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TRADE PERFORMANCE AND TRANSMISSION OF PRICE VOLATILITY: THE CASE OF INDIAN PEPPER

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ABSTRACT

The impacts of trade liberalization policies have mainly reflected in prices and it has been argued that increased integration between the domestic markets and the world markets would result in increased volatility in domestic prices. In the context of ASEAN-India FTA, this paper analyzed the price volatility of black pepper and its transmission to domestic market and prices received by the producers. The levels of instability are found significant for most of the price series of black pepper and the volatility of international prices have increased considerably in the recent past. The cointegration analysis suggested that liberalization has improved the transmission of price signals between the domestic and the international markets and there is co-movement of prices. The decomposition of the variance in producer prices proved that Export Unit Values and Import Unit Values were the major factors which explained variations in producer price of pepper. Hence, allowing imports of pepper under the ASEAN India FTA would be detrimental to the producers and will make them vulnerable to market instabilities. The uncertainty in prices as a consequence of increased instability will make the farming community apprehensive and may result in farmers moving away from pepper cultivation. The paper calls for all the agencies concerned with the sector to formulate strategies to bring back the prestigious position India had in the world pepper economy. This necessitates policies not only on production technology but also on marketing and price stabilization mechanisms.

I. Introduction

The impacts of trade liberalization policies have mainly reflected in prices and it has been argued that with the increased integration of the domestic markets with the world markets, the volatility of Indian prices would increase and this would have serious implications for price stability and trade competitiveness. The characteristic behaviour of commodity price cycles is that periods of low prices continue for longer periods than price peaks. The producers therefore face the dual problem of low returns and high risks (Page and Hewitt, 2001). In addition to long term decline, the prices show a high degree of volatility, caused by time lag between production decisions and delivery to the market, delayed response by producers to price signals, inelastic supply and natural shocks. The volatility in the producer prices has always dissuaded the pepper farmers from undertaking long term investment. The flexibility in the cropping pattern to adjust with market conditions, in the short and medium terms, is also limited in the case of pepper since it is a perennial crop. Being a trade dependent crop, the changes in the international trade scenario causes apprehensions among various stakeholders of pepper economy. With the emergence of Vietnam and other new low cost producers, India has lost its dominance in pepper

exports and has turned out to be a regular importer. There are fears that the Indo-ASEAN FTA will jeopardize the pepper production in the country due to surge in imports. In this context, this paper analyses the price volatility of pepper and its transmission to domestic market and prices received by the producers.

II. Pepper Economy in India and ASEAN

Even though the area under pepper has been increasing in India, the country's share in the world area has been fluctuating since 1995, mainly due to increase in area in other countries including ASEAN. The share of ASEAN group of countries in the pepper area ranged from 25 to 37 per cent during the period from 1990 to 2008 (Table1). Among the ASEAN countries, Indonesia alone accounted for about two-thirds of the area while Vietnam contributed about one-fourth of the area in ASEAN, where the area under the crop has been significantly increasing, especially after 2000. The ASEAN countries produced almost 50 per cent of the world production and could be attributed to the high productivity in these countries which was almost 1.5 times of the world productivity. The productivity in Vietnam was 251 per cent of the world productivity. The production of pepper in India increased from 55200 tonnes in 1990 to 73000 tonnes in 2005 and subsequently declined to 69000 tonnes in 2008. While India accounted for 45 per cent of the world area in 2008, the country's share of world production was only about 16 per cent since the productivity was as low as 36 per cent of the world average. Though the area under pepper has increased at a steady pace in India, it has been nullified by stagnating productivity, which was above 300 kg/ha up to 2005 and then declining to 280 kg/ha in 2008. This productivity disadvantage has been attributed to the preponderance of old, senile and unproductive vines in larger areas, disease affected plantations, absence of periodical replanting and non adoption of available technologies (Sarma, 2006, Spice India, 2009).

