Reserve Bank of India Occasional Papers
Vol. 29, No. 3, Winter 2008

Imported Inflation: The Evidence from India

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In the backdrop of recent developments in global commodity prices, this study provides analytical and empirical perspectives on imported inflation in the Indian context. Sources and commodity-wise trends in imported inflation are analysed during the last four decades. Empirical analysis suggests that at the global level, export of inflation from oil exporting countries is significantly higher than that of industrial and non-oil developing countries including Asia. At the same time, despite low domestic inflation, export of inflation from industrial countries is significantly higher than that of non-oil developing countries. Inflation in India is positively influenced by import price, capital flows and exchange rate. Based on a non-parametric approach, import price inflation on an average accounts for about 1 to 2 percentage points increase in domestic inflation. Within the framework of the vector error correction and cointegration model, about 5 percentage points increase in import prices contribute to 1 to 1.5 percentage points increase in domestic prices. In terms of variance decomposition analysis, capital flows have a greater impact on domestic inflation, deriving from the former's association with exchange rate and import prices.

JEL Classification : E31, E37

Keywords : Inflation, Exchange Rate Pass-through

Introduction

Until recently, economists generally held an optimistic view on globalisation. Despite various adverse financial market developments, globalisation ensured rapid economic progress and low inflation rates across countries especially during the 1980s and the 1990s, accompanied by a significant cross-border dispersion of capital flows and enhanced competition for foreign trade in goods and services. However, of late, there is a great deal of concern over the impact of globalisation on exporting and importing of inflation across countries spurred by the record

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level of global commodity prices, particularly in respect of oil, metals and food articles. In India too, the hardening of inflation condition in the domestic sphere has been attributable to global factors in various quarters (Reddy, 2007, Mohan 2006, 2007). However, empirical analysis of the import price pass-through to domestic prices are rather scarce. Studies on conventional exchange rate pass-through to domestic prices do not provide definitive answers. In this milieu, the present study exemplifies various issues. Illustratively, how critical are imports for the economy? Where does inflation come from? What are the channels of imported inflation? Our objective is to address some of these critical issues, based on various facts and figures and investigate the degree to which inflation, whether low or high, is an imported phenomenon. The paper comprises four sections. Section I provides a brief discussion on the various channels through which globalisation affects domestic prices, along with a summary of the literature on cross-country findings. Section II provides various aspects of imported inflation across sources, destinations and commodities at global and regional levels. Section III and Section IV are devoted to the Indian context in terms of stylised facts followed by the empirical analysis of the pass-through of India's import prices to domestic prices. Section V concludes the study.

Section I

The Pass-through Literature: A Cross-country Perspective

Globalisation can impact domestic prices in four ways through (i) cheaper imports of raw materials and capital goods and enhanced competition, (ii) labour mobility and cheaper labour costs, (iii) capital flows and (iv) exchange rates. However, there is disagreement with respect to the impact of various channels. Rogoff (2003) argues that globalisation may not enhance competition, leading to a steeper Phillips curve. In contrast, the IMF supports the fact that globalisation increases competition and thus, flattens the Phillips curve (Ball, 2006). Generally, it is viewed that globalisation, in the form of growing trade integration and reduced barriers to market access by foreign producers, enhances competition in domestic markets through increased imports. Such competition, in turn, leads to efficient allocation of factors as per the comparative advantages, resulting in increasing volumes of trade and higher productivity as economies concentrate their resources in those

sectors in which they have core competence. The overall outcome could be the lower prices.

From cross-country perspective, several studies have examined the retail price sensitivity to exchange rates particularly after the collapse of Bretton-woods system (Box 1). These studies provide various perspectives on the subject. In the early years of floating exchange rates, it was widely expected that movements in exchange rates could have significant impact on domestic prices. Deriving from the purchasing-power parity postulate, it was felt that control of domestic inflation would become more challenging in the phase of exchange rate volatility. However, in recent years, inflation in a number of industrial and emerging market countries has remained surprisingly stable in the face of wide swings in exchange rates. This development drew attention to the issue of exchange rate pass-through (ERPT) to import and domestic prices and to whether and why it has declined. Literature broadly suggests that the exchange rate pass-through, in general, is incomplete. For example, Gagnon and Ihrig (2004), Campa and Goldberg (2005), Bouakez and Rebei (2005) and Bailliu and Fujii (2004) have looked at ERPT in developed economies and found that it has declined for most of them during the 1990s. In a cross-country analysis, McCarthy (2000) and Mihailov (2005) suggested that pass-through to consumer prices is small and in fact, in some cases, it is insignificant. Fact is that many industrialised countries have experienced large exchange rate depreciations in more recent periods but despite that they were able to have a low inflation as exchange rate depreciations had much smaller effects on consumer prices than anticipated (Bailliu and Fujii, 2004). Devereux and Yetman (2002) found empirical evidence suggesting that exchange rate changes were, at best, weakly associated with changes in domestic prices at the consumer level.

In the context of declining pass-through to domestic inflation, two arguments are often made. First is the microeconomic phenomenon based on various structural features of international trade, such as pricing to market by imperfectly competitive firms (Corsetti and Dedola, 2002), domestic content in the distribution of traded goods (Corsetti and Dedola, 2002 and Burstein, Neves and Rebelo, 2000), the importance of non-traded goods in consumption (Betts and Kehoe, 2001), and the scope of

Box 1: Cross-Country Studies on Exchange Rate/Import Prices Pass-through on Consumer Prices

Author(s)/ year	Country/ Period	Extent of ER/IP pass-through to CP	Variables	Methodological Framework
Advanced Economies				
Jonas Stulz (2008)	Switzerland (1976.1 – 2004.12)	IP→CP: Strong	Endogenous variables: Δ ER ΔIP, ΔCP, OG, ΔM Exogenous variable: ΔFCP	Recursive VAR, Impulse Response Function
Reginaldo Pinto Nogueira Junior (2007)	Canada Sweden UK South Korea	ER→CP: NS ER→CP: S ER→CP: NS ER→CP: S [LRPT]	ΔER, ΔCP, ΔPP1	Granger Causality
Sekine (2006)	US Japan Germany UK France Italy (1974Q1-2004Q1)	ER→IP: Declined IP→CP: Declined (In all countries)	ΔIP, ΔEER, ΔFP, ΔCOMP, OG, IPR	Single equation regression
Emerging and Developing Economies				
Nkunde Mwase (2006)	Tanzania (1990Q1-2005Q1)	ER→CP: Declined during 1990s	ΔOG, ΔER, ΔCP, ΔM	Granger Cause, Structural VAR, VEC.
Nombulelo Duma (2008)	Sri Lanka (2003.1 – 2007.7)	IP→CP: Incomplete (19% after 10 months)	ΔOP, OG, ΔER, ΔIP, ΔWP, ΔCP, ΔM	VAR, Impulse Response Function
Reginaldo Pinto Nogueira Junior (2007)	Brazil Mexico South Africa Czech Rep. (post-IT)	ER→CP: NS ER→CP: S ER→CP: S ER→CP: S [LRPT]		
Jeevan Kumar Khundrakpam (2007)	India (Post Reform)	ER→Domestic Prices (Coefficient of LRPT is 0.20 for ER appreciation and 0.05 for ER depreciation)		VAR, Rolling regressions
Dubravko Mihaljek and Marc Klau (2008)	Hong Kong India Malaysia Philippines Singapore Thailand Columbia Hungary Peru Venezuela Czech Rep. Poland South Africa Turkey Israel (Late 1980s/early 1990s–2000 to 1994–2006:Q2)	ER→CP : Decline ER→CP : Decline ER→CP : Increase ER→CP : Decline ER→CP : Decline ER→CP : Decline ER→CP : Decline ER→CP : Decline ER→CP : Decline ER→CP : Decline ER→CP : Increase ER→CP : Decline ER→CP : Decline ER→CP : Decline ER→CP : Decline	ΔCP, ΔFP ΔER OG ΔEREERG	Simple regression

Notations: CP: Consumer prices, IP: Import prices, ER: Exchange Rate, OG: Output gap, M: Money Stock, FP/ FCP: Foreign Consumer Prices, WP: Wholesale Prices, OP: Oil Prices, RI: Rate of Interest, PPI: Producer Price Index, LRPT: Long-run Pass-through, IT: Inflation Targeting, ERERG: Equilibrium Real Exchange Rate Gap, IPR: Import Penetration Ratio, COMP: Commodity Prices, EER: Effective Exchange Rate.
Note: S: Significant, NS: Not Significant.

substitution between goods in response to exchange rate changes (Burstein, Eichenbaum and Rebelo, 2002). Others argued, however, that the failure of pass-through is more of a macroeconomic phenomenon, related to the slow adjustment of goods prices at the consumer level (Engel, 2002). Campa and Goldberg (2002) provided evidence for OECD countries that both micro and macro factors are important in the evolution of exchange rate pass-through estimates over time, but they ultimately come down on the side of a microeconomic explanation, based on the changing composition of import goods. Campa and Goldberg (2006) argued that there are a number of forces that contribute to less than complete pass through of exchange rates into the final consumption prices of imported goods. Calvo and Reinhart (2000), using a VAR model of exchange rate and inflation, found that the impact of ERPT is considerably higher for emerging markets than for developed economies. Using an Error Correction Model, Hausmann, Panizza and Stein (2001) found similar results. Sekine (2006) estimated the ERPT for major industrial countries (the United States, Japan, Germany, the United Kingdom, France and Italy) by dividing into impacts of exchange rate fluctuations to import prices (first-stage pass-through) and those of import price movements to consumer prices (second-stage pass-through). He found that both the first and second-stage pass-through effects declined over time for all of the sample countries. He supported the view that more competitive pressures as reflected in high import penetration ratio have reduced the pass-through effect. However, there are arguments that relationship with import penetration might go in both directions. On the one hand, the higher import penetration and the consequent greater competition may turn the domestic firms merely as price taker, thus leading to an increase in the pass-through effect. On the other hand, greater competition and a commensurate reduction in the market power of dominant firms may reduce the pass-through effect.

In the context of Canada, Lapham and Leung (2006) explored two potential explanations for the observed decline in exchange rate pass-through to consumer prices over the last two decades: (i) a general fall in inflation and (ii) the restructuring in the retail industry. They argued that the restructuring in Canadian retail sector apparently had increased competition and reduced firms' pricing power and contributed to low

inflation. Shifts in monetary policy towards lower inflation may have altered the consumer behaviour and may have changed the competitive environment in the retail sector. These forces together have lowered retailers' ability and willingness to pass-through the exchange rate movements to their prices. Leiderman and Bar-Or (2000), Eichengreen (2002), Mishkin and Savastano (2001) and Schmidt-Hebbel and Werner (2002) also argued that the declining ERPT is a by-product of credibility gains of monetary policy. According to them, credible monetary authorities are expected to act according to the inflation stability objective, which keeps low inflation expectations even in the advent of a large depreciation. In this sense, Levin, Natalucci and Piger (2004) actually suggested that measuring the degree of ERPT would be an indirect assessment of central bank credibility.

