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Economic Reforms, Foreign Direct Investment and its Economic Effects in India

by

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Abstract: Foreign direct investment (FDI) has boomed in post-reform India. Moreover, the composition and type of FDI has changed considerably since India has opened up to world markets. This has fuelled high expectations that FDI may serve as a catalyst to higher economic growth. We assess the growth implications of FDI in India by subjecting industry-specific FDI and output data to Granger causality tests within a panel cointegration framework. It turns out that the growth effects of FDI vary widely across sectors. FDI stocks and output are mutually reinforcing in the manufacturing sector. In sharp contrast, any causal relationship is absent in the primary sector. Most strikingly, we find only transitory effects of FDI on output in the services sector, which attracted the bulk of FDI in the post-reform era. These differences in the FDI-growth relationship suggest that FDI is unlikely to work wonders in India if only remaining regulations were relaxed and still more industries opened up to FDI.

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I.   Introduction

The stock of foreign direct investment (FDI) in India soared from less than US$ 2 billion in 1991, when the country undertook major reforms to open up the economy to world markets, to almost US$ 39 billion in 2004 (UNCTAD online database). Currently, it is being discussed to deregulate FDI restrictions further, e.g., by allowing FDI in retail trade. Policymakers in India as well as external observers attach high expectations to FDI. According to the Minister of Finance, P. Chidambaram, "FDI worked wonders in China and can do so in India" (Indian Express, November 11, 2005). The Deputy Secretary General of the OECD reckoned at the OECD India Investment Roundtable in 2004 that the improved investment climate has not only resulted in more FDI inflows but also in higher GDP growth (OECD India Investment Roundtable 2004). The implicit assumption seems to be that higher FDI has caused higher growth.[1] Bajpai and Sachs (2000: 1) advise policymakers in India to throw wide open the doors to FDI which is supposed to bring "huge advantages with little or no downside."

Yet, as we discuss in more detail in Section II, it is far from obvious that FDI in India will have the desired effects. Skepticism may be justified for several reasons. The recent boom notwithstanding, FDI inflows may still be too low to make a big difference. For instance, Kamalakanthan and Laurenceson (2005) suspect that FDI cannot reasonably be considered an important driver of economic growth in India because its contribution to gross fixed capital

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[1] Fischer (2002) makes this assumption explicit when stating that greater openness to FDI would permit a significant increase in growth in India.

formation has remained small.[2] Moreover, some observers doubt that economic reforms went far enough to change the character of FDI in India and, thus, result in types of FDI that may have more favorable growth effects. For example, Balasubramanyam and Mahambare (2003) as well as Fischer (2002) argue that the reforms implemented so far have not eliminated the distinct anti-export bias of India's trade policy. This may explain why, according to Arabi (2005) and Agarwal (2001), FDI in India has remained domestic market seeking.

It is widely believed that the type of FDI and its structural composition matter at least as much for economic growth effects as does the overall volume of inward FDI. Agrawal and Shahani (2005) reckon that it is the quality of FDI that matters for a country like India rather than its quantity.[3] FDI is often supposed to be of higher quality if it is export oriented, transfers foreign technologies to the host country, and induces economic spillovers benefiting local enterprises and workers (Enderwick 2005). All the more surprisingly, the structure and type of FDI are hardly considered in previous empirical studies on the FDI-growth links in India.

Against this backdrop, this paper raises two major questions: First, we assess in Section III whether India's reforms in 1991, apart from giving rise to FDI, have also induced changes in the structure and type of FDI which may be

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[2] See also Bhat et al. (2004: 182).

[3] According to Agrawal and Shahani (2005: 644), "the worst case could be when FDI moves into an economy just to produce for the domestic markets … as its ultimate aim is to displace the local industry." In sharp contrast, Palmade and Anayiotas (2004: 3) criticize the "general misconception that market-seeking FDI in domestic sectors such as retail yields little development impact."

relevant for its growth impact. Second, we evaluate in Section IV whether the growth impact of FDI differs between the primary, secondary and tertiary sectors. We apply cointegration and causality analyses on the basis of industry-specific FDI stock data which are available for the period 1987-2000.

We find some support to the proposition that the character of FDI in India has changed in the post-reform period, though possibly not to the extent as the proponents of a further liberalization of FDI regulations might implicitly assume. Moreover, the growth impact of FDI is shown to differ significantly across sectors. Most notably, there is at best weak evidence for a causal link between FDI and output growth in the services sector, which attracted the bulk of additional FDI in recent years. This leads us to conclude that the current euphoria about FDI in India rests on weak empirical foundations. FDI is rather unlikely to work wonders in India.

II.   Earlier Literature and Open Questions

Several earlier studies on the growth impact of FDI in India are in striking contrast to the currently prevailing euphoria. Agrawal (2005) estimates a fixed effects model based on pooled data for five South Asian host countries, among which India figures prominently, and the period 1965-1996. The coefficient of the FDI-to-GDP ratio turns out to be negative, though not significant. However, this approach ignores that FDI is endogenous. Moreover, the inclusion of exports as a right hand side variable may bias the coefficient of the FDI variable downwards to the extent that the growth impact of FDI may run through export

promotion. Similar qualifications apply to Pradhan (2002) who estimates a Cobb-Douglas production function with FDI stocks as additional input variable. FDI stocks have no significant impact when considering the whole period of observation (1969-1997).

Most studies accounting for the fact that causation may run both ways tend to find that higher growth leads to more FDI, rather than vice versa. Chakraborty and Basu (2002) explore the two-way link between FDI and growth by using a structural cointegration model with vector error correction mechanism. Using aggregate data for 1974-1996, they find that causality runs more from GDP to FDI. In the long run, FDI is positively related to GDP and openness to trade. Furthermore, FDI plays no significant role in the short-run adjustment process of GDP. In an earlier study, Dua and Rashid (1998) report similar results. Kumar and Pradhan (2002) consider the FDI-growth relationship to be Granger neutral in the case of India as the direction of causation was not pronounced. Sahoo and Mathiyazhagan (2002) corroborate what appeared to be the consensus until recently, while the Granger causality and Dickey-Fuller tests presented by Bhat et al. (2004) provide no evidence of causality in either direction.[4]

Several explanations have been offered for the at best weak impact of FDI on growth in India. The Asian Development Bank refers to concerns in India

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[4] Sahoo and Mathiyazhagan (2002: 17-18) conclude: "FDI does not matter in the growth of the economy. It implies that India's progress towards 'market oriented economy' through policy reforms in 1991 … has not worked properly." However, in the published version of the same paper, Sahoo and Mathiyazhagan (2003) come to exactly the opposite conclusion: "India's progress to 'market oriented economy' … in the 1980s and the early 1990s … has worked properly. FDI inflow has played a vital role in the Indian economy."

"about the apparently limited linkages between MNEs and local firms" (ADB 2004: 228). According to Kumar (2003: 27), linkages with the local economy have remained weak even in the software industry where foreign companies are said to operate as "export enclaves."[5] Bhat et al. (2004) suspect that a lack of local skills has prevented economic spillovers from foreign to local companies. A more differentiated picture is portrayed by Kathuria (2002), who argues that only those domestic firms which invested in R&D, in order to make use of foreign technologies, benefited from spillovers. Athreye and Kapur (2001: 418) note that, according to surveys conducted in the early 1990s, almost half of foreign investors did not transfer up-to-date technology to their Indian subsidiaries or joint-venture partners as intellectual property protection was considered too weak. In the chemical industry, which figured most prominently as a target of FDI until the mid-1990s (see Section III), 80 percent of foreign investors referred to this problem, which may have inhibited more favorable growth effects. At the same time, Kumar and Agarwal (2000) show that local R&D intensity of foreign companies was lower than that of domestic companies, once other factors are controlled for.