Table 1: Comparison of Indian and ASEAN Pepper Production

Year	India		Vietnam		Indonesia		ASEAN		World	
Area (000 Hectares)										
1990	171.5	(48.5)	9.2	(2.6)	74.8	(21.1)	100.9	(28.5)	353.7	(100)
1995	193.3	(53.3)	7.0	(1.9)	71.5	(19.7)	91.4	(25.2)	362.4	(100)
2000	196.0	(45.7)	27.9	(6.5)	100.0	(23.3)	144.1	(33.6)	429.3	(100)
2005	228.3	(41.4)	49.1	(8.9)	135.0	(24.5)	203.0	(36.8)	550.9	(100)
2008	246.0	(44.5)	50.0	(9.0)	117.5	(21.2)	185.4	(33.5)	553.1	(100)
Production (000 Tonnes)										
1990	55.2	(19.2)	11.2	(3.9)	69.9	(24.3)	127.1	(44.1)	287.9	(100)
1995	60.7	(25.6)	12.1	(5.1)	59.0	(24.9)	99.5	(42.0)	237.2	(100)
2000	59.0	(18.8)	51.0	(16.3)	69.1	(22.0)	158.5	(50.5)	313.6	(100)
2005	73.0	(16.8)	80.3	(18.5)	94.3	(21.7)	214.4	(49.4)	433.6	(100)
2008	69.0	(15.9)	98.3	(22.7)	79.7	(18.4)	214.2	(49.4)	433.2	(100)
Productivity (Kg/Ha)										
1990	322	(39.5)	1219	(149.7)	935	(114.8)	1259	(154.6)	814	(100)
1995	314	(48.0)	1729	(264.1)	825	(126.0)	1088	(166.3)	654	(100)
2000	301	(41.2)	1828	(250.3)	691	(94.6)	1100	(150.6)	730	(100)
2005	320	(40.6)	1635	(207.8)	699	(88.7)	1056	(134.2)	787	(100)
2008	280	(35.8)	1966	(251.0)	678	(86.6)	1155	(147.5)	783	(100)

Note: Figures in parentheses indicate percentage to world total

Source: Estimates based on faostat

Trade Performance of Indian Pepper

Traditionally, India had been a major exporter of pepper. Indian pepper fetches a premium price in the world markets because of its preference and intrinsic qualities. Increased domestic demand for consumption and competition from new entrants, including ASEAN countries have reduced India's global share in pepper exports. Pepper exports from India decreased from 38741 tonnes in 1990 to 28886 tonnes in 2008 and in between it ranged from 15004 tonnes to 47703 tonnes (Table 2). The value of export varied much on the basis of unit value realization rather than quantum of exports. The imports of pepper to India decreased from 1473 tonnes in 1990 to 873 tonnes in 1993 and then ranged between 2000 and 3000 tonnes up to 1999. The imports of pepper crossed the 5000 tonnes mark in 2000 and it increased substantially afterwards, which could be ascribed to the increased imports from Vietnam, Indonesia and Sri Lanka. The trade balance in quantity terms has always been positive but the country became a net importer of pepper in value terms during 2006 and 2007, which was due to increased unit value of imports.

India imports pepper as whole pepper (neither crushed nor ground, HS 090411) and also as crushed or ground pepper (HS 090412). In most of the years, almost 100 per cent pepper imported to the country was in the form of whole pepper. Among the top producers, India is the only country which imports substantial quantity of pepper. The trade balance in the case of pepper has shown a declining pattern and the country became a net importer in both value and quantity terms in some of the recent years.

The imports of pepper from different countries have shown a discernibly increasing trend in the recent decades. The pepper imports increased from 1473 tonnes in 1990 to 19652 tonnes in 2005 and then declined to 13120 tonnes in 2009 at a Compound Annual Growth Rate (CAGR) of about 18 per cent for both quantity and value terms. The

Table 2: Trend in Exports and Imports of Pepper by India

Year	Exports		Imports		Trade Balance	
	Quantity	Value	Quantity	Value	Quantity	Value
	Tonnes	Million$	Tonnes	Million$	Tonnes	Million$
1990	38741	111.9	1473	2.1	37268	109.8
1991	47703	120.9	2163	2.7	45540	118.2
1992	30731	61.4	1686	1.5	29045	59.9
1993	20435	33.5	873	0.6	19562	32.9
1994	15004	26.2	2414	3.7	12590	22.5
1995	16264	29.5	2186	3.9	14078	25.6
1996	21719	37.0	2292	5.2	19427	31.8
1997	21404	49.3	2153	7.6	19251	41.7
1998	19237	82.0	3551	14.2	15686	67.8
1999	35636	164.3	3124	11.7	32511	152.6
2000	32858	144.6	5868	13.8	26990	130.8
2001	35403	130.8	5713	11.8	29689	118.9
2002	47210	115.5	15369	24.9	31842	90.6
2003	25270	57.6	13806	20.6	11465	37.0
2004	36536	74.7	14687	20.7	21849	54.0
2005	47678	58.9	19652	27.3	28026	31.6
2006	22684	29.0	18125	31.4	4560	-2.4
2007	19662	29.4	11560	36.8	8102	-7.4
2008	28886	55.4	13120	47.4	15765	8.0