Zorzi *et al.* (2007) examined the degree of exchange rate pass-through to prices in 12 emerging markets in Asia, Latin America and Central and Eastern Europe. Their findings falsified the conventional hypotheses that ERPT into both import and consumer prices is always higher in emerging than in developed economies. For emerging markets, most notably the Asian countries, pass-through to import and consumer prices was found to be low and not very dissimilar from the levels of developed economies (Table 1). Ito and Sato (2007), covering the crises hit countries of the 1990s, found that the degree of ERPT is higher in Latin American countries and Turkey than in most of the East Asian

Table 1 : Accumulated Percentage Response of Consumer Prices to 1 percentage Exchange Rate Shock

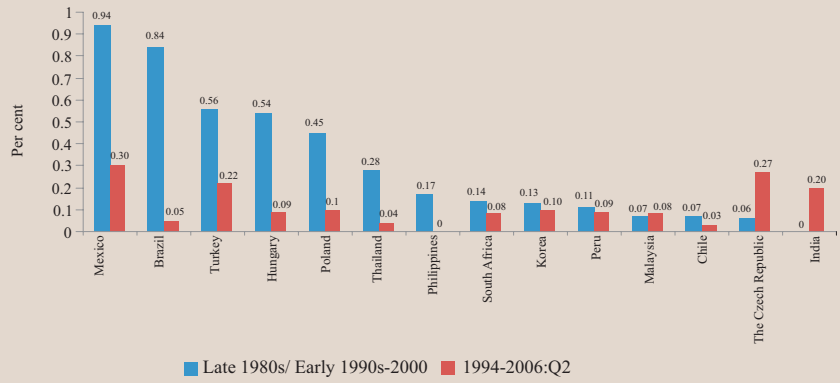
Country	4 Qtr Response	8 Qtr Response
China	0.08	0.77
Hong Kong	0.07	0.37
Korea	0.19	0.13
Singapore	-0.15	-0.06
Taiwan	0.01	0.01
Czech Rep.	0.61	0.77
Hungary	0.48	0.91
Poland	0.31	0.56
Turkey	0.09	0.12
Argentina	0.02	0.04
Chile	0.35	0.35
Mexico	0.76	1.39

Source: ECB Working Paper No.739, March 2007.

countries. In particular, Indonesia, Mexico, Turkey and to a lesser extent, Argentina showed a strong response of CPI to the exchange rate shock. Mihaljek and Klau (2008) provided estimates of the pass through from exchange rate and foreign prices changes to inflation in 14 emerging market countries for the period 1994 to mid-2006. They also confirmed that in general the extent of pass through has declined in recent periods (Chart 1). In the case of China, Yu (2007) found an incomplete ERPT to domestic prices. Nogueria Jr. (2007) compared the change in the degree of ERPT for a set of emerging and developed countries which have adopted inflation targeting. He found that ERPT on consumer as well as producer prices decreased after the adoption of inflation targeting for most of the economies. Producer prices, however, were found to be more responsive than consumer prices to the exchange rate shocks. He argued that ERPT are still important for driving domestic inflation over the long run.

Some researchers argued that exchange rate pass-through to domestic prices would also depend on whether the movement in exchange rate is perceived to be temporary or permanent phenomenon. Using staggered price setting behavior, Taylor (2000) showed that firms tended to change prices more often when cost changes were perceived to be more persistent. In this case when inflation is high, ERPT tends to be high as well. According to Campa and Goldberg (2005), the pass-through of costs into mark-ups is endogenous to a country's inflation performance, which

Chart 1: Pass-Through of Exchange Rates to Inflation



Source: Mihaljek and Klau, 2008.

has been confirmed empirically by Choudhri and Hakura (2006), Baqueiro, Diaz de Leon and Torres (2003), Gagnon and Ihrig (2004) and Ca'Zorzi, Hahn and Sanchez (2006). Arguing that the extent of pass-through to consumer prices is less than that to import prices, Bacchetta and Wincoop (2001) argued that apart from the local distribution costs, there could be an alternative complementary explanation based on the optimal pricing strategies of firms based on the fact whether importing domestic firms face competition from other domestic final goods producing sectors (*e.g.*, the non-traded goods sector) in the domestic markets or not. If yes, such firms prefer to price in domestic currency, while exporting firms tend to price in the exporter's currency. In that case, the pass-through to import prices is complete, while the pass-through to consumer prices is zero. Furthermore, it may be argued that since exchange rate hedging has become more prevalent in recent years, it would take longer time lags from changes in exchange rates to reflect in changes in import or final consumer prices. Even though, the variable and methodology varied but they reflected that the reasons behind the decline in exchange rate pass-through to consumer prices could be a macroeconomic as well microeconomic phenomenon and in some cases may be common for the most and sometimes it may be more country-specific (Devereux and Yetman, 2002).

Section II

Global Trade in Inflation

Inflation rates remained well within the comfort zones of most of economies particularly the advanced and also in a number of emerging market economies during the 1980s and 1990s (Table 2). There are various explanations to the question whether the underlying factors were common or country specific that led to a general fall in inflation. For instance, low inflation is often construed as one of the benefits from increased globalisation and thus, intense global competition and low costs in the recent decades. To be specific, the greater participation of emerging market economies in the world trade has ensured low inflation by supplying at low costs. Examining this hypothesis, IMF (2006) found that the direct impact of globalisation through import prices has, in

Table 2: Global Consumer Price Inflation

(Per cent)

Region	1970s	1980s	1990s	2000s	2003-07
1	2	3	4	5	6
WORLD	10.9	15.6	15.1	3.7	3.6
(1) Industrial	8.7	6.2	2.8	2.1	2.2
(a) US	7.1	5.6	3.0	2.8	2.9
(b) Euro Area	–	–	1.5	2.2	2.1
(2) Developing	16.2	36.8	36.1	5.7	5.4
(a) Non-oil Developing	17.6	42.9	39.3	5.3	5.0
(i) Asia	10.3	9.0	8.0	3.1	3.8
(b) Oil Exporting	11.2	12.0	18.2	9.0	9.5
India	9.0	8.0	8.1	5.1	5.5

Note: – Not Available.
Source: IMF.

general, been small in the industrial economies though the impact on relative prices through foreign competition has been significant. However, IMF confirmed that inflations rates in advanced countries had become less sensitive to domestic capacity constraints, *i.e.*, supply side constraints. Besides globalisation, low inflation rates were attributed to the more credible monetary policies of central banks. White (2008) contended that the argument of more effective central bank policy did not explain why inflation fell sharply in countries with varied levels of economic and financial developments, central bank independence and exchange rate regimes. Another line of argument for low inflation relates to domestic deregulations that have taken place in many countries during recent period. Lastly, the literature also suggests that excess global savings in recent periods or equivalently a global investment drought led to low prices. Apart from these, there is another alternative associated argument of broad productivity gains reflected in lower prices.

White (2008) argued that none of these four arguments fully explained the low inflation phenomenon and thus advocated a global demand and supply approach in which all these explanations mattered to varying degrees during different periods. If one casts a glance over the inflation record of past three-four years across the countries, it was largely subdued despite significant rise in commodity prices, strong growth and accommodative monetary policy in major currency areas. However, of

late, most of the advanced as well as emerging market and developing economies have witnessed inflationary pressures generally attributable to rising energy and food prices. Does this mean the supply side concerns can no longer be hidden and thus have to necessarily reflect through high inflation. More important will be to know the extent to which the underlying arguments for low inflation hold good in the circumstances when most of advanced and emerging markets faced increasing inflationary pressures and conduct of monetary policy was becoming more difficult. Recent developments also raise the issues whether the recent phase of high prices across countries had nothing to do with globalisation and instead was on account of those items which are less substitutable and the demand for which was less price elastic. In short, it is debatable whether the recent rise in headline inflation across the countries was solely a supply-side phenomenon and thus making the task of price stability more challenging for the hapless central banks or inflation is still a monetary phenomenon and central banks' monetary policies will again prove to be credible and relevant.

II.1 Where does the inflation come from?

Reflecting the trends in domestic prices, export and import prices (or export and import unit value indices) across countries show as to how inflation is exported from sources and imported at destinations across the globe. Deriving from the IMF's International Finance Statistics, Table 3 provides a comparative perspective on export price inflation at global and various regional levels through the 1950s to the current decade.

At the global level, export prices witnessed a substantial rise in the 1970s, significant moderation in the 1980s, deflation during the 1990s and strong revival in the current decade, especially since 2003. At the regional level, export of inflation during the 1970s was mainly due to oil exporting countries. Due to the sharp increase in the oil price, aggregate export of inflation from developing economies was higher than that of industrial countries. Interestingly, as the reference shifts to non-oil developing countries, especially Asia, a different picture emerges; export of inflation from these countries was not higher than industrial countries.

During the 1980s and the 1990s, the sharp decline of export price inflation could be attributable to two major developments. On the one

Table 3: Global and Regional Export Price Inflation

(Per cent)

Regions	1950s	1960s	1970s	1980s	1990s	2000s	2003/7
1	2	3	4	5	6	7	8
WORLD	1.8	0.6	12.8	3.3	-0.1	4.1	7.6
Industrial	0.4	0.4	11.1	3.3	0.2	4.0	7.7
(a) US	1.6	1.6	9.5	3.8	0.4	2.1	3.4
(b) Japan	1.4	-0.1	9.0	3.6	-0.2	-0.5	1.6
(c) Euro Area	-	-	-	-	6.2	6.9	11.6
Germany	4.3	1.9	12.4	3.2	-0.3	4.3	8.7
Developing	0.4	1.9	19.3	3.0	-1.0	4.3	7.6
(a) Non-oil	0.6	2.9	10.7	1.8	-1.2	2.2	5.1
(i) Asia	1.1	2.4	9.7	2.0	-0.8	1.4	3.9
(b) Oil Exporting	0.3	-0.3	38.5	1.2	1.4	16.8	19.6
India	**-0.5**	**1.0**	**8.6**	**2.6**	**-2.0**	**4.6**	**10.2**

Note: – Not Available.

Source: IMF International Financial Statistics.

hand, export of inflation from the oil exporting countries remained subdued, despite the second-oil shock in the early 1980s. Non-oil developing countries maintained low export price inflation, despite the substantial acceleration in their domestic inflation, as they were engaged aggressively in enhancing the world market for their exports. In the 1990s too, the non-oil developing countries played a key role in deflation of export prices at global level. On the other hand, industrial countries continued to have their export price inflation more or less similar to developing countries but a percentage point higher than Asia. In the more recent period, region-wise trends showed that in the current environment oil exporting and industrial countries played a major role in global trade in inflation. Export prices of oil exporting countries increased on average 19.6 per cent annually during 2003-07, about twenty times the average in the 1980s and the 1990s. During the same period, export prices of industrial countries also increased by 7.7 per cent, comprising Euro area export price inflation at 11.6 per cent (up from 6.2 per cent in the 1990s) and the US export price inflation at 3.4 per cent (up from 0.4 per cent in the 1990s). Similarly, export prices of non-oil developing countries and the emerging Asia witnessed an increase of 5.1 per cent and 3.9 per cent, respectively, during 2003-07, but lower than the trends in the industrial countries.

II.2 Where does inflation go?

Table 4 shows the import price inflation at global and regional levels through the 1950s to the current decade. Similar to the export price inflation, import price inflation was substantially lower during the 1980s and 1990s as compared with the 1970s and the more recent period. Across regions, there are several distinguishing features of imported inflation. During the 1970s, unlike export price inflation, import price inflation of developing countries was lower than that of industrial countries. For non-oil developing Asia, import price inflation was lower by 400 basis points than industrial countries. During the 1980s, industrial countries continued to maintain import price inflation higher by about 180 basis points than that of developing countries, notwithstanding substantial moderation in import price inflation in general. In the 1990s, import price inflation at global level witnessed a deceleration, accompanied by marginal inflation in industrial countries and a deceleration in developing countries. In the more recent period, there is more or less convergence of import price inflation of developing and industrial countries. Import price inflation is relatively high in the Euro area than the US and developing Asia.

