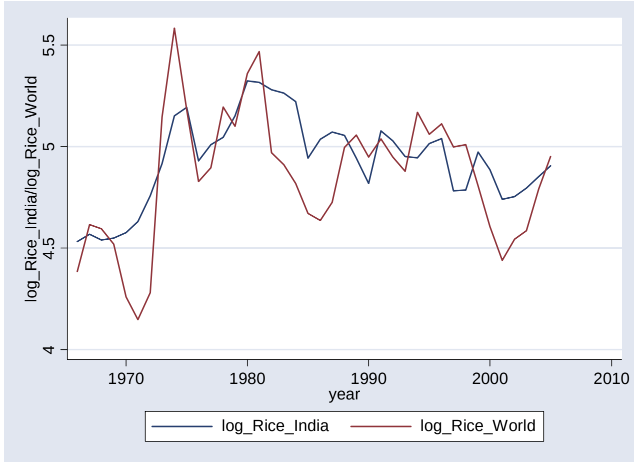


Maize



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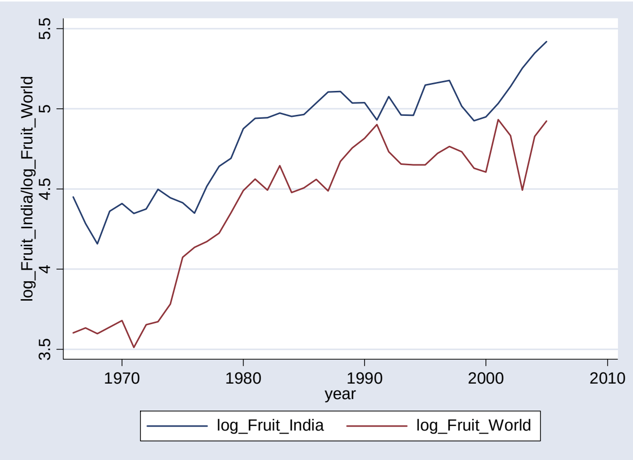

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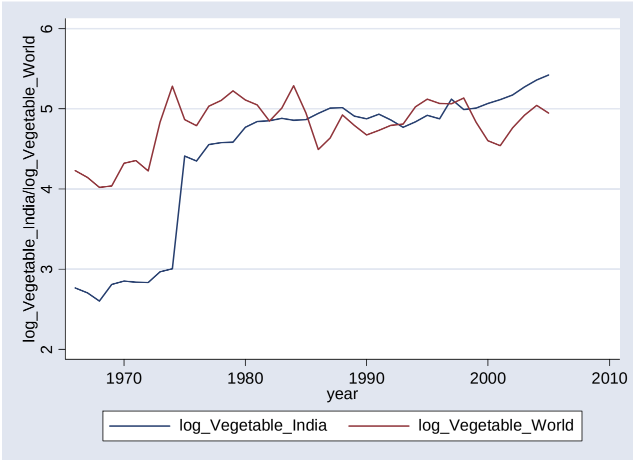
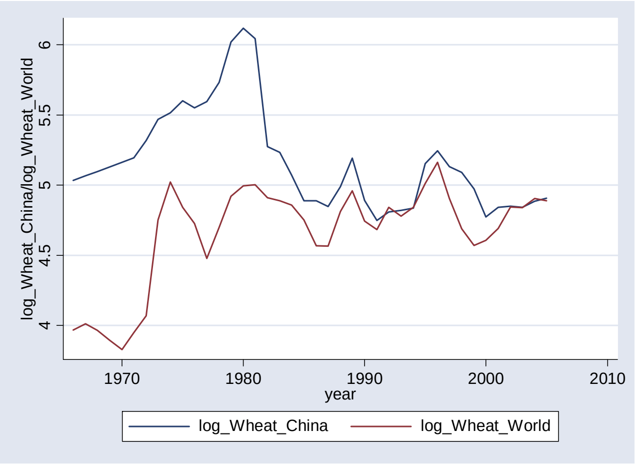