Another explanation, which has received particular attention in the literature, concerns FDI-induced exports as a possible transmission mechanism from FDI to GDP growth. Findings have remained ambiguous. In some contrast to Kumar (1990), Sahoo (1999) shows that foreign firms had somewhat higher export

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[5] In addition, Kumar (2003) suspects that at least some FDI inflows have crowded out local investment.

ratios than comparable domestic firms in selected industries in 1990-1994. However, several studies are more in line with the ADB's (2004: 224) verdict that FDI accounts for a "trivial share" of India's exports.[6] According to Sharma (2000), FDI had no significant impact on the country's export performance.[7] Pailwar (2001) argues that India has not been able to attract FDI in export oriented areas. Banga (2003) agrees that FDI has not played a significant role in export promotion, but points out that export effects differ between home countries of foreign investors and between traditional and non-traditional export industries.[8]

It is open to question which of these findings still apply. Earlier studies may fail to fully capture the effects of the changing policy framework in the post-reform period. The ADB (2004: 244) expects a fundamental shift in the behavior of foreign investors and in the benefits host countries may derive from FDI when the policy environment changes as it did after India's reform program of 1991. The New Industrial Policy, triggered by the severe liquidity crisis and the ensuing structural adjustment program agreed with the IMF, marked the departure from restrictive FDI regulations and included the liberalization of trade barriers.[9] Policy changes relevant to FDI included: automatic approval of

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[6] According to this source, FDI accounts for about 3 percent of India's exports, compared with 50 percent or more in various East Asian host countries.

[7] See also Athreye and Kapur (2001: 414-415).

[8] It turns out that US FDI has a positive impact on the export intensity of non-traditional export industries, whereas Japanese FDI has not.

[9] The extremely short account of India's reform program draws on Kumar (2003), Balasubramanyam and Mahambare (2003), Agrawal (2005) and Gupta (2005). As noted by

FDI projects meeting certain conditions; opening up to FDI in various sectors, including mining, financial services and telecommunication (though still subject to limits of foreign ownership); lifting foreign ownership restrictions in most manufacturing industries; gradual dismantling of performance requirements;[10] and incentives for companies operating in export processing zones, the number of which increased. Trade policy reforms that may have induced more world-market oriented FDI included sharply reduced import tariffs.[11]

Even if one rejects the view of Gupta (2005: 199) that "India fully liberalized its economy and became completely open to FDI", the reforms appear to be comprehensive enough to have a say on both the type of FDI entering India and the economic impact of FDI. The liberalization of technology policy seems to have had the effect that foreign investors increasingly entered into technical collaboration agreements, most of which involved some form of financial and equity participation (Athreye and Kapur 2001: 418). Moreover, if Gupta (2005) is right in that India's earlier import substitution strategy had impaired the economic benefits to be derived from FDI, trade liberalization should have resulted in larger benefits. As a consequence of trade liberalization, India may no longer belong to the group of relatively closed host countries for which,

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Balasubramanyam and Mahambare, the relaxation of the dirigiste trade and FDI regime started in the mid-1980s already.

[10] However, balancing requirements with respect to foreign exchange were relaxed only recently.

[11] Agrawal (2005: 97) notes that the average weighted tariff rate declined from 87 percent in 1990-91 to 20 percent in 1997-98.

according to Basu et al. (2003), long-run causality is uni-directional from GDP to FDI.

Furthermore, India's closer integration into the world economy which was helped by the reform program enabled the country to better exploit its comparative advantages, not least by alerting foreign direct investors to these advantages. The survey results presented by ATKearney (2004) suggest that India is increasingly perceived as a R&D hub for a wide range of industries. It has become common place among foreign investors that India offers a well educated workforce which, according to Borensztein et al. (1998), is essential for FDI to have positive growth effects. Likewise, India compares favorably with China in terms of financial market development (McKinsey Quarterly 2004), which represents another factor favoring positive growth effects of FDI (Alfaro et al. 2001; Choong et al. 2004; Hermes and Lensink 2003).

And indeed, some of the studies referred to above do provide first indications that FDI effects in India have become more favorable in the post-reform period. In the analysis of growth effects in five South Asian host countries, the coefficient of the FDI-to-GDP ratio turns positive if the estimate of the production function is restricted to 1990-1996, i.e., when economic liberalization gathered momentum in the region (Agrawal 2005). Similarly, Pradhan (2002) reports more favorable results based on FDI stock data for India when restricting the period of observation to 1986-1997.

Yet it remains open to question whether economic reforms and liberalization resulted in major changes in the type and character of inward FDI. The same is true with regard to the growth effects of FDI in India in the post-reform era. This is for several reasons. First, Kumar (2003) argues that some changes in the structure of inward FDI may rather have impaired the growth impact of FDI. For example, Kumar refers to the increasing role of M&As which, according to this author, are inferior to greenfield FDI. Second, the (admittedly limited) information on FDI characteristics available from surveys of so-called FDI companies has hardly been used in the literature to reveal the type of FDI India has attracted recently. Third, and most importantly, studies based on disaggregated FDI data, whether for India or for any other country, are extremely rare. To the best of our knowledge, Alfaro (2003) is the only study that analyzes FDI flows at the sector level, though in the context of a heterogeneous group of host countries. Utilizing cross-country panel data on sector level FDI flows and controlling for a series of macroeconomic and institutional factors, Alfaro shows that the growth impact of FDI varies across sectors, with positive and significant effects visible only in the manufacturing sector. While providing a differentiated picture on FDI effects, it remains open to question whether findings apply to a specific host country like India. Further, Alfaro's analytical approach is limited to cross-section regressions and, hence, does not address questions regarding the cointegration process and the causal links in the FDI-growth relationship. We attempt to fill these gaps by making

use of recent developments in econometric techniques as well as disaggregated data on FDI stocks in India. As shown below, the sector structure of FDI has changed dramatically. This provides additional reason to expect that the growth consequences of FDI in India depend on what kind of sectors receive FDI (Dua and Rashid 1998: 155).

Before we assess the growth implications of FDI in India by subjecting industry-specific stock data to cointegration and Granger causality tests in Section IV, we present some stylized facts in the following section. The focus is on the composition of FDI in India in the post-reform era as well as on survey data for FDI companies. Moreover, a simple inspection of FDI, export and output trends in specific sectors and industries may provide first hints as to whether FDI is likely to work wonders in the liberalized policy environment in India.

III.   Stylized Facts

It is beyond serious doubt that India's reform program of 1991 has boosted FDI inflows, even though Kumar (1998) is probably right in that the worldwide surge of FDI has played an important role, too. Annual average inflows of US$ 200 million in 1987-1990 pale against annual average inflows of US$ 4.1 billion in 2001-2004 (UNCTAD online database). FDI has gained prominence in relative terms, too (Figure 1). FDI inflows accounted for 3.2 percent of gross fixed capital formation in 2001-2004. Compared with all developing countries (10.5 percent in 2004) and China (14.9 percent in 2004), this share is still low.

However, in the pre-reform period of 1987-1990, FDI inflows accounted for just 0.3 percent of gross fixed capital formation in India. Inward FDI stocks, relative to GDP, soared from less than one percent in the late 1980s and early 1990s to almost six percent in 2004. This ratio is approaching the corresponding ratio for China (8.2 percent in 2004), though still lagging considerably behind the corresponding ratio for all developing countries (26.4 percent).