Table 4: Global and Regional Import Price Inflation

(percent)

Region	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**	**2000s**	**2003/7**
1	2	3	4	5	6	7	8
WORLD	0.6	0.4	12.7	3.2	-0.1	4.4	7.9
Industrial	0.7	0.0	13.0	3.5	0.1	4.5	8.0
(a) US	2.3	1.0	13.4	3.6	0.3	3.2	5.0
(b) Japan	-1.3	0.2	15.3	3.6	-0.1	5.1	8.8
(c) Euro	-	-	-	-	-	8.4	12.1
Germany	-3.3	-0.1	13.3	2.3	-0.2	5.5	10.2
Developing	-0.8	3.3	11.3	1.7	-0.7	4.3	7.4
(a) Non-oil	-0.8	3.2	11.1	1.8	-0.7	4.3	7.4
Asia	-1.1	5.2	8.8	2.0	-0.3	3.5	6.0
(b) Oil Exporting	-	-	-	-	0.6	2.1	5.9
India	**-0.9**	**0.4**	**13.9**	**0.3**	**-3.2**	**4.1**	**5.0**

Note: – Not Available.

Source: IMF International Financial Statistics.

II.3 Net Terms of Trade

Deriving from Table 3 and Table 4, it can be inferred that all regions/ countries could engage in exporting as well as importing of inflation. For some countries, import of inflation could be greater than export of inflation and *vice versa* for other countries. At a more formal level, export and import price inflation differential as shown in Table 3 and 4 translates to changes in terms of (net) terms of trade (NTT), which in turn reflect gains for countries and regions from the cross-border trade. Trends in the terms of trade indicator reveal various aspects of gains from trade for industrial and developing countries (Table 5). First, over a long horizon from the 1950s through the current decade, the net terms of trade showed a declining trend for industrial countries but a rising trend for developing countries region. Within developing countries, there were disparities as NTT showed a declining trend for non-oil exporting countries but a sharp rising trend for oil exporting countries. Second, a crucial insight derives from the comparision between average terms of trade for various periods with the benchmark value of NTT at 100 for the base year 2000. For the more recent period (2003-07) in particular, industrial countries continued to enjoy a favourable terms of trade, as the NTT was higher than the

Table 5: Global and Regional Terms of Trade

(Per cent)

Region	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**	**2000s**	**2003-07**
1	2	3	4	5	6	7	8
World	95.8	100.3	104.1	100.5	103.9	100.9	101.1
Industrial Countries	109.5	118.2	113.6	97.8	104.3	101.4	101.5
United States	119.3	133.4	115.8	100.3	103.3	100.1	98.8
Euro Area					117.1	100.8	100.8
Developing and	-	-	-	-	-	-	-
Emerging Economies	66.4	55.0	81.0	106.3	102.4	99.6	100.2
Non-oil developing	129.6	114.8	118.7	102.3	107.4	95.7	93.7
Developing Asia	121.6	81.2	113.7	104.2	106.0	94.1	91.9
Western Hemisphere	108.4	169.0	157.0	140.8	117.9	110.8	113.7
Africa	77.2	67.2	90.9	118.2	106.9	104.4	107.8
Oil Exporting	-	-	-	58.5	68.9	129.9	153.7
India	**89.0**	**93.7**	**90.1**	**83.7**	**105.1**	**97.8**	**99.6**

Note: - Not Available.

Source: IMF.

benchmark. On the other hand, for developing countries, the NTT was almost stable, closer to the benchmark, attributable to oil exporting countries, which witnessed the spurt in the NTT. Within developing countries, the NTT was lower by 7 to 8 per cent than the benchmark for the same period for non-oil developing and Asia regions.

II.4. Global Commodity Prices

According to the commodity price index data of the IMF and the World Bank, all commodities price index witnessed a sharp 18.4 per cent increase during 2003-07 as compared with a deceleration, *albeit* marginally, during the 1990s, spurred by metals, energy, and food commodities. The World Bank's commodity price index of low and middle income countries also showed a sharp acceleration during the current decade, as compared with deflation trends in the 1980s and the 1990s (Table 6). In the first quarter of 2008, several commodities witnessed record level of prices. Food price inflation was highest since the late 1970s whereas prices of metals and non-fuel commodities were highest since the late 1980s.

Table 6: Trends in Global Commodity Price Inflation

(Per cent)

Commodity Group	1960s	1970s	1980s	1990s	2000s	2003-07	2008(Q1)*
1	2	3	4	5	6	7	8
All Commodities	-	-	-	-0.4	13.9	18.4	45.5
Non Fuel Commodities	-	-	0.8	-2.0	8.2	12.9	48.3
Food	1.2	12.1	-1.7	-2.1	6.1	9.0	72.9
Beverages	-0.4	17.8	-5.4	1.9	4.6	8.8	34.2
Agr. Raw Materials	0.3	14.2	4.2	-0.3	2.6	3.8	21.4
Metals	3.8	9.4	2.0	-3.3	17.7	28.5	30.4
Energy	-	-	-	2.1	19.9	23.2	87.2
Crude oil spot average	-0.6	46.4	-2.4	2.0	20.6	23.8	66.5
Developing Countries Index (World Bank LMIS)	0.9	12.4	-1.8	-1.5	9.4	16.2	36.02

Note: - Not Available.

* : Current trend from World Bank Commodity price pink sheet, May 2008.

Source: IMF: IFS Online; World Bank: Commodity prices Online database.

II.4.1 Oil Price Inflation

The surge in international prices of petroleum products since the early part of the current decade is attributable to growing consumption demand of emerging economies, led by China. In order to support high economic growth, China's oil demand as per cent to world oil demand more than doubled from the average 4.1 per cent in the early 1990s to 8.9 per cent in 2006 (Table 7). In terms of incremental trends in oil consumption, emerging market economies accounted for about 80.0 per cent of global oil demand during 2000-05, with China accounting for almost half of the demand of emerging economies. In 2006, China's incremental oil demand was about 72 per cent of global oil demand. On the other hand, India's oil consumption demand, though showed an increasing trend, did not witness the sharp acceleration, which was observed in the case of China. The recent trends showed that softening of incremental oil demand from industrial and other developing countries to the extent of 36 per cent whereas the incremental oil demand for emerging economies increased to 136 per cent of global demand.

Table 7: Trends in Growth of Energy Oil consumption

(Per cent)

Period	**1965/69**	**1970/74**	**1975/79**	**1980/84**	**1985/89**	**1990/94**	**1995/99**	**2000/05**	**2006**
1	2	3	4	5	6	7	8	9	10
Share in world (per cent)									
EMEs	14.8	15.3	17.8	21.4	23.8	26.8	31.3	33.9	36.6
China	0.8	1.7	2.7	2.8	3.3	4.1	5.5	7.0	8.9
India	0.9	0.8	0.9	1.2	1.6	1.9	2.5	3.0	3.1
Average growth (per cent)									
EMEs	7.8	7.6	6.5	1.5	4.2	4.0	4.3	3.6	2.9
China	17.7	25.3	8.5	-1.4	6.6	6.0	7.6	8.7	6.6
India	11.9	3.4	6.4	5.4	7.2	4.0	8.6	3.8	0.2
Average Incremental share (per cent)									
EMEs	14.4	7.8	20.8	-28.2	64.0	-307.5	77.6	79.6	136.0
China	1.6	0.2	-1.5	-0.3	15.8	-248.6	19.0	35.2	72.1
India	1.2	0.7	1.2	-3.1	8.8	-20.7	15.6	8.1	0.9
Oil price increase (per cent)	1.8	4.2	15.6	31.9	18.5	18.8	17.6	28.8	64.3

II.4.2 Prices of Food grains

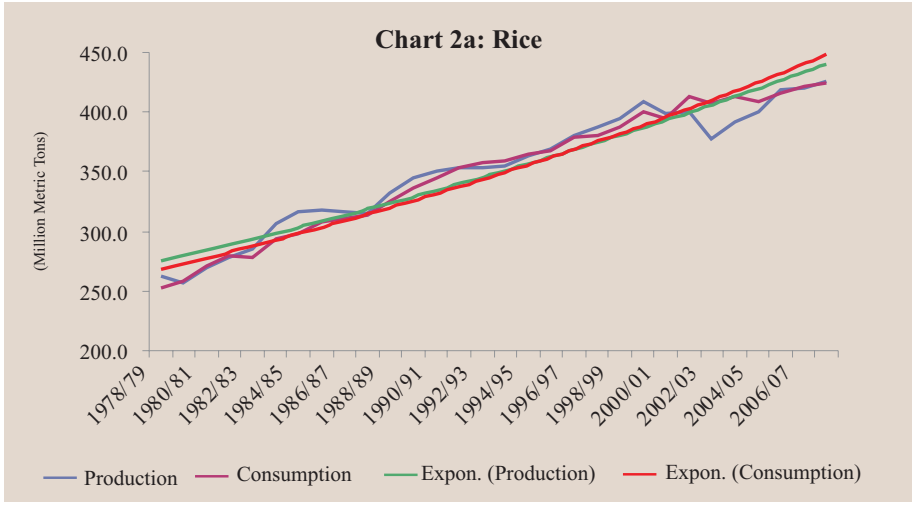
The trends in production, consumption and stock of major cereals and grains reveal various insights about the factors underlying the price dynamics of these commodities in recent years (Table 8). For major food items, such as rice and wheat, the underlying trend in consumption was lower than that of production until the early part of the current decade, thereby, resulting in accumulation of stocks and subdued prices in the 1980s and 1990s. However, this situation has reversed in recent years.

Table 8: Major Food grains: World Demand and Supply

(Million metric tons)

	Rice			Wheat		
Year	**Production**	**Consumption**	**Stock**	**Production**	**Consumption**	**Stock**
1	**2**	**3**	**4**	**5**	**6**	**7**
1978/79	262.4	252.3	54.8	438.9	413.3	134.8
1979/80	256.8	257.6	54.0	417.5	431.9	120.5
1980/81	269.9	271.2	52.6	435.9	444.1	112.7
1981/82	277.9	280.0	50.5	445.0	445.1	112.5
1982/83	285.0	278.7	56.8	472.7	455.6	129.9
1983/84	306.9	294.4	69.3	484.3	468.9	145.3
1984/85	316.8	298.4	87.7	508.9	486.2	168.0
1985/86	318.0	307.9	97.7	494.8	484.6	178.3
1986/87	316.0	310.4	103.3	524.1	511.4	191.0
1987/88	315.3	313.3	105.3	498.3	530.4	158.8
1988/89	332.1	325.7	111.7	494.9	519.4	134.4
1989/90	345.2	336.3	120.6	533.2	531.2	136.4
1990/91	351.0	345.0	126.7	588.4	553.9	170.9
1991/92	353.4	353.2	126.8	543.0	551.5	162.4
1992/93	354.1	357.6	123.3	561.9	548.0	176.1
1993/94	354.7	358.9	119.1	558.3	552.9	181.5
1994/95	363.9	365.2	117.8	522.9	542.2	162.2
1995/96	368.7	368.1	118.4	537.0	544.5	154.7
1996/97	381.1	378.9	120.6	581.3	573.2	162.8
1997/98	387.0	379.7	127.9	610.0	577.2	195.6
1998/99	394.6	388.2	134.3	589.9	578.9	206.6
1999/00	408.9	399.7	143.4	586.4	584.8	208.2
2000/01	398.9	395.3	147.1	582.1	584.5	205.7
2001/02	399.7	413.5	133.3	581.6	586.1	201.2
2002/03	378.1	407.9	103.5	569.2	604.5	165.9
2003/04	391.7	413.2	82.1	554.2	588.2	131.8
2004/05	400.8	408.4	74.4	626.1	607.2	150.8
2005/06	418.1	416.0	76.5	621.3	624.4	147.7
2006/07	420.6	420.9	76.1	593.0	615.8	124.8
2007/08	425.3	424.2	77.2	606.7	619.1	112.5

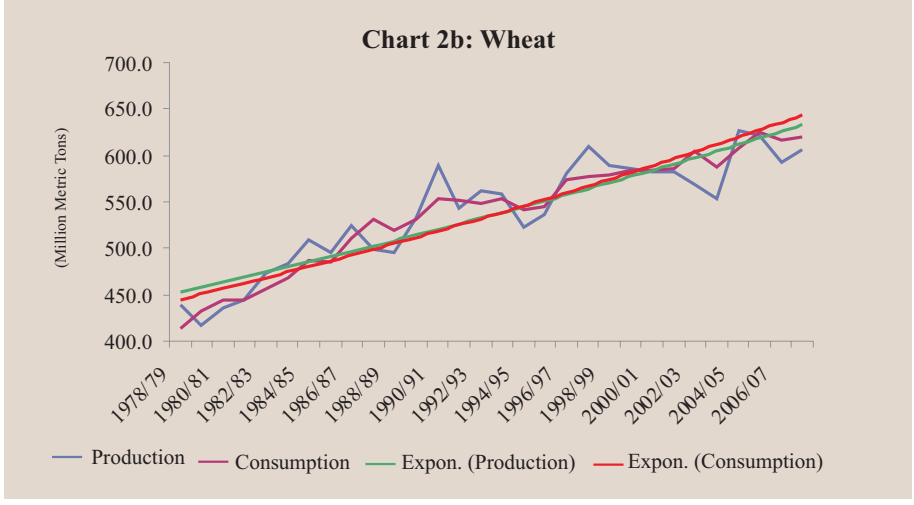
Source: US Department of Agriculture.