Vegetable

Appendix 2. Graphs of log agricultural commodity prices- World and China



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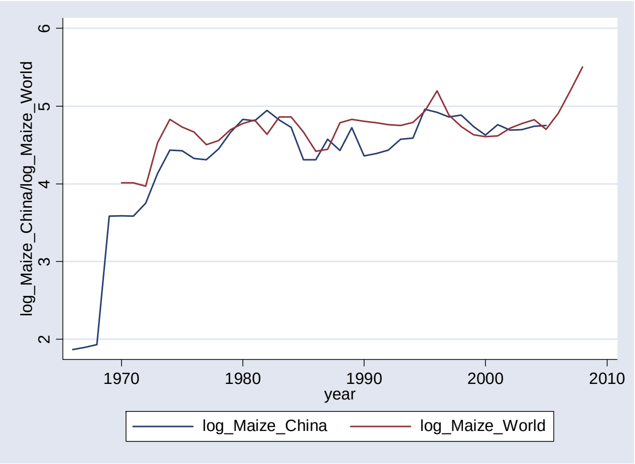

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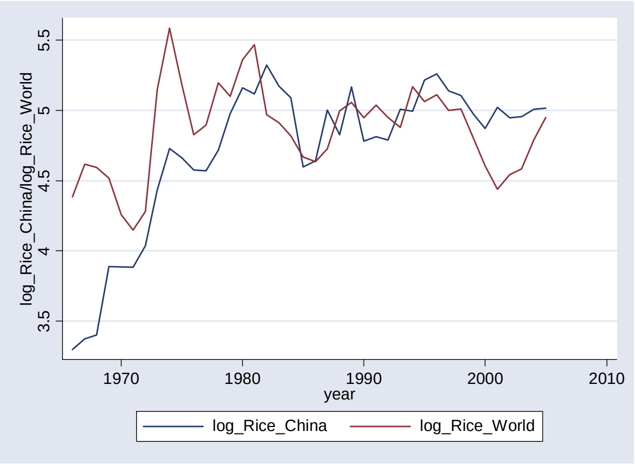

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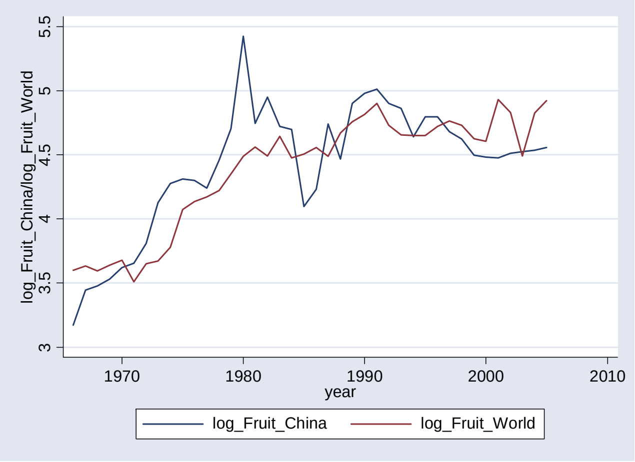