Source: WITS database

growth in quantity of exports was found to higher in the second period (2000-2008) when compared to the initial period. While Sri Lanka and ASEAN accounted for most of the imports in 1990, during 2008 also they together accounted for about 94 per cent. The share of ASEAN countries in import of pepper to India in quantity terms increased from about 49 per cent in 1990 to about 63 per cent in 2008 while in value terms the share increased from about 30 per cent to 57 per cent in the

above period. Among the ASEAN countries, Indonesia is the major exporter to India and accounted for about 44 percent of imports to India in quantity terms while the share in value terms was about 40 per cent in 2008. In recent times, Vietnam has emerged as a major exporter to India. The quinquennial average of exports from Vietnam to India increased from mere 66 tonnes (1995-1999) to 6082 tonnes (2004-2008), while the exports in value terms (in million$) were 0.15 and 10.1 respectively. The emergence of Vietnam as the major producer and exporter affected Indian growers by reducing the country's exports to US market and depressed domestic prices by enhancing domestic availability. While duty free imports were being made from Sri Lanka for the oleoresin industry in Kerala, in recent years, the import of pepper for purposes other than oleoresin production and for processing have shown a rapidly increasing trend, which could depress domestic prices through increased availability. Import from Vietnam under the Advance Licensing Scheme was primarily for re-export after value addition (Mohandas, 2007).

III. Analysis of Pepper Prices

Pepper prices vary substantially, largely because of fluctuations in supply in major producing countries**.** Pepper price tends to move in a cyclical way and price fluctuation can be very different from year to year. The characteristic behavior of commodity cycles is that periods of low prices endure for longer than price spikes. The ever increasing domestic demand has kept pepper prices in the country above the international prices in some of the years, which in turn has led to fall in exports in those years. The unit price of pepper imports had been invariably lower than unit price of exports, wholesale price and farm harvest price. Weak buying by the major consuming countries, US and EU, especially from the second half of 2008 has suppressed the prices because need based buying is reported by the buyers without stocking up for future, taking into consideration the global slowdown.

(i) Price Instability

Price volatility remains a major concern for primary exporting countries. World commodity price volatility is caused by shocks to both supply and demand, but shocks to supply predominantly affect agricultural commodities (Dehn et al., 2005).The 'commodity problem' is often described as a combination of declining terms of trade and price volatility. The producers therefore face the dual problem of low returns and high risks. In addition to long term decline, the prices of many of the agricultural commodities show a high degree of volatility, caused by time lag between production decisions and delivery to the market, delayed and inappropriate response by producers to price signals, inelastic supply and natural shocks. There are also apprehensions that since there are considerable volatility in prices in the world agricultural markets, dismantling of trade barriers on imports and freer exports would increase the volatility of domestic prices and destabilize farm incomes.

The instability in domestic and international prices and export as well as import unit values in rupee and dollar terms were estimated as the percentage deviation of price from its exponential trend level as estimated in the Commodity Price Statistics published by UNCTAD. The instability indices[1] (Table 3) for the entire price series under consideration were found to be higher for the second period from 2000-2008. The instability of prices in dollar terms was found to be higher than that for the prices in rupee terms. The instability of international price in rupee terms more than doubled in the second period while in dollar terms it increased by 1.7 times. A similar pattern was also found in the case of average world price instability. So it can be rightly concluded that the volatility of international prices have risen considerably in the recent past. The magnitude of domestic price instability was similar to that of international price instability and has almost doubled in rupee terms. The magnitudes of instability in farm harvest prices in two periods were lower than domestic wholesale prices. The instability of the Export

Table 3: Instability in Pepper Prices (Instability Index)

Particulars of Price	Market	Unit	1990 -1999	2000 -2008	1990 -2008
Domestic Price	MG1 Cochin	Rs/Kg	18.47	33.10	47.78
Domestic Price	MG1 Cochin	$/Kg	24.60	35.89	41.88
Farm Harvest Price	Kerala	Rs/Kg	17.26	25.76	47.97
Farm Harvest Price	Kerala	$/Kg	21.33	27.79	42.05
International Price	MG1 New York	Rs/Kg	15.13	32.53	46.53
International Price	MG1 New York	$/Kg	20.62	35.12	39.81
International Price	Average - World	Rs/Kg	19.41	32.17	45.16
International Price	Average - World	$/Kg	25.05	34.74	39.95
Export Unit Value	India	Rs/Kg	12.73	21.79	42.27
Export Unit Value	India	$/Kg	18.35	24.21	31.85
Import Unit Value	India	Rs/Kg	18.64	27.59	44.12
Import Unit Value	India	$/Kg	23.48	29.84	37.99
Import Unit Value	India - ASEAN	Rs/Kg	25.56	31.59	49.57
Import Unit Value	India - ASEAN	$/Kg	28.93	33.99	41.20
Import Unit Value	India – Sri Lanka	Rs/Kg	16.28	34.24	48.69
Import Unit Value	India - Sri Lanka	$/Kg	20.88	36.58	42.03

Unit Value in rupee terms was found to be higher. The Import Unit Value instability more than doubled in the case of imports from Sri Lanka. During the period from 1990-99, the instability index was found to be highest for Import Unit Value from ASEAN whereas the increase in second period was minimum. For the overall period, the instability was the highest for Import Unit Value from ASEAN.