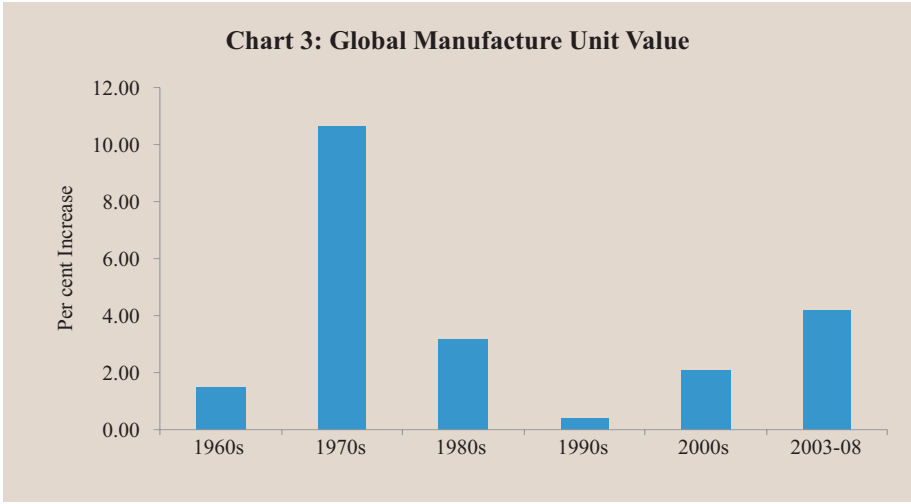


The trend in consumption has outpaced that of the production (Chart 2a and Chart 2b). Consequently, the stock level has declined substantially, fueling the acceleration in price inflation of these commodities. Illustratively, the stock of rice in 2007-08 showed a decline of 47.5 per cent from the peak in 2000-01. Similarly, the stock of wheat in 2007-08 showed a sharp 54.0 per cent decline from the peak in 1999-2000.

II.4.3 Global Manufacture Unit Value Index

According to the World Bank, industrial countries' manufacture export price inflation, which reflects on the import cost for developing





countries, increased to an average of 4.2 per cent during 2003-08 as compared with negligible 0.4 per cent during the 1990s and 3.2 per cent in the 1980s. On a positive note, however, manufactures export price inflation did not witness the kind of acceleration that was witnessed in the 1970s, despite oil price inflation in the more recent period being substantially higher than the 1970s (Chart 3).

Section III

The Evidence from India

In the Indian context, the study addresses the following questions: (i) How important are imports for the economy?, (ii) What do we import?, (iii) Where do we import from? and How does imported inflation affect domestic prices? In order to examine these aspects, developments at the aggregate level and in respect of sources and commodity composition of imports are discussed below.

III.1 Role of Imports in the economy

The ratio of imports to GDP at factor cost at current prices (M/GDP), which is often used as the indicator of aggregate import intensity in the economy increased from 6.7 per cent in 1950-51 to 22.9 per cent by 2007-08 (Chart 4). Decade-wise, the import intensity which averaged 7.4 per cent in the 1950s, moderated to about 6.0 per cent in the 1960s and 1970s but accelerated to 8.7 per cent, 11.8 per cent, and 20.0 per

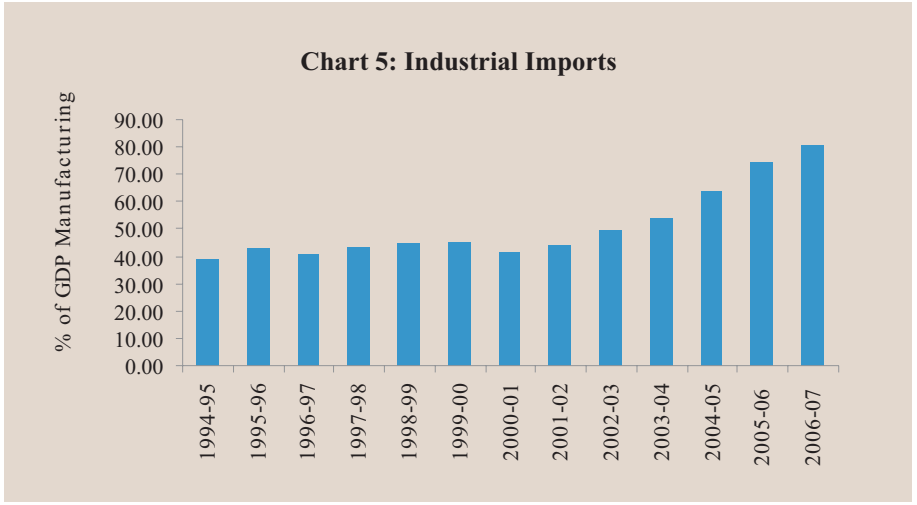
Chart 4: Import-GDP Ratio

cent during the 1980s, the 1990s and the current decade (up to 2007-08), respectively. Since services dominate the Indian economy, it is useful to relate merchandise imports to GDP originating from commodities sector including agriculture, mining and manufacturing activities. From this perspective, the ratio of total merchandise imports to GDP of the commodity sector (M/GDPG) increased from 10.5 per cent in 1950-51 to 61.4 per cent in 2007-08 (Chart 4).

Yet another consideration is that large component of imports relates to the manufacturing sector in the form of industrial inputs. Accordingly, imports of industrial inputs (non-oil imports less imports of bulk consumption goods, gold and silver, manufactured fertiliser and professional instruments) should relate to GDP originating from the industrial sector. Deriving from the Directorate General of Commercial Intilligence and Statisties (DGCI&S) data, the ratio of imported industrial inputs to GDP originating from the industry sector (which includes mining and quarrying, manufacturing, electricity, and construction sectors) increased from 24 per cent in 1994-95 to 48 per cent in 2006-07; the acceleration was noticeable particularly during the current decade (Chart 5).

III.1.1 Oil Imports

Oil imports (in US dollar terms) accounted for 33 per cent of India's total imports in 2007-08, as compared with the average 23.2 per cent in



the 1990s, 27.2 per cent in the 1980s and 21.2 per cent in the 1970s. The rising share of oil imports is attributable to the sharp increase in international crude oil price and volume growth of oil imports. The Indian basket oil price increased sharply from US$ 27.8 per barrel in 2003-04 to US$ 106.1 per barrel in 2007-08; 33.2 per cent increase annually during 2004-05 to 2007-08. According to the Petroleum Planning Analysis Cell (PPAC), oil imports in volume terms grew on average 10.2 per cent per annum during 2004-05 to 2007-08. In quantity terms, domestic consumption of petroleum products in India grew at an average of 3.2 per cent during 2000-01 to 2007-08, as compared with 4.9 per cent growth in the 1970s and 6.3 per cent growth in the 1980s and the 1990s (Table 9). In recent years, especially, since the late 1990s, domestic oil consumption growth has been significantly differing from oil import volume growth, reflecting the impact of oil imports for exports of oil refined products. Illustratively, during 2000-01 to 2007-08, in quantity terms, oil imports in volume terms grew at an average of 8.3 per cent as compared with domestic oil consumption growth of 3.2 per cent. Exports of oil refinery, mainly due to private sector oil companies, have emerged as an important component of India's exports, surpassing traditional exports like textiles. According to British Petroleum (BP) energy statistics country database, India has become 6 respescitive largest refinery country in the world. In 2007-08, oil exports accounted for about 17 per cent of India's total exports as compared with the share of textiles exports at 12 per cent.

Table 9: Oil Imports Volume Growth

(Per cent)

Year	Domestic Consumption	Oil Imports (Gross) Volume Growth	Oil imports (net) volume growth
1	2	3	4
1997-98	6.5	-	-
1998-99	7.4	10.6	14.1
1999-2000	7.2	17.0	17.2
2000-01	3.1	12.0	1.8
2001-02	0.4	2.8	0.8
2002-03	3.7	4.1	4.4
2003-04	3.5	10.3	6.2
2004-05	3.6	6.4	3.2
2005-06	1.4	7.8	3.4
2006-07	6.7	14.5	6.9
2007-08 (Apr-Feb)	-	12.2	9.4
Average 1997-98 to 2007-08	4.4	9.8	6.7
Average 2000-01 to 2007-08	3.2	8.8	4.5

Note : In gross terms, total oil imports in volume include imports of crude oil and finished petroleum products. In net terms, oil import volume growth pertains to total oil imports in volume less exports of oil in volume.

: – Not Available.

Source : Petroleum Planning Analysis Cell (PPAC), Ministry of Petroleum and Natural Gas, Government of India.

III.1.2 Non-oil Imports

Within non-oil imports, industrial inputs including capital goods and raw materials account for a major share of India's total imports. Industrial inputs (non-oil imports *less* imports of bulk consumption goods, gold and silver, manufactured fertiliser and professional instruments) accounted for 58.0 per cent of India's total imports or 82.8 per cent of total non-oil imports in 2006-07. Commodity-wise, capital goods comprising machinery and transport equipment accounted for about a fifth of India's total imports during 2003-07 (or 34.4 per cent of non-oil imports and 42.6 per cent of industrial inputs). Within capital goods, non-electrical machinery, electronics and transport equipment were the key components; for instance, in 2006-07, these three commodities accounted for about 85 per cent of total capital goods imports, leaving only 15 per cent for imports of metals, machine tools, project goods,

electrical machinery, *etc.* Imports of mainly export related items accounted for 12.6 per cent of India's total imports (17.6 per cent of non-oil imports and 22 per cent of industrial inputs imports) during the same period. Two major items in this category were chemicals and pearls and precious stones such as diamond and articles of jewellery, which account for 86 per cent of imports of mainly export related items. Among bulk goods, fertiliser imports accounted for about 1.5 per cent of India's total imports during 2003-07 as compared with 1.9 per cent, 2.4 per cent and 3.6 per cent during the 1970s, 1980s, and the 1990s, respectively. Among other major items of imports, vegetable oil accounted for 2.2 per cent and 1.8 per cent of total imports during 2000-01 to 2006-07 and 2003-04 to 2006-07, respectively as compared with 3.3 per cent, 3.7 per cent and 1.6 per cent in the 1970s, 1980s, and the 1990s, respectively. The share of gold in India's total imports increased sharply from about 2.5 per cent in the early 1990s to 9.6 per cent during the second-half of the 1990s and remained almost steady at 8.5 per cent during the current decade, accompanied by rising international gold prices and the quantum jump gold consumption supported by liberalised gold imports policy.