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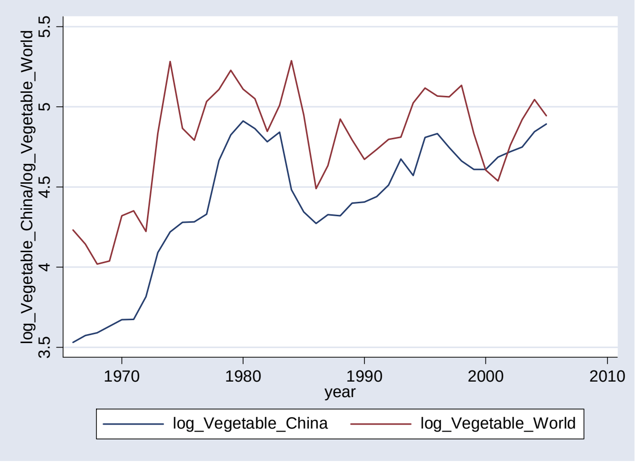
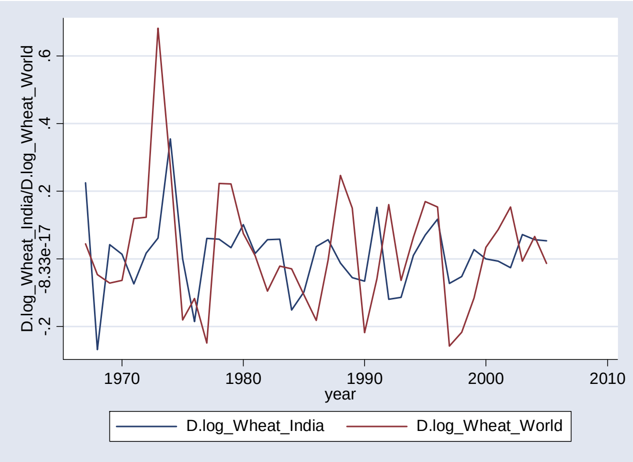
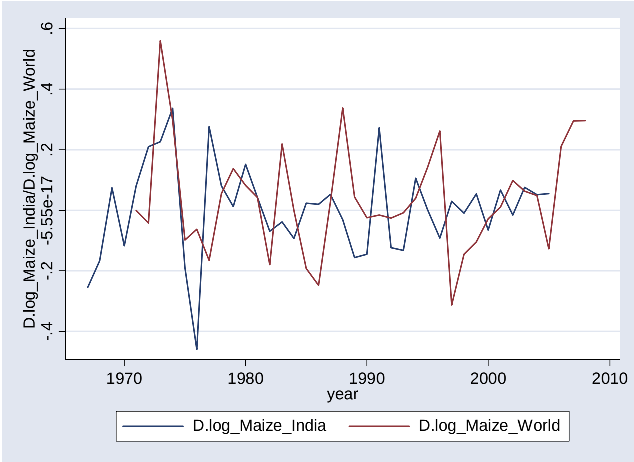


Vegetable

Appendix 3. Graphs of first differences of log agricultural commodity prices- World and India



D.Wheat



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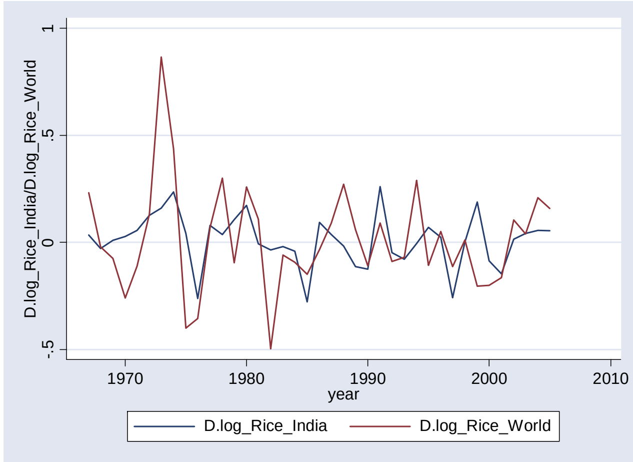

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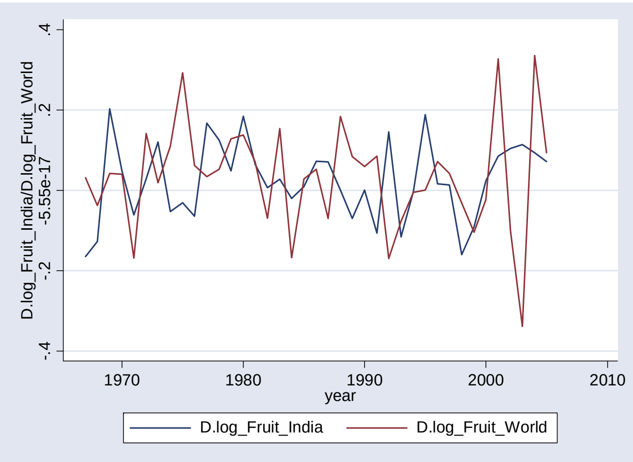
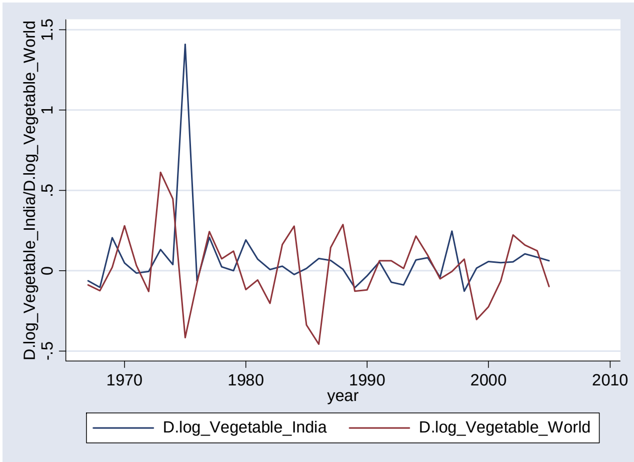
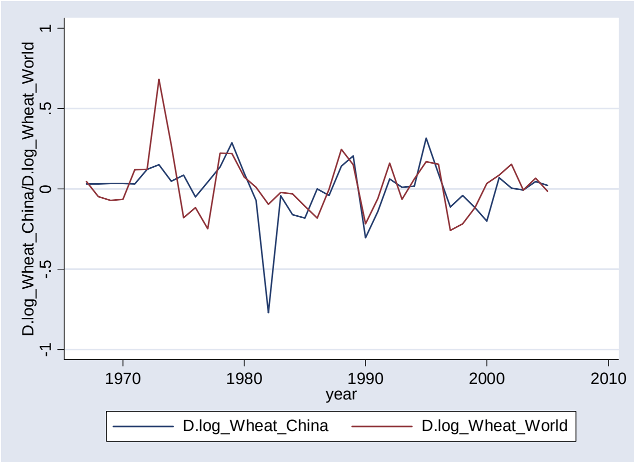