The post-reform period is not only characterized by booming FDI. At the same time, the sector and industry-wise composition of FDI has changed dramatically. Comparable data on inward FDI stocks for specific sectors and industries are available only until 2000. These data reveal a tremendous shift from FDI in the primary and the manufacturing sectors to FDI in services since the mid-1990s (Figure 2). As concerns the primary sector, it is mainly FDI in agriculture that has lost in relative importance.[12] In the manufacturing sector, all previous priority areas, notably the chemical industry and (electrical and non-electrical) machinery accounted for steeply decreasing shares in overall FDI stocks. Yet FDI stocks in nominal terms multiplied even in these industries.[13] Furthermore, priority areas have changed *within* the manufacturing sector, too. While FDI in the chemical industry clearly ranked first until the mid-1990s, stocks reported for "motor vehicles and other transport equipment" as well as

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[12] Industry-specific FDI stocks are not shown in Figure 2.

[13] For example, the share of the chemical industry in overall FDI stocks dwindled from almost 30 percent in 1987 to 3.4 percent in 2000, even though FDI stocks in this industry increased fivefold to Rs. 26.2 billion in 2000.

"food, beverages and tobacco" exceeded stocks in the chemical industry in 2000.

As discussed below, these changes in the structure of inward FDI may have important implications for both the type and characteristics of FDI in India as well as its economic effects. However, the data situation leaves much to be desired when it comes to FDI in services. This is mainly because booming FDI stocks in the services sector are largely confined to the unspecified category of "other services."[14] Presumably, FDI in this category is heavily concentrated in information and communication services. While it is impossible to assess the relative importance of branches such as the software industry and telecommunications on the basis of stock data, Kumar (2003: 7) notes that telecommunications accounted for about 60 percent of FDI approvals in the services sector during 1991-2000. Recent information on actual FDI inflows shows that services subsumed by the Reserve Bank of India under "computer services" and "financing, insurance, real estate and business services" accounted for 30 percent of total FDI inflows in 2002/03-2004/05 (Reserve Bank of India 2005: 82).

Survey data compiled by the Reserve Bank of India (var. iss.) on so-called FDI companies indicate that, in addition to the increased significance and changing composition of FDI, the type and character of FDI has changed in several respects since the reform program of 1991 (Table 1). Indicators point to

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[14] In addition, FDI in financial services gained considerably in importance. By contrast, FDI stocks in services such as "electricity and water distribution", "trade", and "transport and storage" continued to be of minor importance.

an increasing world-market orientation of FDI. Exports accounted for almost 15 percent of production by all FDI companies surveyed in 2002-03, compared to less than 10 percent in 1990-91. Accordingly, FDI in India continues to be motivated by serving local markets in the first place. But the increasing export orientation may have favorable effects on India's economic development. Balasubramanyam et al. (1996) argue that world-market oriented FDI is superior to purely local-market oriented FDI because the former is more in line with comparative cost advantages of host countries (see also Nunnenkamp and Spatz 2004). The increasing export orientation of FDI appears to be due to two factors: (i) the emergence of new industries that attracted FDI (most notably "computer and related activities"), and (ii) rising shares of exports in the production of industries in which FDI has a longer tradition (such as tea plantations, rubber products, and engineering).

Overall imports increased by the same order as exports, leaving the ratio of exports to imports constant. However, imports of capital goods still account for a minor share in overall imports, though this share varies widely across industries. As a consequence, the extent to which India may benefit from technology transfers embodied in imports of capital goods seems to be limited. On the other hand, concerns that rising imports by FDI companies would crowd out local suppliers seem to be unfounded. The ratio of imported to indigenous supplies of raw materials, stores and spares stayed more or less constant when

comparing this indicator for all surveyed FDI companies in 1990-91 and 2002-03.

Another major change in FDI characteristics concerns its technological sophistication. This has two aspects. First, rising payments of royalties (in percent of production) suggest that FDI companies have increasingly transferred foreign technologies which may support India's industrial upgrading. In 1990-91, such transfers were largely confined to FDI in engineering. They still figure most prominently in this area, with transport equipment standing out with the highest ratio of royalties to production by far. However, other industries, notably the chemical industry, have also drawn increasingly on technologies available abroad. The second aspect relates to R&D undertaken by FDI companies in India. Measured as a percentage of production, local R&D has gained in significance by still more than transfers of foreign technology. This applies to all industries for which data are available. Yet local R&D is concentrated in exactly the same industries, namely chemicals and engineering, which stand out in terms of transfers of foreign technology.[15] This strongly suggests that transfers of foreign technology and local R&D represent complementary means for industrial upgrading, rather than the former substituting the latter.

In the remainder of this section, we portray trends in FDI stocks, exports and output in order to get a first impression on possible implications of the changing composition and character of FDI in India. All series are in constant prices.

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[15] While the ratio of R&D to production is highest in "computer and related activities" (0.77 percent), chemicals and engineering accounted for 73 percent of R&D expenditure by all surveyed FDI companies in 2002-03.

Nominal FDI stocks, reported in Indian Rupees by the Reserve Bank of India and presented in UNCTAD (2000) and Central Statistical Organisation (var. iss.), have been converted into constant prices by using the deflator for net capital stocks (all institutions) as available from the online Database on Indian Economy of the Reserve Bank of India. For exports, we use the export quantum index provided by the Government of India's Directorate General of Commercial Intelligence and Statistics and also to be drawn from the Database on Indian Economy. However, export indices are available only for some industries that are comparable to industry-specific FDI data. The Database on Indian Economy also offers output data in constant prices (originating from India's Central Statistical Organisation).

Comparing FDI and export trends, Figure 3 indicates that export growth in the primary and secondary sectors may have been stimulated by rising FDI stocks immediately after reforms in 1991. But exports stagnated in the second half of the 1990s even though FDI peaked in 1998, and exports resumed a higher growth path recently when FDI in the primary and secondary sectors suffered a setback. Different patterns are shown for selected manufacturing industries. The chemical industry reported high export growth prior to reforms when FDI stagnated. During most of the post-reform period, exports and FDI in this industry developed more or less on parallel trends, but exports continued to grow after FDI had declined in 1998-1999. As concerns machinery, it appears that ups and downs in FDI were typically preceded by export developments in

the 1990s. By contrast, the transport equipment industry seems to provide an example for FDI having promoted export growth in the post-reform period.

FDI and output trends for major sectors are portrayed in Table 2. India experienced only minor changes in GDP growth rates when comparing the pre-reform period of 1987-1991 with three sub-periods of the post-reform era. This is in striking contrast to FDI which boomed especially since the mid-1990s. Yet, when considering that GDP growth was subdued in the late 1990s by adverse exogenous factors, including the (limited) fallout from the Asian crisis, export-depressing effects of the global economic slowdown and unfavorable weather conditions, it appears that India has embarked on a somewhat higher growth path.[16]

As concerns the primary sector, output growth was on a declining trend. This trend was not stopped by the relatively strong increase in FDI in 1991-1995. It should be noted, however, that FDI trends diverged significantly within the primary sector; while FDI stocks have soared in mining and quarrying since 1997, they have fallen considerably in agriculture (not shown). The manufacturing sector experienced a temporary growth acceleration after reforms in 1991 when FDI stocks doubled. But output growth in manufacturing weakened in 1995-2000, even though FDI stocks continued to rise. Patterns within the manufacturing sector are too diverse for a simple data inspection to reveal a clear picture on the links between FDI and output growth. The evidence

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[16] In various issues of the Asian Development Outlook, however, the Asian Development Bank argued that India's slowing growth in the late 1990s was also due to a slackening in the pace of reform; for a similar statement, see Fischer (2002).

for manufacturing industries in which FDI stocks are concentrated may be summarized as follows (details not shown):

- The food industry (including beverages and tobacco) experienced stable and relatively low output growth throughout the period of observation, while FDI stocks were on a steep upward trend, though with considerable fluctuation.