III.1.3 Food Imports

India's dependence on food imports in general declined over the years (Table 10). The share of food imports in total imports was 4.8 per cent during 2000-2006, as compared with the average 5.0 per cent in the 1990s, 8.3 per cent in the 1980s, 18.3 per cent in the 1970s and 23.2 per cent in the 1960s. Currently, vegetable oil is the major item of food

Table 10: India's Food Trade

Period	Food Exports (per cent to total exports)	Food Imports (per cent to total imports)
1	2	3
1960s	34.3	23.2
1970s	31.7	18.3
1980s	23.5	8.3
1990s	16.8	5.0
2000s	10.8	4.8

Source: World Bank and UNCTAD.

Table 11: Growth Trend in Production and Consumption of Wheat and Rice in India

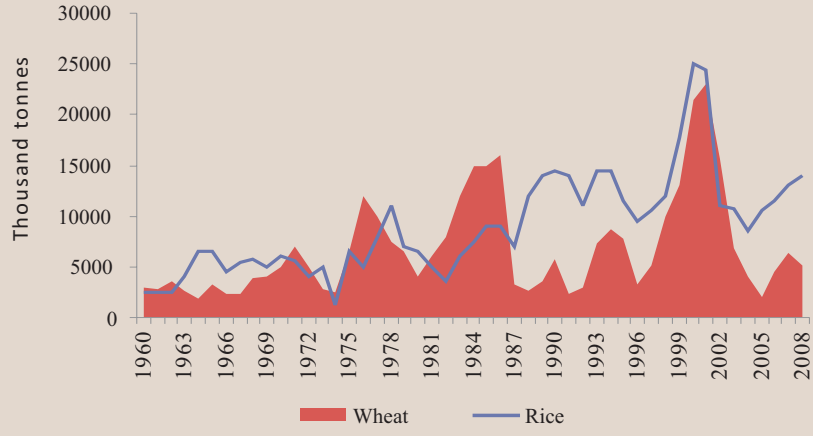
(Per cent)

	Wheat		Rice	
	Production	**Consumption**	**Production**	**Consumption**
1	2	3	4	5
1960s	8.2	5.0	9.3	5.5
1970s	7.1	5.4	4.8	4.7
1980s	4.7	4.4	4.6	5.4
1990s	2.9	3.0	2.6	1.4
2000s	1.2	1.6	1.6	2.8

Source: US Department of Agriculture (USDA).

imports. It accounted for 2.2 per cent and 1.8 per cent of total imports during 2000-01 to 2006-07 and 2003-04 to 2006-07, as compared with 3.3, 3.7 and 1.6 per cent in the 1970s, 1980s, and the 1990s, respectively. However, in the current environment, India's food balance in respect of major cereals such as rice and wheat show some critical trends. The declining stock of major cereals reflects impact of consumption growth outpacing production growth (Table 11). The stock of wheat has declined sharply from the peak of 23 million tonns in 2003 to 5.1 million tonns in 2008, while the stock of rice has declined from the peak of 25 million tonns in 2000 to 14 million tonns in 2008 (Chart 6).

Chart 6: Stock of Wheat and Rice (milled) in india



III.2 Imports Volume Growth

At the aggregate level, the quantum index of imports has grew rapidly to an annual average growth of 27.0 per cent during 2003-07, from 5.8 per cent in the 1970s, 5.9 per cent in the 1980s, and 12.4 per cent in the 1990s (Chart 7). Spurred by high growth and capacity expansion of Indian industries in the recent years, the surge in import growth was accompanied by import volume growth of machinery and transport equipment (46.6 per cent) and chemicals (25.3 per cent). Similarly, basic metals such as iron and steel, copper, aluminum, lead and tin posted a high growth rate of above 20 per cent in volume terms during 2003-07. Bulk imports such as fertiliser and vegetable oil also grew at an average of 53.0 per cent and 26.0 per cent, respectively during 2003-07.

III.3 Import Unit Value Index

An analysis of DGCIS data reveals various aspects of imported inflation (Table 12 and Annex 1). First, the aggregate import price inflation in domestic currency terms in the current decade (upto 2006-07) softened significantly as compared with the trends in the decades of the 1950s through the 1990s, excepting the 1970s which witnessed the first major oil shock. Second, it is interesting to gauge foreign price of India's imports (price of imports in foreign currency such as the US dollar); since import price in domestic currency as provided by the DGCI&S is affected by

Chart 7: India's Imports Volume Growth

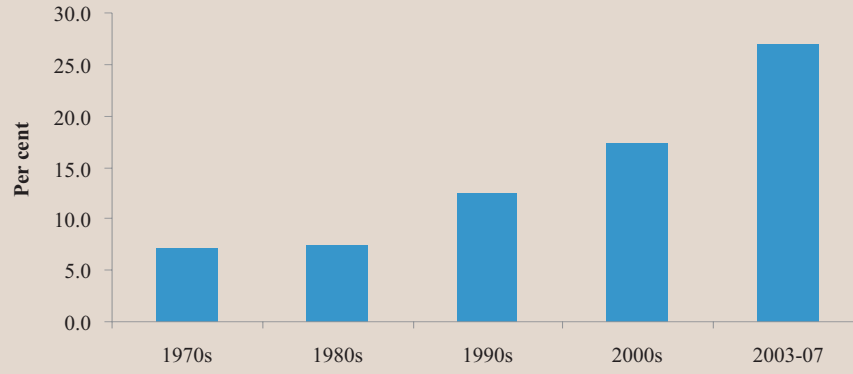


Table 12: Trends in India's Domestic Price and Import Price Inflation rates

(Per cent)

Period	Import Price Inflation (US dollar)*	Import Price Inflation (domestic currency)	Domestic Inflation (WPI)	Exchange Rate Depreciation
1	2	3	4	5
1950s	1.6	1.6	1.8	0.0
1960s	1.2	6.3	6.4	5.1
1970s	12.6	13.4	9.0	0.8
1980s	0.4	8.0	8.0	7.7
1990s	-3.2	7.2	8.1	10.5
2000s	5.2	4.5	5.1	-0.7
2003-07	6.6	3.3	5.3	-3.3

* : Estimated as import price inflation inclusive of transaction cost (cost, insurance and freight, *i.e.*, cif basis) in domestic currency (Import Unit value index of DGCI&S) less the changes in exchange rate.

exchange rate. The latter reveals that excepting the decade of the 1970s, India's import price inflation in US dollar terms remained subdued through the 1950s to the 1990s. In the current decade, however, such measure of import price inflation averaged 5.2 per cent, in contrast to the deceleration trend in the 1990s and the subdued trend in the 1980s.

III.4 Sources of India's Import Price Inflation

Table 13 reflects on the source of India's non-oil import price inflation in terms of export price inflation of countries, which account for major share of India's total imports. Furthermore, Table 14 shows the association of the source with India's principal commodities' imports. The share of 22 countries shown in this Table accounted for 61 per cent and 53 per cent of India's total imports during the 1990s and the current decade, respectively. Among 22 select countries, export price inflation during 2003-07 was highest for South Africa and Australia. From South Africa, India imports mainly natural or cultured pearls, precious or semiprecious stones, precious metals such as gold and articles thereof. From Australia, India imports mainly gems, pearls, precious and semi-precious stones, gold and jewelry, which together account for 70 per cent of India's total imports from this country. Export prices of countries in the Euro area, which account for 19 per cent of India's total imports,

Table 13: Export Price Inflation of India's Major Import Partners

(Per cent)

	Export Price Inflation				India's Imports Share	
Countries	**1990s**	**2000s**	**2003-07**	**Latest Trend Year on Year 2008 (Jan/Feb)**	**1990s**	**2000s**
1	2	3	4	5	6	7
Australia	-2.4	9.4	14.3		3.1	2.9
Belgium	0.5	5.3	9.7		6.6	4.8
Brazil	1.0	6.8	11.3	12.2	0.8	0.5
Canada	-0.2	5.7	9.4	17.9	1.1	0.8
China		0.6	2.1		1.6	5.4
France	-2.3	2.9	7.7		2.3	1.6
Germany	-0.3	3.0	7.5		7.0	3.9
HK	0.3	-0.2	0.8		0.8	1.7
Indonesia	-0.8	7.1	-2.6		1.1	2.2
Israel	1.1	2.7	5.5		0.7	0.9
Italy	1.8	7.2	12.4		2.4	1.4
Japan	-0.2	-0.5	1.6	5.7	6.3	3.2
Korea	-4.3	-0.6	2.5		2.2	2.8
Netherlands	-0.1	4.6	8.9		1.4	0.8
Singapore	-0.8	1.1	2.9	9.3	0.2	0.1
South Africa	-1.4	8.5	18.0		2.8	3.2
Spain	-0.7	4.8	9.9		0.5	0.3
Sweden	0.1	4.6	9.7	12.8	0.7	0.8
Switzerland	2.0	4.8	7.9	17.2	3.0	3.7
Thailand	1.5	2.9	6.0	8.2	0.4	0.8
UK	1.2	4.2	8.2	13.1	5.9	4.1
US	0.4	2.1	3.4	6.8	9.4	6.4
Regional Groups						
World	-0.1	4.0	7.6		100.0	100.0
Industrial Countries	0.2	4.0	7.7		51.5	36.1
EU	6.2	6.9	11.6		28.8	19.2
Developing	-1.0	4.3	7.6		48.5	63.9
Asia	-0.8	1.4	3.9		13.8	21.3
Oil exporting	1.4	16.8	19.6		21.2	8.6
Non-oil developing	-1.2	2.2	5.1		25.5	28.7
India (import price inflation)						

have also witnessed sharp acceleration in the current decade as compared with the 1990s. The latest trend for 2008 (January/February) showed that for most countries in the Euro area, year-on-year export price inflation has increased by about 500 basis points than the average inflation during 2003-07. From the Euro area, India mainly imports industrial machinery from countries like Germany. India's import from the US could be much

Table 14: India's Non-oil Imports from Select Countries

Countries	**Major Commodities**	**Import Value (US $ billion)**	**Total Imports (US $ billion)**	**Share** (%)
1	2	3	4	5
Australia	Gems and jewellery, mineral fuels, ores, cereals	6.1	7.0	87.1
Belgium	Gems and jewellery	3.3	4.1	80.5
Brazil	Mining (ores and iron and steel)	0.5	1.0	49.5
Canada	Cereals, Vegetables, Fertiliser, Paper, machinery	1.0	1.8	56.1
China	Electronics, machinery, chemicals, minerals, project goods, plastic, silk	13.7	17.5	78.3
France	Machinery (aircrafts)	3.0	4.2	71.2
Germany	Industrial machinery	4.9	7.5	65.3
HK	Gems and jewellery and electronics	1.9	2.5	76.0
Israel	Gems and jewellery, electronics, fertiliser	0.8	1.1	72.7
Italy	Machinery and metals	1.6	2.7	59.3
Japan	Machinery, iron & steel, professional instruments, ships, chemicals, vehicles	3.4	4.6	73.9
Korea	Electrical, machinery, minerals, plastic, vehicles	3.6	4.8	75.0
Netherlands	Metals, machinery, plastic, chemicals	0.7	1.2	54.2
Singapore	Machinery, fuels, electrical, chemicals, paper, project goods, professional instruments	4.8	5.5	86.5
South Africa	Gems and jewellery	1.5	2.5	60.0
Sweden	Metals, machinery, gems and jewellery	1.5	1.9	78.9
Switzerland	Gems and jewellery	7.0	9.1	76.9
Thailand	Machinery, electronics, metals, plastic	0.9	1.7	55.3
UK	Gems and Jewelry, machinery and electronics, metals and professional instruments	3.0	4.2	70.2
US	Machinery, metals, fertiliser, chemicals, gems and jewellery, professional instruments	9.5	11.7	81.2

cheaper than the Euro area, as export price inflation of the former was significantly lower than the later. As regards select developing countries and China, which has emerged recently as the largest source of India's imports, their export price inflation was substantially lower than that of industrial countries in Euro area.