D.Fruit

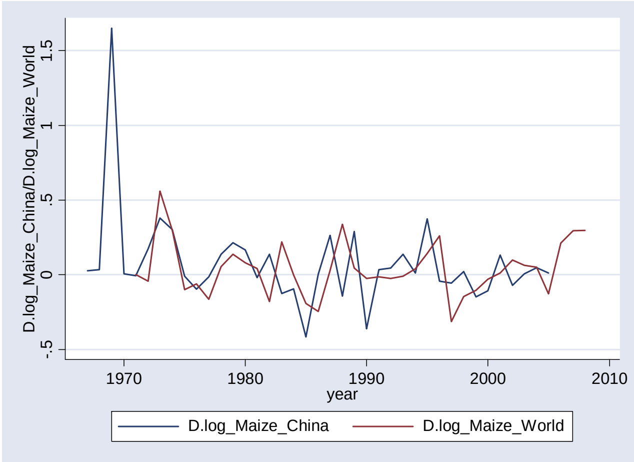


D.Vegetable

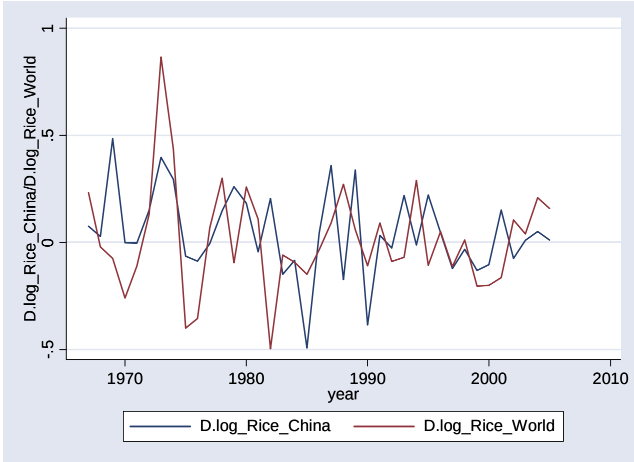
Appendix 4. Graphs of first differences of log agri cultural commodity prices- World and China