- In the pre-reform period, output growth was highest in the chemical industry and in (electrical and non-electrical) machinery. In both industries, it was immediately after reforms of 1991 that FDI stocks increased most significantly. This may have contributed to higher rates of output growth in 1995-2000. At least in machinery, however, higher rates of output growth were sustained in the most recent past, even though the growth of FDI stocks suffered a setback in the previous sub-period.

- Since 1991 annual average output growth has been most pronounced in the transport equipment industry. At the same time, this industry witnessed the steepest increase in FDI stocks within the manufacturing sector. It thus appears that, similar to what has been observed before with respect to exports, FDI is most likely to be associated with higher output growth in the transport equipment industry.

Finally, the services sector reported relatively high output growth even before the FDI boom started. Soaring FDI stocks since the mid-1990s went along with somewhat higher output growth. This may suggest that FDI was attracted to the

services sector by its favorable growth performance and, at the same time, was a stimulus to still better performance. However, it should be kept in mind that the FDI boom in this sector was largely confined to a few services.

IV. Cointegration and Causality

1. Approach

A growing literature has recognized the theoretical possibility of two-way feedbacks between FDI and economic growth along with their long-run and short-run dynamics. Empirical investigations in the context of the Indian economy, as reported in Section II, have failed to provide any conclusive evidence in support of such two-way feedback effects; causality between FDI and economic growth is either found neutral for India, or to run mainly from economic growth to FDI. Earlier studies have some limitations in common, however. First, the period of observation is typically too short to capture the effects of economic reforms and the subsequent boom in FDI. Second, by using macro level data on FDI and GDP, the variation in the sector-specific nature of FDI and its impact on growth is ignored.[17] Third, almost all of the studies on the growth impact of FDI are devoid of a test of cointegrated relationship between the two variables of interest.[18] Given the unit root characteristics of time series variables in general, results based on panel regression analysis are subject to spurious correlation. Therefore, a better understanding of the FDI-growth

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[17] As indicated in Section II, Alfaro (2003) is the only available study on sector-wise FDI flows.

[18] Chakraborty and Basu (2002) provide an exception.

relationship in the context of policy reform and changes in the structure of FDI requires complementary analyses that rigorously explore the issue of cointegration.[19] Finally, the long-run and short-run dimensions of the causal relationship between FDI and growth have more or less been left open in the earlier literature on India. Causality has typically been tested by evaluating the effect of lagged values of the explanatory variable on the current value of the dependent variable. However, an appropriate assessment of the causal links between the referred variables requires estimation of a vector error correction model that emanates from the cointegrated relationship between the variables.[20]

In the light of significant changes in the structure of FDI in post-reform India (Section III), this paper deviates from the previous studies by focusing on the importance of industry-specific FDI in explaining the relationship between FDI and economic growth. We apply a panel cointegration framework that allows for heterogeneity across 15 industries in the primary, secondary and tertiary sectors (Table 3). Two questions are of particular importance for our purpose: (1) Is there a long-run steady state relationship between FDI and output for all of the 15 industries included in our panel? (2) Given the existence of a cointegrated relationship, can we accurately identify the chronology of causal effects between

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[19] Being introduced in the econometric literature by Granger (1981), the concept of cointegration was further extended and formalized by Engle and Granger (1987). The concept refers to the idea that, although economic time series may exhibit non-stationary behavior, an appropriate linear combination between trending variables could remove the common trend component and, hence, produce a stationary relationship between the variables.

[20] The link between the cointegration technique and the error correction model is formalized in Granger (1983). Following the works of Granger (1986, 1988), Engle and Granger (1987), and Granger et al. (2000), the use of vector error correction models has gained prominence in the recent literature.

FDI and output by unravelling the short-run dynamics of the long-run relationship?

Utilizing time series data on FDI stocks and output, we empirically test these questions in the rest of this section. As reported above, a consistent series of industry-specific FDI stocks is only available for the period 1987-2000. While each of these industries covers a broad range of goods or services, the choice of these industries is driven by data reporting of the Reserve Bank of India (RBI) on FDI stocks and by the Central Statistical Organisation (CSO) of India on output. A simple panel regression with the variables defined at levels reveals a strong positive association between output and FDI. The correlation coefficient between the two variables is 0.89.

Our empirical investigation regarding the association between FDI stocks and economic growth follows the three step procedure suggested in Basu et al. (2003). We begin by testing for non-stationarity in the two variables of FDI stocks and output in our panel of 15 industries. Prompted by the existence of unit roots in the time series, we use the panel cointegration technique developed by Pedroni (1995, 1999) to test for a long-run cointegrated relationship between the two variables in the second step of our estimation. Given the evidence of cointegration in the long-run FDI-growth relationship across the panel, we use an error correction model to uncover Granger causality in the relationship in the final step of our estimation.

2. Empirical Findings

Test of Unit Roots

The panel data framework for unit root test has gained attractiveness in the empirical literature because of its weak restrictions. It captures the member-specific effects and allows for heterogeneity in the direction and magnitude of the parameters across the selected panel. In addition, it allows for a great degree of flexibility in terms of model selection. The alternatives for model choice range from a model with heterogeneous intercepts and heterogeneous trends to a model with no intercepts and no trends. Within each model, it is possible to test for common time effects.

Following the methodology used in earlier research, we test both mean stationarity and trend stationarity in the two variables of output and FDI stocks. We also control for time effects common to all industries (t= 1987-2000) within each model. Consequently, the models of interest are: model with heterogeneous intercepts and no common time effect (M_1); model with heterogeneous intercepts and common time effect (M_2); model with heterogeneous intercepts and heterogeneous trends ignoring common time effects (M_3); and model with heterogeneous intercepts and heterogeneous trends allowing for common time effects (M_4). We test for the null of non-stationarity in the two referred variables against the alternative of stationarity by taking each of the models in turn. The test is a residual-based test that evaluates four different statistics for variables at

their levels and at first differences. These four statistics represent a combination of the tests used by Levin et al. (2002) and Im et al. (2003).[21] While the first two test statistics are non-parametric rho-statistics, the last two are parametric ADF t-statistics. Sets of these four statistics for each of the four models are reported in Table 4.

The first two rows under each model report the panel unit root statistics for output and FDI stocks at levels. Given that the left tail of the normal distribution is used to reject the null of non-stationarity, the positive values and the small negative values reported in these rows consistently fail to reject the null across different models.[22] The last two rows under each model report the panel unit root statistics for first differences in output and FDI stocks. The large negative values for the statistics indicate rejection of the null of non-stationarity at the one percent level for all models. We may, therefore, conclude that output and FDI stocks have unit root properties, or are integrated of order one, i.e. I (1) variables for short.

Test for Panel Cointegration

With confirmation on the integrated order of the two variables of interest, the question is that they might or might not have a common stochastic trend, or, they might or might not be cointegrated. We resolve this question by looking for a long-run relationship between output and FDI stocks using the panel

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[21] Since each test statistic has its own weaknesses, it is now a standard practice to use a combination of test statistics for the unit root test.