Section IV

Import Price Pass-through to Domestic Prices in India

The pass-through of globalisation to domestic prices in India can be gauged in two stages. In the first-stage, export prices of foreign partners at global and regional levels percolate to import prices of India. In the second stage, changes in import prices affect costs of production and domestic supply of goods and services, thus, affect aggregate domestic inflation measured by producers' prices, which in India relates to wholesale prices. In this context, it is crucial to consider a caveat. Import prices can be measured in two ways: in foreign currency and domestic currency terms. The latter is usually measured in cost-insurance-freight *(cif)* basis and thus, includes transaction cost and also takes into account the effect of exchange rate as explained in Annex 2. In what follows, we examine the pass-through using various empirical approaches.

IV.1 Correlation Analysis

Table 15 provides correlation of India's import price inflation in US dollar terms with export price inflation at global and regional level for industrial, developing and oil exporting countries, based on annual data. Export price inflation of oil economies showed greater correlation with India's import price.

Table 16 shows the correlation of India's import prices in domestic currency with domestic prices. In level form, the import price index had near perfect correlation with domestic price index. Since such correlation could be exaggerated due to the trend components in variables, it is meaningful to consider the correlation of inflation rates. In terms of the latter, the import price inflation had significant correlation with domestic inflation.

Table 15: Correlation of India's Import prices with Global and Regional Export Prices

	India	Emerging	Industrial	Oil	World
1	2	3	4	5	6
India	1.00				
Emerging Economics	0.68	1.00			
Industrial Economics	0.63	0.71	1.00		
Oil	0.72	0.84	0.57	1.00	
World	0.70	0.86	0.97	0.72	1.00

Table 16: Correlation of India's import price index with domestic price (WPI)

	Correlation of Import Price Index with Domestic Price Index	Correlation of Import price inflation with domestic inflation rates
Variables	**1950-2007**	**1950-2007**
1	2	3
WPI	0.99	0.61
Domestic Fuel price	0.99	0.62
Domestic manufactured Price	0.99	0.56
Exchange Rate	0.96	0.19

However, cross-correlation measure reflects contemporaneous association, which may not translate into causal relation. Table 17 shows as to whether India's import price inflation measured in US dollar could be Granger caused by export price inflation at global and regional levels. Results suggest that the export price inflation of world, industrial countries and developing countries Granger cause India's import price inflation and the latter does not cause the former. The uni-directional causal relation of global and regional export price with India's import price suggests

Table 17: Granger Causal Relation of India's Import Price with Global and Regional Export Prices

Null Hypothesis:	F-Statistic	Probability
1	2	3
(i) Developing economies export price inflation does not Granger Cause India's import price inflation	3.95	0.03
(ii) India's import price inflation does not Granger Cause Developing economies export price inflation	0.22	0.80
(iii) Industrial economies export price inflation does not Granger Cause India's import price inflation	6.98	0.00
(iv) India's import price inflation does not Granger Cause Industrial economies export price inflation	0.81	0.45
(v) Oil exporting economies export price inflation does not Granger Cause India's import price inflation	1.14	0.33
(vi) India's import price inflation does not Granger Cause Oil economies export price inflation	0.32	0.73
(vii) World export price inflation does not Granger Cause India's import price inflation	7.71	0.00
(viii) India's import price inflation does not Granger Cause world export price inflation	1.24	0.30

that India is price taker, consistent with a small country engaged in world trade. Interestingly, export price inflation of oil exporting countries did not cause import price inflation of India, contrary to contemporaneous correlation measure.

IV.2. Measuring the Pass-through

The pass-through of import prices to domestic prices can be assessed in two ways using the non-parametric approach and the model based approach such as the vector error correction model (VECM). Under the non-parametric approach, the contribution of import price inflation to domestic inflation is derived as the weight assigned to imports (the share of imports in economic activity) multiplied by import price inflation. Illustratively, taking into account the import share of gross output at about 20 per cent and the average import price inflation at 4.7 per cent during 2003-08, the impact on domestic inflation would be 0.94 percentage points or 17.6 per cent share of domestic inflation averaging at 5.3 per cent during the same period (Table 18). Since non-agricultural commodities account for the bulk of merchandise imports, the contribution of imports price inflation to domestic inflation could be about 1.4 percentage points, based on imports-GDP ratio with GDP excluding agriculture and community and personal services.

Table 18: Impact of Imports Price Inflation on Domestic Inflation: Non-parametric approach

(Per cent)

Year	Import price Inflation	Domestic Inflation (WPI)	Imports/ GDP Ratio	Imports/ GDP Ratio*	Impact 1	Impact 2	Ratio1	Ratio2
1	2	3	4	5	6=2* 4	7=2*5	8=6/3	9=7/3
1970s	14.7	9.0	6.0	12.3	0.89	1.81	9.9	20.2
1980s	8.0	8.0	8.7	15.9	0.70	1.27	8.7	16.0
1990s	7.2	8.1	11.8	20.0	0.85	1.45	10.5	17.8
2000s	4.8	5.1	16.8	25.8	0.81	1.24	15.7	24.1
2003-07	3.4	5.5	19.9	29.7	0.67	1.00	12.3	18.3
2003-08	4.7	5.3	19.9	29.7	0.94	1.40	17.6	26.3

* : GDP measure excludes the components of agriculture and allied activities and community and personal services.

IV.2.1 Vector Error Correction and Cointegration Analysis

The vector error correction model comprises six variables including domestic prices (LWPI), import prices or unit value index (LMUV), Indian Rupee-US dollar exchange rate (LEXR) and GDP at factor cost at constant prices in natural logarithm scale, and interest rate (call money rate) and capital flows, defined as the current account deficit *plus* capital account surplus to GDP ratio (XBOPRS) to investigate as to how import prices affect domestic prices. Domestic inflation rate for fuel group and growth of agricultural production were used as exogenous variable to account for domestic and external supply shocks. The economic intuition is that capital flows would depend upon macroeconomic fundamentals such as the growth and inflation condition, apart from gains from the movement in exchange rates. Moreover, these variables determine policy actions, which is critical for sustained capital flows. At the same time, capital flows is expected to affect macroeconomic variables. Of particular interest, rise (fall) in capital flows would exert appreciation (depreciation) pressures on exchange rate and thus, affect import prices, domestic prices and growth.

The VECM model used annual data for the period 1950-2007, since import prices data were available annually. Empirical estimation involved 2 lags of endogenous variables based on various lag section criteria such as Akaike information criteria (AIC) and final prediction criteria (FPE). In order to derive meaningful insights about the role of policy and capital flows, the model was estimated initially with four variables (LWPI, LMUV, LEXR, LY) and then interest rate and capital flows were included. Table 19 presents results of Johansen's cointegration rank test, which confirms the existence of a single cointegration relation among endogenous variables domestic prices, import prices, exchange rate and output, subject to the linear deterministic trend with intercept as well as trend in endogenous variables.

Given our objective of investigating whether domestic prices depend upon import prices and other variables, we retrieved the coefficients of the single long-run cointegrating vector using normalised restriction on domestic prices (*i.e.*, as the dependent variable). Subsequently, interest rate and capital flows were allowed as additional endogenous variable,

Table 19: Johansen's Cointegration Rank Test

Cointegration Rank Test (Trace)						
Hypothesised No. of CE(s)	Statistic	Critical Value (5 %)	Probability	Statistic	Critical Value (5 %)	Probability
None	44.46	47.86	0.10	77.68	63.88	0.00
At most 1	20.02	29.80	0.42	32.10	42.92	0.38
At most 2	5.80	15.49	0.72	15.99	25.87	0.49
At most 3	1.30	3.84	0.25	4.50	12.52	0.67
Cointegration Rank Test (Maximum Eigen value)						
None	24.44	27.58	0.12	45.58	32.12	0.00
At most 1	14.22	21.13	0.35	16.12	25.82	0.53
At most 2	4.50	14.26	0.80	11.48	19.39	0.46
At most 3	1.30	3.84	0.25	4.50	12.52	0.67

one after the other, to examine the changes in the long-run coefficients deriving from the VECM. It may be noted that the cointegration rank test confirmed single cointegration relation for all alternative scenarios. The estimated long-run cointegration relation is presented in Table 20. Since the variables are in logarithm scale, these coefficients of long-run cointegration relation quantify elastic response of domestic prices to other variables.

Table 20: Cointegration of Domestic Prices with Import prices and Other variables

	Coefficients of the single long-run vector from alternative VECM		
Variables	**VECM1**	**VECM2**	**VECM3**
1	2	3	4
LMUV1(-1)	0.19526	0.3227	0.27724
	[3.56121]	[4.70008]	[4.14283]
LEXR(-1)	0.36981	0.5067	0.55268
	[3.80792]	[4.12529]	[4.72840]
LY(-1)	-1.229657	-2.383422	-3.078489
	[- 4.13155]	[- 4.98767]	[- 6.54669]
CALL(-1)		-0.041073	-0.035195
		[-3.87498]	[- 3.40215]
XBOPRS(-1)			0.07438
			[3.54023]
Trend	0.08816	0.12315	0.14847
	[7.97285]	[7.25340]	[9.06413]
C	15.5623	29.4086	38.0105

Figures in brackets indicate the estimates of 't'statistic associated with the coefficients. Most coefficients reported in the Table are statistically significant, since the computed't' statistic is higher than the critical value of 2.0 at 5 per cent level of significance.

Beginning with the model of four variables (VECM1), it was found that import prices and exchange rate had a statistically significant positive impact while real output had significant negative impact on domestic prices in the long-run. As interest rate was included in the model (VECM2), there was strengthening of the response of domestic prices to imports prices, exchange rate and output. Comparing the model with interest rate with the model without interest rate, the long-run response of domestic prices to output witnessed a sharp acceleration. The interest rate variable showed statistically significant inverse relationship with domestic prices, though the size of its coefficient was substantially lower than other variables. Subsequently, with the introduction of the capital flows variable in the model (VECM3), there was a marginal strengthening of exchange rate impact on domestic prices. However, there was substantial strengthening of output impact on domestic prices due to capital flows. The impact of import prices on domestic prices in this model witnessed some moderation, *albeit* marginally, as compared with the earlier models, VECM1 and VECM2. All the three models showed that domestic output had predominant role in determining the long-run path of domestic prices. The elasticity response of domestic prices was greater with respect to exchange rate than with respect to import prices. From policy perspective, a significant finding was that the impact of capital flows was about twice the impact of interest rate on domestic prices.