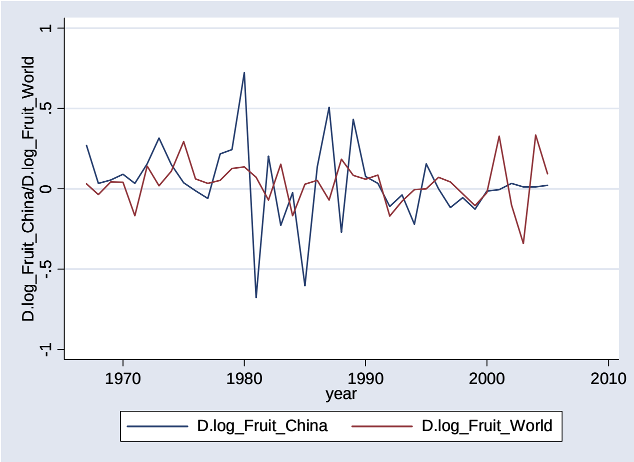
D.Wheat



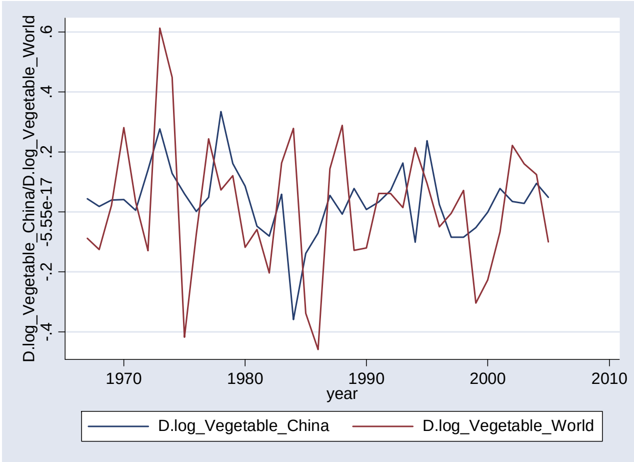
D.China



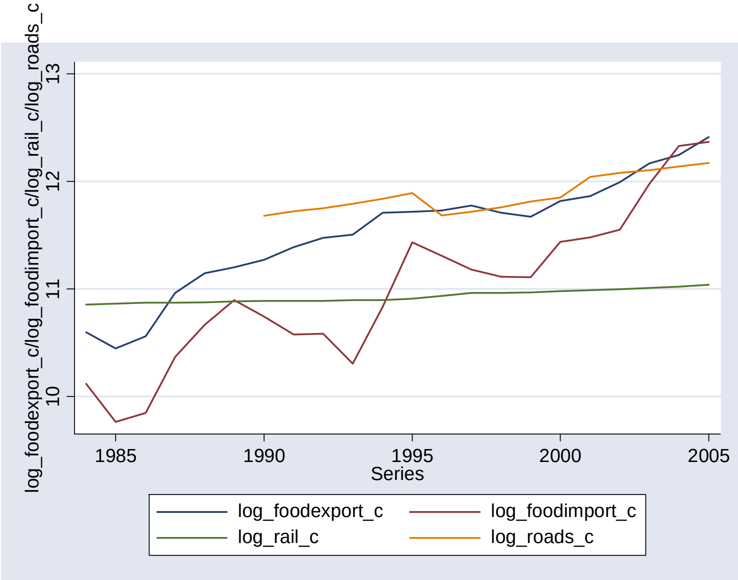
D.China



D.Fruit



D.Vegetable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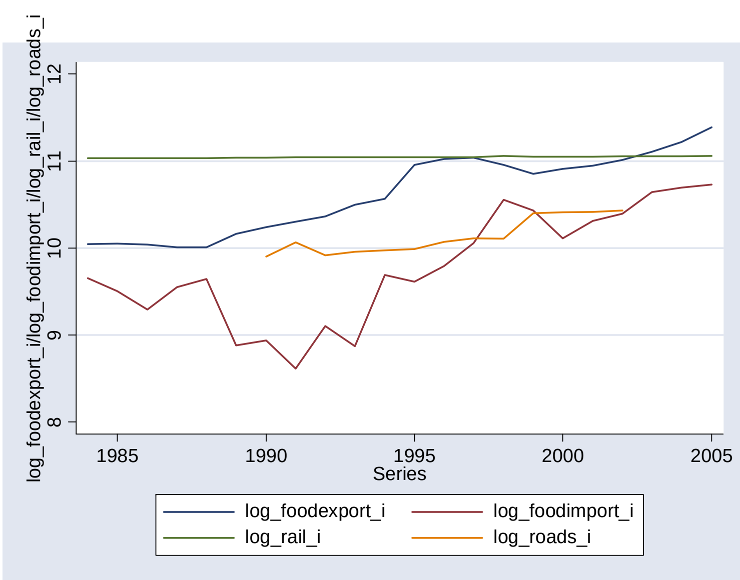
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