The pattern of variability in prices was also analyzed using residual trend approach[2] as proposed by Glejser (1969) and Johnston (1972) and used by Scandizzo and Diakosawas (1987) and Hazell (1989).The residual trend approach involves regression of the absolute value of residuals from the initial trend regression against time and testing for significant trend.

Even though the average levels of instability as expressed by the instability index were sizeable for many series, the residual trend analysis did not indicate any significant trend increase or decrease in absolute variability. The trends for the absolute values of the Import Unit Value trend residuals for the first period indicated non-significant decline in the absolute variability of Import Unit Values while it was non-significant rise in the second period with the exception of ASEAN Import Unit Value in dollar terms. In the case of domestic and international prices the analysis indicated a non significant trend decline in the second half (Table 4).

(ii) Transmission of Price instability

It is often argued that due to free trade there would be chance of transmission of price volatility to domestic market affecting the magnitude as well as stability of the farm income. The changes in covariance pattern over time and thereby the extent of transmission of world price instability to the domestic prices was studied using cross-product trend approach[3]. The estimates of the cross product regressions (Table 5) did not exhibit any significant trend in any of the periods and therefore conclusive evidences could not be derived from the residual and cross product trend analyses.

Table 4: Estimates of Residual Trend Regressions

Particulars	Market/Price	Unit	1990 -1999	2000 -2008	1990 -2008
Domestic Price	MG1 Cochin	Rs/Kg	0.333	-2.640	-0.408
Domestic Price	MG1 Cochin	$/Kg	-0.019	-0.061	0.004
Farm Harvest Price	Kerala	Rs/Kg	0.101	-0.938	-0.714
Farm Harvest Price	Kerala	$/Kg	-0.023	-0.027	-0.004
International Price	MG1 New York	Rs/Kg	0.531	-1.713	-0.195
International Price	MG1 New York	$/Kg	-0.015	-0.041	0.013
International Price	Average - World	Rs/Kg	1.558	1.585	-0.184
International Price	Average - World	$/Kg	0.010	-0.034	0.073
Export Unit Value	India	Rs/Kg	0.195	-2.882	-0.304
Export Unit Value	India	$/Kg	-0.023	-0.069	-0.007
Import Unit Value	India	Rs/Kg	-0.499	1.928	0.534
Import Unit Value	India	$/Kg	-0.036	0.043	0.024
Import Unit Value	India - ASEAN	Rs/Kg	-0.450	1.121	0.455
Import Unit Value	India - ASEAN	$/Kg	-0.014	-0.036	0.017
Import Unit Value	India – Sri Lanka	Rs/Kg	-0.287	1.031	0.586
Import Unit Value	India – Sri Lanka	$/Kg	-0.042	0.024	0.023

Table 5: Estimates of Cross Product Trend Regressions

Particulars	Unit	1990-1999	2000-2009	1990-2009
World Price & Domestic Price	Rs	18.22	-350.8	2.24
World Price & Domestic Price	$	-0.043	-0.199	0.003
World Price & Farm Harvest Price	Rs	-13.68	-182.7	-25.76
World Price & Farm Harvest Price	$	-0.057	-0.108	-0.012
Export Unit Value & Domestic Price	Rs	8.662	-304.4	-16.91
Export Unit Value & Domestic Price	$	-0.041	-0.177	-0.01
Export Unit Value & Farm Harvest Price	Rs	-16.13	-163.7	-36.3
Export Unit Value & Farm Harvest Price	$	-0.052	-0.1	-0.021
Import Unit Value & Domestic Price	Rs	-7.33	-26.94	0.135
Import Unit Value & Domestic Price	$	-0.039	-0.025	0.003
Import Unit Value & Farm Harvest Price	Rs	-25.56	-8.42	-14.42
Import Unit Value & Farm Harvest Price	$	-0.042	-0.013	-0.004
Import Unit Value (ASEAN) & Domestic Price	Rs	-0.575	-3.47	-0.258
Import Unit Value (ASEAN) & Domestic Price	$	-0.021	0.334	0.005
Import Unit Value (ASEAN) & Farm Harvest Price	Rs	-8.653	-74.72	-11.57
Import Unit Value (ASEAN) & Farm Harvest Price	$	-0.01	0.154	-0.007
Import Unit Value (Sri Lanka) & Domestic Price	Rs	0.345	-132.71	5.22
Import Unit Value (Sri Lanka) & Domestic Price	$	-0.055	-0.084	0.005
Import Unit Value (Sri Lanka) & Farm Harvest Price	Rs	-32.77	-63.67	-15.94
Import Unit Value (Sri Lanka) & Farm Harvest Price	$	-0.070	-0.045	-0.006