[22] The only exceptions are the ADF statistics of Im et al. (2003) in models M_3 and M_4.

cointegration technique. This technique is a significant improvement over the conventional cointegration tests applied on a single series. As explained in Pedroni (1999), conventional cointegration tests usually suffer from unacceptable low power when applied on data series of restricted length. Panel cointegration technique addresses this issue by allowing to pool information regarding common long-run relationships between a set of variables from individual members of a panel. Further, with no requirement for exogeneity of the regressors, it allows the short-run dynamics, the fixed effects, and the cointegrating vectors of the long-run relationship to vary across the members of the panel.

The specific cointegration relationship we estimate has the following form:

$$FDI_{it} = \alpha_i + \delta_t + \beta_i GDP_{it} + e_{it} \tag{1}$$

where α_i ($i =1, 2,....,15$) refers to industry-specific effects, δ_t refers to time effects, and e_{it} is the estimated residual indicating deviations from the long-run steady state relationship. With a null of no cointegration, the panel cointegration test is essentially a test of unit roots in the estimated residuals of the panel. If e_{it} in equation (1) is found to be stationary, or consistent with I (0), one may claim that cointegration exists between FDI stocks and output. Pedroni (1999) refers to seven different statistics for testing unit roots in the residuals of the postulated long-run relationship. Of these seven statistics, the first four are referred to as panel cointegration statistics; the last three are known as group mean panel cointegration statistics. In the presence of a cointegrating relation, the residuals

are expected to be stationary. A positive value for the first statistic and large negative values for the remaining six statistics allows rejection of the null of no cointegration. All of the seven statistics under different model specifications are reported in Table 5. Most of the statistics for all different model specifications suggest rejection of the null at the one percent level. We, therefore, conclude that the two unit root variables of output and FDI stocks are cointegrated in the long run. Put differently, FDI and economic growth in India are positively associated with each other.

Test of Causality: All Industries

With the affirmation that output and FDI stocks are cointegrated, we test for Granger causality in the long-run relationship using an error correction model. As proposed by Engle and Granger (1987), and demonstrated by Granger et al. (2000), the causality test itself is a two-stage estimation process. The first step relates to the estimation of the residual from the cointegrated relationship shown in equation (1). Incorporating the residual e_{it} as a right hand side variable, the dynamic error correction model is estimated at the second step for drawing inferences on Granger causality. Following these steps, the dynamic error correction model of our interest has the following form:

$$\Delta FDI_{it} = \alpha_{1i} + \eta_{1i}e_{it-1} + \Sigma_k \beta_{1ik}\Delta FDI_{i,t-k} + \Sigma_k \beta_{2ik}\Delta GDP_{i,t-k} + u_{1it}$$

$$\Delta GDP_{it} = \alpha_{2i} + \eta_{2i}e_{it-1} + \Sigma_k \gamma_{1ik}\Delta GDP_{i,t-k} + \Sigma_k \gamma_{2ik}\Delta FDI_{i,t-k} + u_{2it} \qquad (2)$$

in which k refers to the optimal lag length for each industry in the panel.[23]

The two coefficients η_{1i} and η_{2i} represent speeds of adjustment along the long-run equilibrium path; while η_{1i} can be interpreted as displaying the long-run effects of output on FDI stocks, η_{2i} can be taken to imply the long-run effects of FDI stocks on output.[24] Following Engle and Granger (1987), for the i [th] industry in the panel, the existence of cointegration between the referred variables indicates causal links among the set of variables as manifested by $|\eta_{1i}| + |\eta_{2i}|$ > 0. Accordingly, failing to reject H_0: $\eta_{1i} = 0$ for all i, $i = 1,2,\ldots15$, implies that output does not Granger cause FDI stocks for any of the industries included in the panel for the long run. Conversely, failing to reject H_0: $\eta_{2i} = 0$ for all i, $i = 1,2,\ldots15$, implies that FDI stocks do not Granger cause output in any of the industries in the panel in the long run.

The set of coefficients β_{2ik} and γ_{2ik} capture interim effects and reflect the adjustment process between the associated set of variables in response to a random shock. Consequently, failing to reject H_0: $\beta_{2ik} = 0$ for all i and k, ($i = 1,2,\ldots15$, $k = 1,2,\ldots k$), implies that output does not Granger cause FDI stocks for any of the industries included in the panel in the short run; and failing to reject H_0: $\gamma_{2ik} = 0$ for all i and k, ($i = 1,2,\ldots15$, $k = 1,2,\ldots k$), implies that FDI stocks do not Granger cause output for any of the industries included in the

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[23] With no evidence of increased model significance from extended lags, we kept the lag length limited to two periods.

[24] The long-run effects reflect movements along the path of a steady state equilibrium relationship between output and FDI stocks and, hence, are considered permanent.

panel in the short run. Following conventional procedure, we use a standard F test to test the referred sets of long-run and short-run hypotheses. The results of these tests are shown in Table 6.

As is apparent from the table, the null of no short-run causality and no long-run causality is rejected for both of the linear causal links tested within the cointegrated model. For the short run, both the hypotheses of no causality are rejected at the one percent level indicating strong bi-directional links between FDI stocks and output. For the long run, the hypothesis of no causality from output to FDI stocks is rejected at the one percent level; the hypothesis of no causality from FDI stocks to output is rejected at the five percent level. Thus, though there is evidence of bi-directional causal links, causality running from FDI stocks to output is relatively weaker when considering the entire panel of 15 industries.[25]

Test of Causality: Sector-wise Disaggregation

Although the causality tests for the entire industry panel provide evidence of two-way links between output and FDI stocks, the observed changes in the composition of FDI in post-reform India (Section III) suggest that the direction and magnitude of causal links between the two variables might vary between individual members of the industry panel. To explore this possibility, we repeat the Granger causality tests for each of the three broad sectors listed in Table 3. The results of these tests are reported in Table 7.

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[25] Alfaro's (2003) observation of an insignificant growth effect of cross-country FDI flows offers an interesting reference point for this result.

And indeed, the results reveal that the nature of the causal links between FDI stocks and output are strikingly different across sectors. For the primary sector, the null of no causality from output to FDI stocks and that of no causality from FDI stocks to output cannot be rejected for either the short run, or the long run. By contrast, the manufacturing sector displays robust bi-directional causal links in the long-run relationship between the two variables of FDI stocks and output; in the short run, causality for the manufacturing sector is seen to be uni-directional and running from FDI stocks to output. Most interestingly, there is no strong evidence of long-run causal links between the two variables of interest in the tertiary sector, even though the bulk of additional FDI flowing to post-reform India was attracted by the tertiary sector, rather than the manufacturing sector. There is only a weak long-run causality running from output to FDI. The results for the short run, however, reflect feedback effects between the two variables in the tertiary sector.

The sector-specific causality tests for the case of India are largely in line with the cross-country findings of Alfaro (2003).[26] The marked differences in the short and long-run dynamics of the FDI-growth relationship between major sectors of the Indian economy may be attributed to specific characteristics of FDI in these sectors and their capacity to absorb foreign technologies and make use of spillovers. As argued by UNCTAD (2001: 138), the scope for linkages

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[26] As reported in Section II, the cross-country regressions by Alfaro (2003) indicate that FDI has a significantly positive impact on growth in the manufacturing sector only. By contrast, significantly negative effects are found in the primary sector. Effects remain ambiguous in the services sector according to Alfaro.

between foreign and domestic firms is typically limited in the primary sector. This limitation may have prevented the primary sector in India from realizing growth benefits from FDI. The scope for linkage intensive activities and associated benefits from spillovers tends to be wider in the manufacturing sector. Hence, it appears that it was mainly the manufacturing sector that benefited from trade liberalization, financial liberalization and human capital formation in post-reform India and the complementary process of technological diffusion.[27] As noted in Table 1, several manufacturing industries have become more closely integrated into world markets in terms of exports and imports as well as in terms of technology transfers and complementary local R&D activity.