Manufacturing Price Response

Alluding to earlier discussion, the response of aggregate price indices with respect to exchange rate, import prices, capital flows and interest rate could be affected due to inclusion of administered prices such as oil price and food price and thus, weaken the causal relationship among the variables. Although, the VECM models discussed above included oil prices and food prices as exogenous variable, the need was felt to gauge the response of domestic prices of non-oil manufacturing commodities exclusively. In this regard, Johansen's cointegration rank test continued to support the existence of single long-run relationship binding the variables. As evident from Table 21, import price and exchange rate variables had statistically significant long-run impact on domestic

Table 21: Cointegration of Domestic Manufacturing Prices (with capital flows and interest rate)

Variables	VECM4 (without capital flows and interest rate)	VECM5 (with capital flows)	VECM6 (with capital flows and interest rate)
1	2	3	4
LPMNF	-1	-1	-1
LMUV1	0.23543	0.219101	0.289839
	(3.88865)	(2.91520)	(3.34168)
LEXR	0.454016	0.596261	0.622291
	(4.26786)	(4.45521)	(4.09531)
LY	-1.5973	-2.705071	-3.157122
	(-4.69181)	(- 6.03089)	(- 5.04258)
Capital flows		0.068645	0.070082
		(2.73659)	(2.65166)
Interest rate			-0.020112
			(- 1.51959)
Trend	0.09035	0.124445	0.137823
	(7.05193)	(7.44409)	(6.27093)
C	20.09129	33.65366	39.08988

Figures in bracket indicate asymptotic 't' statistic, which could be statistically significant for value above 2.0 for 5 per cent level of significance.

manufacturing prices. Real activity had inverse relationship with domestic prices. The elasticity response of domestic prices with respect to exchange rate was higher than the elastic response of domestic prices with respect to import prices. The long-run cointegration relation suggested that, *ceteris paribus*, as much as 4 per cent increase in import prices affected domestic prices of manufactured commodities by a percentage point. On the other hand, about 1.5 per cent increase in the exchange rate increased domestic prices by a percentage point. However, in terms of absolute coefficient size, the increase in real activity had significantly larger impact on domestic prices than exchange rate and import prices. The capital flows had statistically significant positive impact on domestic prices in the long-run, but such impact was lower than the impact of import prices, exchange rate and output. The interest rate variable had a negative association with domestic prices in the long-run, though its statistical significance was not as strong as other variables as evident from asymptotic 't' statistic. Moreover, with capital flows and interest rate, there was a strengthening of the elastic response of domestic prices with respect to import prices, exchange rate and output.

Impulse Response Analysis

Given the underlying long-run and short-run dynamics, a VECM serves useful for analysing dynamic interaction among economic variables by way of impulse response and forecast error variance decomposition (FEVD) analysis. The impulse response function enables to evaluate as to how a shock to a variable affects other variables in the model. On the other hand, for each variable, the FEVD enables to evaluate the importance of other variables in terms of accounting of total variation in the variable under investigation. Based on the above VECM, generalised impulse response analysis showed that a standard deviation shock to import prices in domestic currency was associated with increase domestic prices, depreciation of exchange rate and rise in interest rate. Domestic output responded negatively to higher domestic prices and rising import costs accompanied by exchange rate depreciation, despite an increasing response of capital flows. The increasing response of capital flows to rising import costs and domestic prices but lower output is in line with the real world situation of an emerging economy like India. A possible explanation could be that when domestic prices are high, authorities pursue tight policy in the form of higher interest rates. This, in turn, impinges domestic and foreign interest rate differential and fuel greater capital flows, which are induced by arbitrage opportunities. As regards other variables, shock to exchange rate (entailing a depreciation pressure) was associated with rise in import prices, domestic prices and interest rate but decline in capital flows and output. A positive shock to capital flows was associated with rising prices and interest rate, appreciation of exchange rate and decline in output.

Variance Decomposition Analysis

The forecast error variance decomposition provides another perspective on the importance of the variables in terms of their volatility characteristics and spillover. Unlike the generalised impulse response analysis, the FEVD analysis of the VECM, based on Choleski decomposition procedure, requires a specification of ordering of variables. In this regard, we adopted the ordering of variables with (i) interest rate as the instrument of policy appearing in the first place (*i.e.*, autonomous policy actions), followed by (ii) capital flows as they are arbitrage induced,

(iii) exchange rate as it is determined in the market by demand and supply conditions for foreign exchange resources, (iv) import prices (which depend upon exogenous foreign supplier price and exchange rate), (v) domestic output, which depends on exchange rate impact on exports and import costs, and (vi) domestic prices in the final place, to depend upon all the preceding variables. Results of FEVD are summarised in Table 22. It was found that over medium term 3-5 year horizon, about 30-40 per cent of total variation in domestic prices was explained by other variables, with dominant share of capital flows (19-20 per cent), followed by exchange rate (10-12 per cent) and import prices (2-3 per cent). The predominance of capital flows on prices variable was due to the former's impact on exchange rate consistent with market determined exchange rate regime. Moreover, the inadequate response of capital flows to macroeconomic variables such as output and inflation could be another factor. Finally in the aggregate analysis, global factors comprising the capital flows, exchange rate and import prices, accounted for about 18 per cent, 30 per cent and 50 per cent of total variation in domestic prices over short, medium and longer horizons of 1-year, 3-year and 10-year, respectively.

A Numerical Simulation

Based on the vector error correction model for aggregate price index, the coefficients of long-run cointegration vector were used to compute the underlying contribution of global factors such as import prices, exchange rate and capital flows to domestic inflation in the more recent period, especially during 2000-01 to 2007-08. Results of the numerical exercise are summarised in Table 23. On average, global factors could have played a dominant role in determining domestic inflation during the period 2000-01 to 2007-08. Shifting reference to period 2003-04 to 2007-08, which witnessed capital flows with appreciation of exchange rate, the contribution of global factors was reduced by more than 50 per cent. However, despite exchange rate appreciation in the more recent period 2006-07 to 2007-08, global factors could have had a significant impact on domestic inflation but could have been moderated significantly due to domestic factors such as high output growth.

Table 22: Variance Decomposition of LPMNF

Period	S.E.	LPMNF	LMUV1	LEXR	LY	XBOPRS	CALL
1	0.03	81.38	3.18	3.91	0.49	10.88	0.16
2	0.06	73.00	2.68	7.20	0.25	15.95	0.92
3	0.07	70.05	2.35	7.78	0.16	17.59	2.08
4	0.09	67.11	2.14	9.69	0.14	18.84	2.07
5	0.10	63.12	2.48	12.11	0.26	20.34	1.68
6	0.11	58.96	3.09	14.53	0.47	21.62	1.33
7	0.12	55.16	3.71	16.75	0.70	22.60	1.08
8	0.14	51.71	4.26	18.79	0.95	23.37	0.91
9	0.15	48.49	4.78	20.69	1.24	24.02	0.78
10	0.16	45.46	5.30	22.46	1.55	24.55	0.68
Variance Decomposition of LMUV1:							
1	0.10	0.00	85.99	5.23	0.00	7.23	1.55
2	0.16	1.68	72.95	4.29	0.02	14.87	6.19
3	0.20	1.52	72.80	3.44	0.03	16.21	6.00
4	0.22	1.28	73.80	3.22	0.05	16.38	5.28
5	0.25	1.12	74.11	3.12	0.04	16.44	5.18
6	0.27	1.02	73.98	3.12	0.04	16.58	5.27
7	0.29	0.95	73.98	3.11	0.03	16.70	5.23
8	0.31	0.88	74.01	3.12	0.03	16.80	5.16
9	0.33	0.82	74.00	3.15	0.03	16.87	5.14
10	0.35	0.77	73.96	3.19	0.02	16.93	5.14
Variance Decomposition of LEXR:							
1	0.05	0.00	0.00	92.01	0.00	0.59	7.41
2	0.09	1.07	3.03	76.90	0.17	0.38	18.45
3	0.14	3.29	4.37	67.23	0.21	1.25	23.65
4	0.17	4.85	5.33	63.22	0.14	1.24	25.22
5	0.19	6.14	5.32	61.25	0.18	1.04	26.06
6	0.20	7.51	5.05	59.16	0.37	0.88	27.04
7	0.22	9.18	4.68	56.78	0.73	0.79	27.83
8	0.23	11.19	4.29	54.14	1.32	0.81	28.25
9	0.24	13.44	3.91	51.24	2.15	0.96	28.30
10	0.25	15.83	3.59	48.11	3.22	1.24	28.01
Variance Decomposition of LY:							
1	0.01	0.00	5.93	6.04	67.85	13.13	7.05
2	0.02	0.43	2.71	19.48	63.31	10.82	3.26
3	0.02	3.00	2.56	27.20	57.08	8.38	1.79
4	0.03	5.95	3.01	30.05	50.92	9.02	1.06
5	0.04	8.59	3.49	31.24	46.81	9.14	0.72
6	0.05	9.87	4.30	33.04	42.95	9.09	0.74
7	0.06	10.41	5.28	34.45	39.66	9.32	0.90
8	0.08	10.82	6.08	35.42	37.07	9.56	1.05
9	0.09	11.20	6.74	36.14	35.02	9.69	1.22
10	0.10	11.45	7.31	36.71	33.33	9.79	1.40
Variance Decomposition of XBOPRS:							
1	0.88	0.00	0.00	0.00	0.00	95.69	4.31
2	1.02	5.12	0.72	3.41	0.95	86.46	3.33
3	1.17	4.01	1.40	5.68	1.86	79.80	7.24
4	1.33	3.61	2.99	4.70	1.59	79.18	7.93
5	1.43	3.31	2.74	4.14	1.40	80.72	7.69
6	1.48	3.10	2.53	4.17	1.32	81.33	7.55
7	1.54	3.14	2.35	4.50	1.34	81.14	7.54
8	1.61	3.51	2.21	5.43	1.53	79.98	7.34
9	1.67	4.08	2.22	7.07	1.97	77.73	6.93
10	1.75	4.77	2.43	9.35	2.65	74.36	6.44
Variance Decomposition of CALL:							
1	2.44	0.00	0.00	0.00	0.00	0.00	100.00
2	3.27	0.18	3.64	0.35	0.49	2.71	92.63
3	3.54	0.16	4.13	2.45	0.84	4.25	88.18
4	3.78	0.36	3.73	3.12	0.80	4.22	87.78
5	4.11	0.42	3.73	2.81	0.68	4.34	88.02
6	4.44	0.42	4.17	2.47	0.59	5.12	87.24
7	4.72	0.50	4.54	2.21	0.52	5.85	86.37
8	5.01	0.70	4.88	1.97	0.50	6.37	85.59
9	5.31	0.90	5.30	1.79	0.51	6.91	84.59
10	5.61	1.10	5.78	1.70	0.57	7.49	83.36
Cholesky Ordering: CALL, XBOPRS, LEXR, LMUV1 and LY LPMNF							

Table 23 Contribution of Global Factors to Domestic Inflation

Period	WPI inflation (Actual)	Simulated Contribution of Global factor (Impact of Exchange rate, Capital flows and Import prices)
2001 to 2007-08	4.8	4.5
2003-04 to 2007-08	5.3	2.0
2006-07	5.4	17.8
2007-08	4.6	6.1

Section V

Key Findings and Conclusion

This study attempted a comprehensive analysis of imported inflation in the Indian context, based on various facts and figures from global developments and stylised facts relating to India's merchandise trade growth and import unit value indices. The study explored non-parametric and parametric time series models such as Johansen's vector error correction and cointegration to gauge the pass-through of import prices to domestic prices. Empirical exercises revealed various perspectives.

(i) The ratio of imports to GDP at factor cost at current prices (M/GDP), which is often used as the indicator of aggregate import intensity in the economy increased from 6.7 per cent in 1950-51 to 22.9 per cent by 2007-08.

(ii) Oil imports (in US dollar terms) accounted for 33 per cent of India's total imports in 2007-08, as compared with the average 23.2 per cent in the 1990s, 27.2 per cent in the 1980s and 21.2 per cent in the 1970s.

(iii) The rising share of oil imports is attributable, mainly, to the sharp increase in international crude oil price. The Indian basket oil price increased sharply from US $ 27.8 per barrel in 2003-04 to US $ 106.1 per barrel in 2007-08; 33.2 per cent increase annually during 2004-05 to 2007-08. However, the price of Indian oil basket has fallen to around US$40 per barrel by December 2008. According to the Petroleum Planning Analysis Cell (PPAC), in quantity terms, domestic consumption of petroleum products in India grew at an

average of 3.2 per cent during 2000-01 to 2007-08, as compared with 4.9 per cent growth in the 1970s and 6.3 per cent growth in the 1980s and the 1990s.