(iii) Integration between domestic and international markets: Multiple Co-integration Approach

Increased integration among markets is a pre-condition for the success of liberalization as correct transmission of price signals is required for farmers to realize price advantage as well as to specialize in production. The nature and extent of market integration among domestic and international markets of pepper during different time periods were analyzed in a multiple cointegration framework. Integration among Cochin, New York, Lampong, Brazil and Sarawak were analyzed for two different time periods, 1990-1999 and 2000-2009 using monthly data. The cointegartion analysis was done separately for prices in rupee and dollar terms. Pair wise cointegration between Cochin and New York markets for MG1 pepper was also attempted.

Before conducting cointegration tests, it is necessary to examine the univariate time series properties of the date and confirm that all the price series are non-stationary and integrated of the same order. The univariate time series properties for the price data were examined using Dickey Fuller (DF) tests, and they were preformed to confirm that all the price series are non-stationary at levels and integrated of the same order.

The estimated test statistics from the DF test for the prices of pepper in different markets at levels and first difference in different time periods are presented in Appendix 1. All the price series in rupee as well dollar terms were transformed into natural logarithm before testing for stationarity as well as cointegration. It could be seen from table that the null hypothesis of non-stationary can be rejected for the prices after first differences. This implied that all the price series of pepper for different markets, namely, Cochin, New York, Lampong, Brazil and Sarawak in different time periods, contained a single unit root and are integrated of order one.

As the five market price series for pepper, *viz*., Cochin, New York, Lampong, Brazil and Sarawak were integrated of the same order, the test

for cointegration was done using the maximum likelihood test procedure (Johansen and Juselius,1990) as it provides most efficient estimate of the cointegrating vectors and also identifies the number of cointegrating relationship among the non stationary variables.

The results of the multivariate cointegration tests for prices of pepper at five markets in rupee and dollar terms in two periods, 1990-1999 and 2000-2009 reported in Table 6 and Table 7 revealed that the null hypothesis of no cointegration (r=0) could be rejected at one percent level of significance for both the periods. But the null hypothesis of r<=3 was accepted for pre-WTO periods confirming that there are three or less than three cointegrating vectors among the different price series in the first period (1990-1999). For the second period (2000-2009), the null hypothesis of r<=3 was rejected and this confirmed the presence of four cointegrating vectors among the series. The trace test showed the presence of three cointegrating vectors in the first period while the number of cointegrating vectors increased to four in the second period. Since the number of price series included in the cointegration test for pepper was five (n=5), the number of common stochastic trends turned out to be two and one in the first and second periods respectively. The finding of n-1 cointegrating vectors in the second period implies that all the prices contain the same stochastic trend and therefore are pair wise cointegarting. It could be seen that the number of market that were cointegrated in the second period was higher than that in the first period. This suggests that liberalization has improved the transmission of price signals between the domestic and the international markets.

In the case of pair wise cointegration between Cochin and New York prices for MG1, there was no cointegration in the first period (1990-1999), while cointegration was confirmed in the second period. Even though the analysis with the annual data could not prove any transmission of instability to domestic markets; cointegartion analysis proved that prices move together, especially in the present liberalized context (Table 8).

Table 6: Results of the Multiple Cointegration Tests for prices of Pepper in Indian and International Markets (Prices in Rupees)

1990 - 1999 Trace Test				2000-2009 Trace Test			
Eigen value	Null	λ-trace	Critical Value	Eigen value	Null	λ-trace	Critical Value
0.3974	r = 0	152.45	68.68	0.6456	r = 0	341.96	68.68
0.3471	r<=1	92.17	47.21	0.5891	r<=1	218.52	47.21
0.2283	r<=2	41.44	29.38	0.5044	r<=2	112.68	29.38
0.0824	r<=3	10.6	15.34	0.1891	r<=3	29.14	15.34
0.0031	r<=4	0.37	3.84	0.0346	r<=4	4.19	3.84

Table 7: Results of the Multiple Cointegration Test for prices of Pepper in Indian and International Markets (Prices in Dollar)