UNCTAD's (2001: 139) proposition, referred to by Alfaro (2003), that the tertiary sector resembles the primary sector with regard to the limited potential of linkages and spillovers may be more contentious. This applies especially to India which has become the show case for outsourcing and international networking in IT services. It thus may pose a puzzle that we do not find a strong growth impact in India's services sector, even though it was exactly this sector that attracted the bulk of additional FDI in the post-reform era. However, recalling some of the facts reported in Section III may help resolve this puzzle. Most importantly, while FDI in the services sector appears to be concentrated in

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[27] For the importance of trade liberalization, financial liberalization and human capital formation as catalysts to more favorable growth effects of FDI, see Balasubramanyam et al. (1996), Hermes and Lensink (2003) and Borensztein et al. (1998), respectively. Moreover, our findings on manufacturing are in line with the cross-country findings on FDI and trade reported in Aizenman and Noy (2005). Using Granger causality tests on disaggregated measures of financial flows and trade, this study finds strongest feedback effects between FDI and manufacturing trade.

information and communication services, the contribution of these services to total output in the services sector is limited.[28] Hence, even if FDI resulted in higher growth in some IT-related services, the impact on total output in the services sector probably remained insignificant. Moreover, the extent of technological spillovers in IT-related services is open to question. According to Kumar (2003: 27), linkages with the local economy have remained weak in the software industry; and in Table 1 it is shown that royalty payments (in percent of production) were surprisingly low for FDI companies in "computer and related activities." This suggests that technology transfers from abroad played a minor role as a transmission mechanism through which FDI may have promoted the development of IT services in post-reform India.

V. Summary and Conclusions

Inward FDI has boomed in post-reform India. At the same time, the composition and type of FDI has changed considerably. Even though manufacturing industries, too, have attracted rising FDI, the services sector accounted for a steeply rising share of FDI stocks in India since the mid-1990s. While FDI in India continues to be local-market seeking in the first place, its world-market orientation has clearly increased in the aftermath of economic reforms. It is against this backdrop that we assess the growth implications of FDI in India. By using industry-specific FDI and output data and applying a panel cointegration

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[28] For instance, the contribution of communication services was less than five percent in 2000 (RBI online data).

framework that integrates long-run and short-run dynamics of the FDI-growth relationship, we address important gaps in the earlier literature.

For the Indian economy as a whole, we find that FDI stocks and output are cointegrated in the long run. At the aggregate level, Granger causality tests point to feedback effects between FDI and output both in the short and the long run. However, the impact of output growth in attracting FDI is relatively stronger than that of FDI in inducing economic growth. In other words, causation is mainly running from output growth to FDI stocks.

At the sector level, it turns out that favorable growth effects of FDI in India are largely restricted to the manufacturing sector, where FDI stocks and output are mutually reinforcing in the long run. By contrast, there is no evidence at all of any causal relationship between the two variables in the primary sector. Most interestingly, and contrary to the widespread view that booming FDI in the services sector is driving growth in India, feedback effects between FDI and output turn out to be transitory in this sector. If at all, causality in the services sector runs from output to FDI in the long run.

It may be tempting to conclude from the sector-specific results that the pre-reform approach to FDI in India was not so bad after all. Traditionally, selective approval procedures and performance requirements were meant to promote FDI in technologically advanced and more export-oriented manufacturing industries, and to discourage FDI in the tertiary sector where foreign investors might replace local service providers. However, such a conclusion would be

misconceived. Our results do support the view that the quality of FDI matters at least as much as the volume of FDI for the growth implications in host economies. More specifically, our results are in line with findings of cross-country analyses according to which the growth implications depend on various factors, including absorptive capacity and local skills, technological spillovers and linkages between foreign and local firms, and export orientation – all of which may differ across industries and sectors in the host economy. Yet all this does not speak in favor of selective FDI policies and policymakers attempting to target preferred types of FDI in specific industries. For such an approach to be successful in attracting growth-promoting FDI, policymakers would have to know exactly about the quality of each FDI proposal and its effects on the local economy. This appears to be an overly heroic assumption. Otherwise, it would be difficult to explain why earlier studies on the FDI-growth nexus in India, the results of which should be shaped more strongly by pre-reform selectivity and targeting, do not produce "better" results than the present study.

On the other hand, our results clearly suggest that the currently prevailing euphoria about FDI in India rests on weak empirical foundations. FDI is unlikely to work wonders if only remaining regulations were relaxed and still more industries opened up to FDI. This is not to ignore that policymakers may contribute to maximizing the benefits of FDI in India. Their contribution has less to do with specific FDI policies. Rather, the policy challenge is to improve local conditions that may render FDI more effective. Openness to trade and

financial sector development seem to be important in this regard. The same applies to the promotion of local entrepreneurship and human capital development. This is even though India is widely acclaimed for its entrepreneurship and highly skilled workforce. However, these undisputable achievements seem to be highly concentrated in a few clusters, both region-wise and industry-wise, whereas large parts of the economy provide by far less favorable conditions for FDI to have stronger growth effects.