(iv) India's dependence on food imports in general declined over the years. The share of food imports in total imports was 4.8 per cent during 2000-2006, as compared with the average 5.0 per cent in the 1990s, 8.3 per cent in the 1980s, 18.3 per cent in the 1970s and 23.2 per cent in the 1960s. Currently, vegetable oil is the major item of food imports; it accounted for 2.2 per cent and 1.8 per cent of total imports during 2000-01 to 2006-07 and 2003-04 to 2006-07, as compared with 3.3, 3.7 and 1.6 per cent in the 1970s, 1980s, and the 1990s, respectively.

(v) Within non-oil imports, industrial inputs including capital goods and raw materials account for a major share of India's total imports. Industrial inputs (non-oil imports less imports of bulk consumption goods, gold and silver, manufactured fertiliser and professional instruments) accounted for 58.0 per cent of India's total imports or 82.8 per cent of total non-oil imports in 2006-07. Commodity-wise, capital goods comprising machinery and transport equipment account for about a fifth of India's total imports during 2003-07 (or 34.4 per cent of non-oil imports and 42.6 per cent of industrial inputs).

(vi) At the aggregate level, the quantum index of imports grew rapidly to an annual average growth of 27.0 per cent during 2003-07, from 5.8 per cent in the 1970s, 5.9 per cent in the 1980s, and 12.4 per cent in the 1990s (Chart 7). Spurred by high growth and capacity expansion of Indian industries in the recent years, the surge in import growth was accompanied by import volume growth of machinery and transport equipments (46.6 per cent) and chemicals (25.3 per cent). Similarly, basic metals such as iron and steel, copper, aluminum, lead and tin posted a high growth rate in volume terms above 20 per cent during 2003-07. Bulk imports such as fertiliser and vegetable oil also grew at an average of 53.0 per cent and 26.0 per cent, respectively, during 2003-07.

(vii) India's food balance shows the declining trend in stocks of major cereals such as rice and wheat show, reflecting the impact of

consumption growth outpacing production growth. The stock of wheat declined sharply from the peak of 23 million tonns in 2003 to 5.1 million tonns in 2008, while the stock of rice declined from the peak of 25 million tonns in 2000 to 14 million tonns in 2008.

(viii) The aggregate import price inflation in domestic currency term in the current decade (upto 2006-07) softened significantly as compared with the trends in the 1950s through the 1990s, excepting the 1970s which witnessed the first major oil shock. India's import price inflation in US dollar terms remained subdued through the 1950s to the 1990s. In the current decade, however, such measure of import price inflation averaged 5.2 per cent, in contrast to the deceleration trend in the 1990s and the subdued trend in the 1980s.

(ix) Export prices of countries in the Euro area, which account for a fifth of India's total imports, have also witnessed sharp acceleration in the current decade as compared with the 1990s. In the Euro area, India mainly imports industrial machinery from countries like Germany. India's import from the US could be much cheaper than the Euro area, as export price inflation of the former was significantly lower than the latter. As regards select developing countries and China, which has emerged recently as the largest source of India's imports, their export price inflation was substantially lower than that of industrial countries in the Euro area.

(x) Export price inflation of oil economies had greater correlation with India's import price. The import price inflation had significant correlation with domestic inflation.

(xi) Based on non-parametric estimation, import price inflation could contribute to domestic inflation on average ranging between 1 and 2 percentage points. The vector error correction model suggested that every percentage point increase in import prices in domestic currency could affect domestic inflation upward by 20 to 30 basis points; alternatively, every five percentage point increase in import price inflation would be associated with one percentage point increase in domestic price inflation.

(xii) Import prices, capital flows and exchange rate had statistically significant positive association with domestic inflation in the long-

run. The interest rate variable had a negative association with domestic prices in the long-run, though its statistical significance was not as strong as other variables. Moreover, with capital flows and interest rate, there was a strengthening of the elastic response of domestic prices with respect to import prices, exchange rate and output. In terms of variance decomposition analysis of the cointegration model, the impact of capital flows on domestic prices was more pronounced than the impacts of import prices and exchange rate, due to the impact of capital flows on the latter variables. The empirical findings suggested that global factors (import prices, capital flows, movements in exchange rate) contributed 20 to 30 per cent in domestic inflation in India.

Significant implication of capital inflows for domestic prices, *albeit* not the case for 2008-09, points toward the need for rising absorptive capacity of the domestic economy. In the long-term perspective, the absorptive capacity of the economy has to be strengthened. Once the global financial markets improve and the capital flows to India resume the rising trend in the period to come, efficient allocation of capital and rising absorptive capacity need to be improved. Otherwise, rising capital flows may have some stabilising impact on domestic inflation through exchange rate appreciation and resultant reduced import prices, but inefficient capital allocation without sufficient absorptive capacity, may lead to the asset bubbles and overheating of the economy. In fact, the dominance of the latter over the former may not be ruled out. Ideally, overheating in the big emerging economies like India, with vast investment requirements in infrastructure, should not emanate on account of foreign capital flows. Lack of the absorptive capacity raises doubts not only regarding the potential gains to the domestic economy from the globalisation but also the overall institutional and policy environment of the country.

Annex 1: Import Price Inflation of Principal Commodities Imports of India

Commodity	1980s	1990s	2000s	2003-07
1	2	3	4	5
General Industrial Machinery & Equipment	16.8	32.2	21.6	46.4
Non-Ferrous Base Metals, Waste & Scrap n.e.s.	5.5	14.7	24.4	43.8
Metal Working Machinery	14.6	178.3	6.8	31.4
Professional, Scientific & Controlling Instruments & Apparatus n.e.s.	26.9	3.0	19.6	31.0
Copper(KG)	7.5	11.4	12.5	30.3
Tin	-0.1	8.3	14.4	28.5
Lead	6.1	11.0	12.7	22.9
Petroleum Crude	-0.6	10.7	26.1	22.2
Manufactures of Metals	9.0	10.6	17.9	20.9
Petroleum Products	-0.4		36.2	20.5
Electrical Machinery	7.2	16.3	12.3	18.5
Machinery Specialised for Particular Industries	16.4	14.4	6.6	15.2
Inorganic Chemicals	1.6	13.8	9.7	14.9
Miscellaneous Manufactured Articles	17.3	-0.9	19.3	14.2
Power Generating Machinery & Equipment	30.9	15.7	16.3	14.2
Nickel(KG)	27.3	4.1	15.6	13.8
Fruits & Nuts	8.3	13.1	6.7	13.3
Photographic Apparatus, etc.	12.3	-1.1	23.0	13.0
Aluminium(KG)	12.1	9.1	8.8	12.6
Artificial Resin & Plastic Material & Cellulose Ester	14.2	4.9	10.1	11.7
Crude Rubber Incl. Synthetic & Reclaimed	7.5	12.8	7.8	10.6
Bevarages	18.2	12.5	1.9	10.0
Dairy Products	9.6	27.0	8.1	9.4
Textile Fibres & Waste	8.7	12.1	5.3	9.3
Paper, Paperboard & Articles thereof	30.6	12.0	4.2	9.1
Minerals excluding Coal, Petroleum, Crude Fertilisers, Sulphur & Precious Stones	8.1	15.1	1.5	8.9
Fertilisers, Manufactured	8.7	33.1	6.1	8.4
Pulp & Waste Paper	10.1	10.0	6.3	7.0
Iron & Steel(KG)	13.8	11.6	5.5	6.9
Crude Fertilisers	5.6	11.7	2.8	6.9
Ores & Concentrates of Base Metals n.e.s.	20.8	15.2	2.2	6.7
Spices	-3.8	0.3	30.6	5.5
Transport Equipment	14.5	9.8	4.8	3.8
Medicinal & Pharmaceutical Products	12.8	12.3	-3.0	3.4
Textile Yarn	10.3	7.3	3.3	2.1
Organic Chemicals	14.3	-1.7	20.6	2.0
Dyeing, Tanning & Colouring Materials	11.2	10.2	-2.7	1.2
Cereals & Cereal preparations	1.7	16.1	9.8	-6.9
memo : commodity groups				
General Index	4.9	8.5	5.5	3.4
Food & Food Articles	1.8	15.5	6.2	2.3
Beverages & Tobacco	18.2	12.5	1.9	10.0
Crude Materials, Inedible, except Fuels	7.3	11.3	8.7	17.2
Mineral Fuels, Lubricants, etc.	-0.4	10.5	26.4	22.0
Chemicals & Related products	6.8	15.3	7.7	6.3
Machinery & Transport Equipment	7.5	12.2	-1.7	-0.2
Note: Estimated from DGCI&S data on Import Unit value indices				
Manufactured Goods Classified Chiefly by Material	12.0	12.3	6.7	10.7

Annex 2: Methodology

Conceptually, import price can be measured in two ways: in domestic currency and foreign currency. In domestic currency, import price accounts for the impact of foreign price, exchange rate, taxes and transaction cost (transport and insurance). Aggregate price of commodities supplied in the economy is postulated as a weighted geometric mean of prices of commodities produced domestically and prices of imports. A notable assumption here is that imports play an important role in augmenting rather than substituting domestic supply of commodities.

$$P_S = P_D^{\omega} P_M^{1-\omega}$$

With logarithm transformation and first difference, the above translates to aggregate price inflation in the domestic economy as the weighted average of price inflation of domestic goods and imports.

$$\pi_S = (1-\omega)\pi_D + \omega\pi_M$$

In the above, the impact of exchange rate also can be incorporated since import prices in domestic currency are a product of foreign price and exchange rate.

$$\pi_S = (1-\omega)\pi_D + \omega(\pi_F + \Delta E)$$

A crucial point here is how to assign weights to imports and domestic goods. One approach is to assign weights to imports in terms of its share in the aggregate measure of economic activity.

$$\omega_N = \frac{M}{Y}$$

The nominal weight, however, is affected by relative price of imports and therefore, in real terms the weight can be derived:

$$\omega_N = \frac{Q_M P_M}{Q_Y P_Y} = \omega_R p_Y^M$$

Notes

[1] This index is generally accepted as a proxy for the price of developing country imports of manufactures in U.S. dollar terms. The index is a weighted average of export prices of manufactured goods for the G-5 economies (the United States, Japan, Germany, France, and the United Kingdom), with local-currency based prices converted into current U.S. dollars using market exchange rates. Weights are the relative share in G-5 exports of manufactured goods to developing countries in a base year (currently 1995), with values: U.S. (32.2%), Japan (35.6%), Germany (17.4%), France (8.2) and United Kingdom (6.6%). The MUV tends to be dominated by movements in the cross exchange rates between the US dollar on the one hand and Japanese yen, euro and pound sterling on the other. At a time of US dollar depreciation, for example, the index will rise, suggesting higher-dollar-based prices from non-U.S. G-5 countries. In contrast, a rising dollar will tend to lower growth in the MUV, as diminishing values of local-currency prices in dollar terms dominate the movements of MUV.

[2] For the trends in 1960s through 1990s, data source is British Petroleum (BP) Energy Statistics Yearbook 2007.

[3] There could also be a third or final stage of the pass-through as consumer prices would be affected by changes in wholesale prices. Since WPI is used for policy purposes in India, this study does not engage in analysing such pass-through.

[4] The lag selection based on Akaike information criterion (AIC) as well as the final prediction error criteria (FPE). Although, the Schwartz-Bayes' criteria and Hannan-Quinn criteria suggested one-period lag, 2 lags were chosen to avoid first order autocorrelation of residuals from the model.

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