1990 - 1999 Trace Test				2000-2009 Trace Test			
Eigen value	Null	λ-trace	Critical Value	Eigen value	Null	λ-trace	Critical Value
0.4199	r = 0	156.98	68.68	0.642	r = 0	341.13	68.68
0.3435	r<=1	92.18	47.21	0.5869	r<=1	218.89	47.21
0.2312	r<=2	42.1	29.38	0.5047	r<=2	113.68	29.38
0.0865	r<=3	10.82	15.34	0.1941	r<=3	30.07	15.34
0.0004	r<=4	0.05	3.84	0.0362	r<=4	4.38	3.84

Table 8: Results of the Cointegration Test between prices of Pepper (MG1) in Indian and International Markets

1990-1999 (Rupees) Trace Test				**2000 - 2009 (Rupees) Trace Test**			
Eigen value	Null	λ-trace	Critical Value	Eigen value	Null	λ-trace	Critical Value
0.0935	r = 0	11.59	15.74	0.1842	r = 0	28.67	15.34
0.0386	r<=1	0.0059	3.84	0.0386	r<=1	4.65	3.84
1990-1999 (Dollar) Trace Test				2000 - 2009(Dollar) Trace Test			
Eigen value	Null	λ-trace	Critical Value	Eigen value	Null	λ-trace	Critical Value
0.0984	r = 0	12.57	15.34	0.1863	r = 0	29.25	15.34
0.0029	r<=1	0.3425	3.84	0.0408	r<=1	4.91	3.84

(v) Relationship between the world market instability and producers price

The price volatility transmission from world price to producer price begins with the average annual export price received by a country, the average Export Unit Value (EUV) and the average import price paid by the country, Import Unit Value (IUV), which need not closely follow the world price. Differences between the world price quotation and the EUV and IUV can be explained by differences in quality, by the seasonal distribution of exports and imports, by forward pricing contracts and by the particular world market location used. The mapping of UVs in local currency to the average producer price is primarily affected by three factors. The first is the share of production sold in domestic market or carried forward stocks, especially if there are quality differentials between the domestic and export/import markets. Second, government intervention in the form of export taxes/ import tariff, attempts at price stabilization, or other intervention in the domestic market induce less than perfectly correlated movements between the domestic price and the EUV/IUV. The third factor is the size and temporal behaviour of marketing and processing margin retained by market intermediaries.

The transformation from EUV/IUV in US dollar to the average producer price (PP) in local currency depends primarily on four factors, namely, the exchange rate, the share of production sold in the domestic market, government intervention and the marketing and processing margins retained by the market intermediaries. The role of changes in the exchange rate in buffering the producer prices from UVs was isolated by a simple variance decomposition analysis[4] as followed by Hazell (1989).

The variance decomposition analysis decomposes the variance of producer price V(PP) into five variability components namely variance of Export Unit Value/ Import Unit Value in dollars V(EUV$)/ V(IUV$), variance of exchange rate V(ER), covariance between EUV or IUV and exchange rates (Cov (EUV$/IUV$, ER)), residual (R) and variance of error term u_t ($\sigma^2 u$). $\sigma^2 u$ was estimated from the u_t of the regression in which producer price (PP) was regressed as a function of EUV as well as IUV in rupees. The results are expressed as percentages in Table 9.

Table 9: Decomposition of Variance in Producer Prices (in %)

Components	1990-1999	2000-2008	1990-2008
Producer Price and Export Unit Value			
V(EUV$)	39.43	47.32	48.53
V(ER)	10.07	0.96	15.43
COV(EUV$,ER)	27.43	-4.09	18.43
σ^2u	0.78	27.97	0.42
R	22.29	27.84	17.19
Producer Price and Import Unit Value			
V(IUV$)	44.31	84.28	58.24
V(ER)	8.40	1.28	14.00
COV(IUV$,ER)	25.91	-11.82	18.96
σ^2u	3.00	7.44	0.25
R	18.38	18.82	8.55

In the decomposition of the variance in producer prices as a function of the Export Unit Value, the major component which explained the variation in all the periods was variance in EUV$. This variability component explained about 39 per cent variation in producer prices in period from 1990-99 and it increased to 47 per cent during the second period. For the overall period V(EUV$) explained about 49 per cent of the producer price variation. It can be inferred that the major factor which explained variation in producer price of pepper was international price through the EUV$. The implications of exchange rate volatility on the trade volume can be in terms of uncertainty in the exchange rates leading to the uncertainty of the effective prices applicable to the exporters, which in turn affects the wholesale prices and then the producer prices, ultimately resulting in uncertain profits. If the profits are more risky, it may be expected that the risk adverse trader or producer will reduce his volume of trade or production to minimize the adverse impact on his profit. Variability in the real exchange rate, V(ER) explained 10 per cent of producer price variation during 1990s, it reduced substantially to 0.96 per cent during the period from 2000-2008 and for the overall period it explained about 15 per cent of the variance in producer prices.