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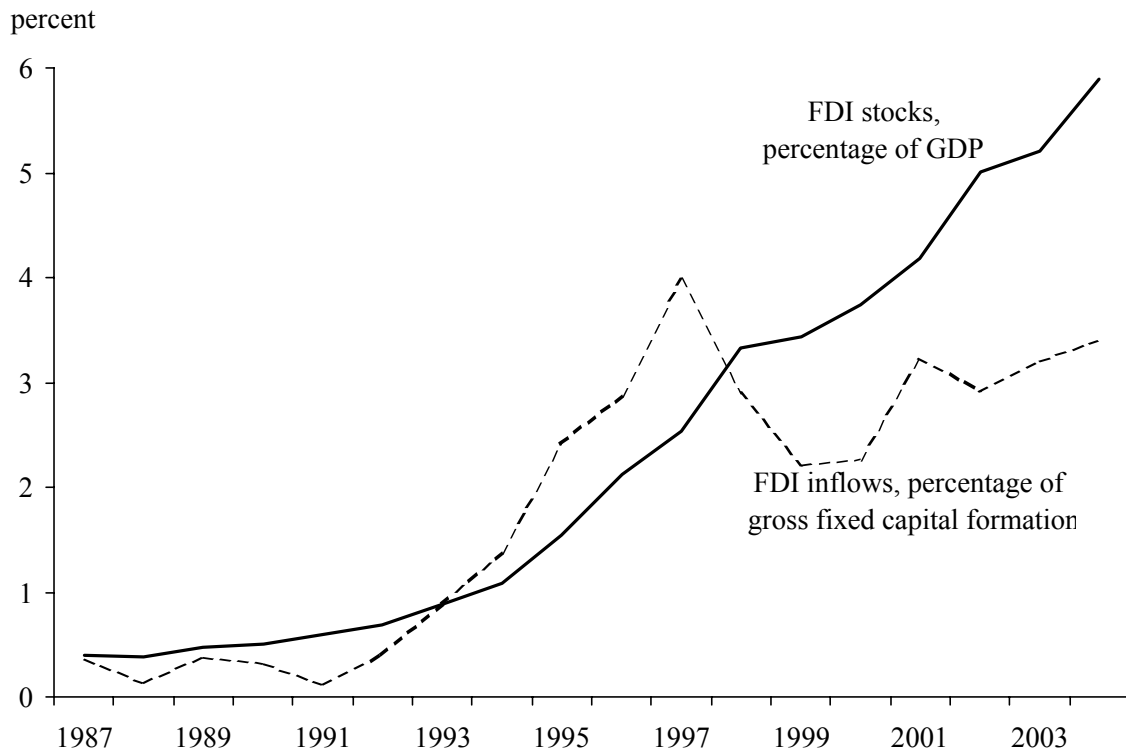
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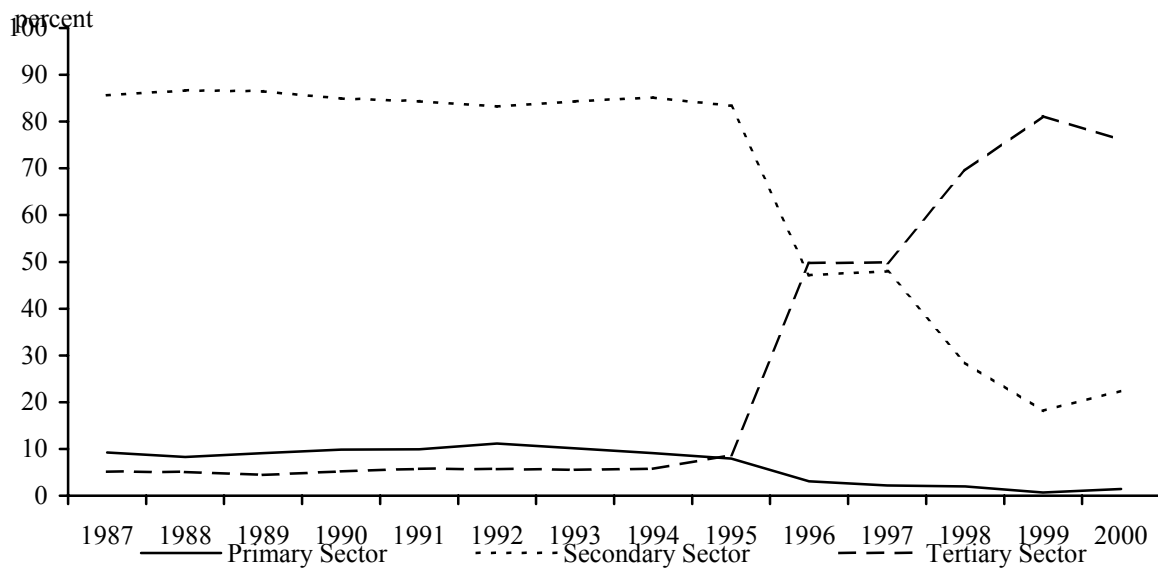Sharma, K. (2000). Export Growth in India: Has FDI Played a Role? Discussion Papers 816, Yale University, Economic Growth Center. New Haven, Conn., mimeo. (http://www.econ.yale.edu/~egcenter/).

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Figure 1 — FDI Trends in India, 1987-2004

percent

FDI stocks, percentage of GDP

FDI inflows, percentage of gross fixed capital formation

Source: UNCTAD online database.

Figure 2 — Sector-wise Composition of FDI Stocks, 1987-2000

percent

Primary Sector   Secondary Sector   Tertiary Sector
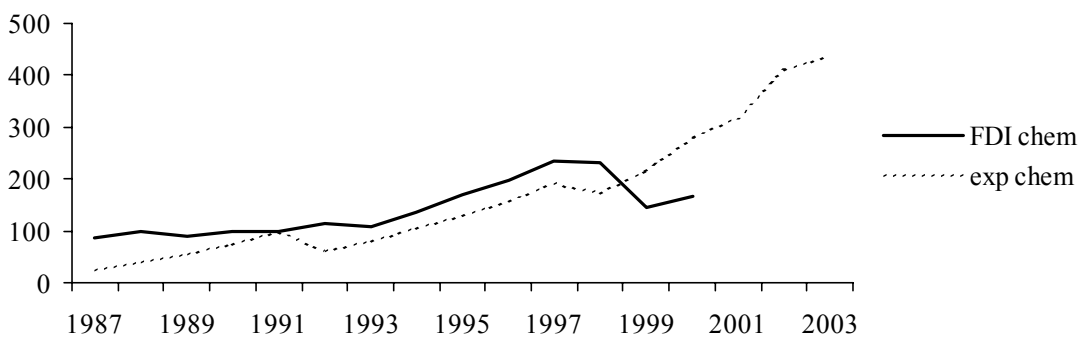
Source: UNCTAD (2000); Central Statistical Organisation (var. iss.).

Figure 3 —   FDI and Export Trends: Total and Selected Industries 1987-2003 (1991=100)
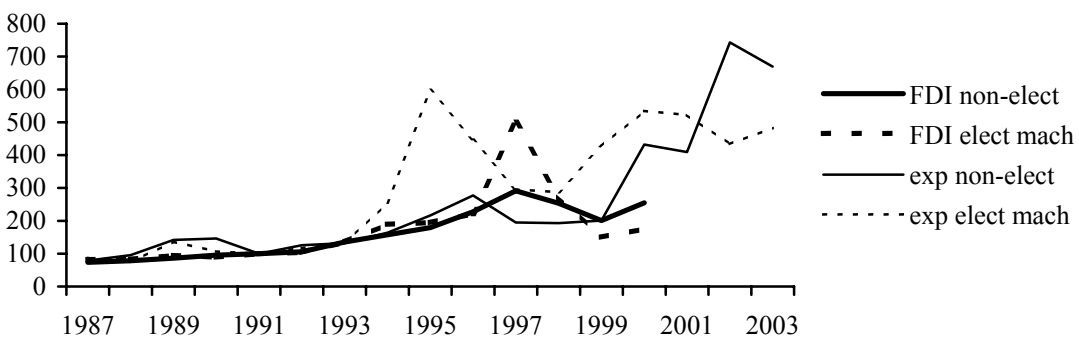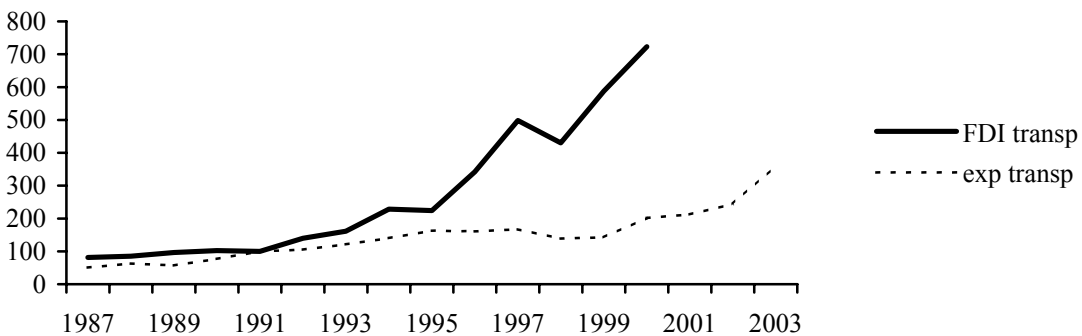
a)   Total
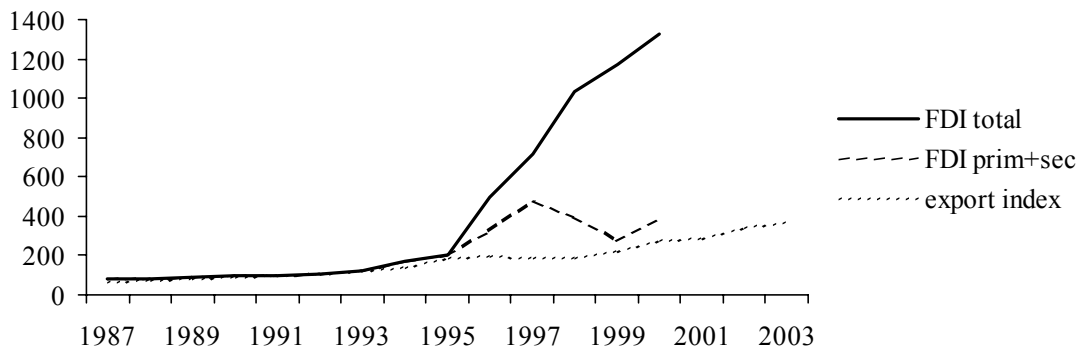
b)   Chemicals

c)   Non-electrical and Electrical Machinery

d)   Transport Equipment

Source: UNCTAD (2000); Central Statistical Organisation (var. iss.); Reserve Bank of India (Database on Indian Economy).