The covariance between exchange rate and export unit value [COV (EUV$, ERR)] played a major role in the contribution to V(PP) during 1990s and for the latter period, the covariance being negative, fluctuations in EUVs are correlated with movements in the real exchange rate and it buffered the producer prices. For the overall period the covariance explained about 18 per cent of the variation in producer prices. The su^2 is that part of V (PP) not explained by the V (EUV$) and V (RR) and explained by the government policy, the effects of domestic market and market intermediaries. The results revealed that su^2 is a major source of V (PP) in the second period from 2000-2008 and its contribution was negligible during the first period. There is a concern that there would be adverse impact of undue price fluctuations in the

world market on domestic prices of pepper. Even though WTO bound rates are higher than the tariff rates fixed by the government, they are not sufficient to protect the farmers from the international pressures. The results also indicated that the variation in producer price is mainly explained by EUV. The variation in producer prices, explained by domestic factors is a much greater source of variability in producer prices in the recent period and hence the country has to reorient its internal policies also to protect the producers from price variations.

Since pepper is also a commodity that is being imported to a great extent in recent years, the decomposition of variance in producer prices as a function of Import Unit Value was also attempted. The variance in IUV has been the dominant source of variance in producer prices. This percentage contribution almost doubled from 44 to 84 per cent in the period from 2000-2008. Hence it could be inferred that the variations in Farm harvest Prices of pepper, especially after 2000, is mainly due to the imports from Sri Lanka and ASEAN countries. The contribution of variance in exchange rate to the producer price variance declined in the second period. The negative covariance component also had a buffering effect on the variation in producer prices in the second period unlike the first period. In the decomposition analysis using IUV, the contribution by s^2 u to variance in producer prices increased from three to seven per cent in the second period, indicating that domestic policies contributed little to the variation in farm harvest prices of pepper if we consider the effect of imports. For the overall period also V (IUV) was the major component contributing to the variance in producer prices. Hence, the fear that the opening the flood gate of imports would detrimentally affect our producers is not just sentimental but really a matter to be dealt with caution.

IV. Summary and Conclusion

The levels of instability were sizeable for most of the price series of pepper and the volatility of international prices have increased

considerably in the recent past. The magnitude of domestic price instability has almost doubled in rupee terms. The cointegration analysis suggested that liberalization has improved the transmission of price signals between the domestic and the international market and there is co- movement of prices. In the decomposition of the variance in producer prices as a function of the Export Unit Value, the major component which explained the variation in all the periods was variance in Export Unit Value and it explained about 39 per cent variation in producer prices in period from 1990-99 and increased to 47 per cent during the period from 2000-2009. It can be inferred that the major factor which explained variation in producer price of pepper was international price through the Export Unit value in dollars. The variation in producer prices, explained by domestic factors is also a source of variability in producer prices in the recent period and hence the country has to reorient its internal policies also to protect the producers from price variations. In the decomposition of the variance in producer prices as a function of the Import Unit Value, the percentage contribution of variance in Import Unit Value almost doubled from 44 to 84 per cent in the period from 2000-2008. Hence it could be inferred that the variations in Farm Harvest Prices of pepper, especially after 2000, is mainly due to the imports from Sri Lanka and ASEAN countries. Hence, allowing imports of pepper would detrimentally affect Indian producers and will make them vulnerable to market instabilities.

The uncertainty in prices as a consequence of increased instability may make the farming community apprehensive and may result in farmers moving away from pepper cultivation. It is time that all agencies concerned with the sector should formulate strategies to bring back the prestigious position India had in the world pepper economy. This should cover policies not only on production technology but also on marketing, risk coverage and price stabilization mechanisms.

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Notes

1. The Instability Index is measured as follows

$$1/n \sum_{t=1}^{n} [(|Y(t) - y(t)|) / y(t)] \times 100$$

Where,
Y (t) is the observed magnitude of the variable
y (t) is the magnitude estimated by fitting an exponential trend to the observed value and n is the number of observations

2. The residual trend approach involves regression of the absolute value of residuals from the initial trend regression against time and testing for significant trend.
The residual trend approach is as follows:
$W_t = \beta_0 + \beta_1 t + u_t$

Where, W_t denotes the world price and t, the time variable.
$D_t = b_0 + b_1 t + v_t$
Where, D_t denotes the domestic price.
The residual trend model is given by,
$|u_t| = \alpha_0 + \alpha_1 t + e_t$
$|v_t| = a_0 + a_1 t + \varepsilon_t$
The slope coefficients α_1 and a_1 are tested for significant difference from zero, where the slope coefficient α_1 denotes world price variability and a_1 indicates domestic price variability.

3. The cross-product trend approach is as follows:
With u_t and v_t denoting the residuals from the initial trend equations for world and domestic prices respectively, the product of u_t and v_t was regressed against time,
$u_t v_t = \gamma_0 + \gamma_1 t + Z_t$
The slope coefficient 'γ'$_1$ was tested for its significant difference from zero in order to test for changes in covariance patterns over time.

4. Simple variance decomposition analysis is as follows:
Let $EUV_{(\$)}/IUV_{(\$)}$ and $EUV_{(R)}/EUV_{(R)}$ denote export unit values and import unit values in US dollars and Indian rupee respectively, ER the real exchange rate and PP the produces price in rupees.
By definition, $EUV_{(R)} = EUV_{(\$)} \times ER$ and
$IUV_{(R)} = IUV_{(\$)} \times ER$
The relationship between $EUV_{(R)}$ and PP as well as $IUV_{(R)}$ and PP are not obvious because of the roles of marketing intermediaries between the producer

and the exporter, the domestic market and government interventions, but it can be approximated with a linear regression of the form

$PP_t = a + b\ EUV_{(R)} + U_t$,

$PP_t = a + b\ IUV_{(R)} + U_t$,

Where U_t is a stochastic residual

$PP_t = a + b\ (EUV_{(\$)} \times ER) + U_t$

$PP_t = a + b\ (IUV_{(\$)} \times ER) + U_t$

Using an approximation due to Goodman (1960), the variance of PP is

$V(PP) = b^2 [\underline{ER}^2 \times V(EUV_{\$}) + \underline{EUV_{\$}}^2 \times V(ER) + 2 \times \underline{ER} \times \underline{EUV_{\$}} \times COV(EUV_{\$}, ER) - COV^2(ER, EUV_{\$}) + R] + \sigma u^2$ and

$V(PP) = b^2 [\underline{ER}^2 \times V(IUV_{\$}) + \underline{IUV_{\$}}^2 \times V(ER) + 2 \times \underline{ER} \times \underline{IUV_{\$}} \times COV(IUV_{\$}, ER) - COV^2(ER, IUV_{\$}) + R] + \sigma u^2$

Where V indicates the variance of the variable and CoV the covariance between two variables, single underline (ER, $EUV_{\$}$, $IUV_{\$}$) denote sample means, R is the a residual, and σu^2 is the variance of u_t. Given the variance of PP, it can be decomposed into five variability components, $V(EUV_{\$})$/ $V(IUV_{\$})$, V(ER), $COV(EUV_{\$}$ ER)/ $COV(IUV_{\$}$ ER), R and σu^2).

Appendix I Results of the Stationarity tests for prices of Pepper in Indian and International Markets

	Market	1990 - 1999		2000-2009					
		Price in Rupee		Price in Dollar		Price in Rupee		Price in Dollar	
		Rho	Tau	Rho	Tau	Rho	Tau	Rho	Tau
Levels	Cochin	-9.37	-2.31	-7.1	-2.13	-6.43	-2.4	-7.00	-2.53
	New York	-13.31	-3.08	-9.95	-2.85	-6. 94	-2.29	-7.42	-2.42
	Lampong	-13.83	-3.2	-10.68	-2.99	-6.89	-2.23	-7.34	-2.36
	Brazil	-13.05	-3.1	-10.37	-2.9	-6.83	-2.29	-7.31	-2.42
	Sarawak	-12.77	-3.04	-10.03	-2.83	-6.83	-2.26	-7.31	-2.39
First Difference	Cochin	-111.97 *	-7.03*	-103.08 *	-6.85*	-106.66*	-7.16*	-99.04*	-6.9*
	New York	-178.09*	-8.87 *	-163.97*	-8.57 *	-96.63*	-6.83*	-86.92*	-6.48*
	Lampong	-164.29 *	-8.67 *	-155.72 *	-8.47*	-102.28*	-7.05*	-92.69*	-6.71*
	Brazil	-168.66 *	-8.92 *	-158.07*	-8.27 *	-90.96*	-6.66*	-83.6*	-5.97*
	Sarawak	-183.30 *	-9.29 *	-169.03 *	-8.67 *	-95.87*	-6.84*	-89.5*	- 6.18*

Note: * Significant at one per cent level.

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