Table 1 —   FDI Characteristics, 1990-91 and 2002-03

	Export, % of prod.	Ratio exports to imports	Imports of capital goods, % of total imports.	Raw materials, stores & spares, imported in % of indigenous	Royalty payments, %of prod.	R&D, % of prod.	Salaries, %of prod.	Memorandum	
								Companies number	Value of production, all. industries= 100
1990-91									
All industries	9.3	1.3	9.0	20.0	0.11	0.09	9.0	300	100.0
Tea plantations	13.7	95.7	18.4	0.5	0.00	0.00	17.0	24	6.3
Textiles	16.4	3.5	19.5	18.7	0.00	0.04	14.4	6	2.0
Rubber products	11.2	1.7	7.2	12.8	0.01	0.00	7.9	4	3.5
Chemicals	9.5	1.2	2.9	23.3	0.02	0.06	2.0	63	29.3
Engineering	7.0	0.8	12.3	26.6	0.24	0.14	9.5	126	38.7
Trade	16.3	2.1	61.6	0.3	0.00	0.05	7.4	8	0.7
2002-03									
All industries	14.8	1.3	7.7	20.6	0.26	0.38	8.3	490	100.0
Tea plantations	22.4	49.3	9.8	1.5	0.00	0.05	37.2	10	1.0
Food products	8.9	2.9	5.1	4.6	0.01	0.09	5.6	16	3.3
Rubber/plastic products	16.4	1.9	16.2	18.8	0.00	0.21	5.0	11	2.0
Chemicals	11.8	0.9	3.4	23.6	0.28	0.39	5.7	76	28.2
Engineering	11.1	0.9	9.2	22.7	0.49	0.65	8.7	153	26.3
machinery & tools	13.5	1.0	3.4	23.8	0.27	0.68	9.5	85	8.5
electr. mach.	11.4	0.8	6.7	30.4	0.25	0.47	7.5	33	5.9
transport equipment	9.2	1.0	16.9	18.6	0.76	0.72	8.8	35	11.9
Computer & related act.	12.7	5.0	74.8	0.0	0.05	0.77	31.8	23	4.4
Trade	19.9	1.4	1.0	0.5	0.01	1.80	9.3	20	1.2

[a] Sum of machinery & tools, electrical machinery and transport equipment.

Source: Reserve Bank of India (various issues).

Table 2 — Major Sectors: Change in FDI Stocks[a] and Output Growth[b], 1987 – 2004

	1987-1991	1991-1995	1995-2000	2000-2004
All sectors				
FDI	1.26	2.07	6.39	n.a.
output	6.00	6.40	5.90	6.30
Primary sector				
FDI	1.35	1.65	1.17	n.a.
output	5.00	3.60	2.70	2.60
Manufacturing				
FDI	1.24	2.05	2.03	n.a.
output	5.60	9.80	5.00	6.60
Services[c]				
FDI	1.41	3.14	56.06	n.a.
output	6.80	7.10	7.90	7.80

[a]Ratio final over initial year of the respective period. — [b]Annual growth rate of GDP and contribution to GDP. respectively. in constant prices. — [c]Includes electricity. gas and water.

Source: UNCTAD (2000); Central Statistical Organisation (various issues); Reserve Bank of India (Database on Indian Economy).

Table 3—Selected Panel of Industries

Broad sector	Included industries
Primary sector	Agriculture, hunting, forestry & fishing Mining & quarrying Petroleum
Secondary sector	Food, beverages & tobacco Textiles, leather & clothing Chemicals & chemical products Basic metals & metal products Machinery equipment & electrical machinery Motor vehicles & other transport equipment
Tertiary sector	Electricity & water distribution Construction Distributive trade Transport & storage Finance Other services

Table 4— Full Panel Unit Root Test for GDP and FDI Stocks[a]

H_0: Variables are non-stationary					
Variables	Levin et al. rho-stat	Levin et al. t-rho-stat	Levin et al. ADF-stat	Im et al. ADF-stat	Decision on H_0
M_1: Heterogeneous intercepts with no common time effect					
GDP	2.30209	3.48977	3.39246	3.66133	Accept
FDI	-0.11060	1.58909	0.64754	-0.27242	Accept
GDPDIFF	-14.51160	-17.36676	-21.40637	-27.51017	Reject
FDIDIFF	-15.50983	-14.59209	-9.36342	-13.23267	Reject
M_2: Heterogeneous intercepts with common time effect					
GDP	1.92248	3.32841	2.94893	2.94396	Accept
FDI	1.85163	3.57200	1.52558	-1.03011	Accept
GDPDIFF	-12.58931	-12.17797	-10.52295	-20.31529	Reject
FDIDIFF	-10.04381	-6.87181	-6.37505	-8.223068	Reject
M_3: Heterogeneous intercepts and heterogeneous trends with no common time effect					
GDP	1.93409	0.22568	-0.29699	-0.53593	Accept
FDI	-1.70406	-1.77677	-1.86162	-3.71896*	Accept
GDPDIFF	-17.19989	-10.18715	-14.02306	-20.43317	Reject
FDIDIFF	-14.86436	-9.98292	-6.64733	-12.14174	Reject
M_4: Heterogeneous intercepts and heterogeneous trends with common time effect					
GDP	-0.50786	-0.71247	-1.07342	-1.29829	Accept
FDI	2.66658	0.70148	-1.64521	-4.32851*	Accept
GDPDIFF	-14.62652	-8.80268	-8.54622	-15.98889	Reject
FDIDIFF	-12.77869	-7.33768	-5.46092	-8.41581	Reject
[a] All tests are left-tail tests that follow normal distribution. * Exceptions to all other statistics.					

Source: own calculations based on RBI online database; UNCTAD (2000); CSO (var. iss.)

Table 5—Results for Panel Cointegration between GDP and FDI[a]

H_0: No cointegration vector between GDP and FDI				
	Model specification			
Statistics	M_1	M_2	M_3	M_4
Panel v-stat	2.49707	2.94133	-0.23055	-0.68771
Panel rho-stat	-5.64840	-5.19672	-3.67648	-2.53801
Panel pp-stat	-12.79293	-10.23135	-13.03658	-9.22998
Panel ADF-stat	-10.91080	-8.65209	-11.75143	-8.50382
Group rho-stat	-3.46427	-3.21411	-1.67613*	-0.79810*
Group pp-stat	-17.74692	-12.30255	-13.73666	-9.10667
Group ADF-stat	-18.89325	-11.04659	-13.63381	-9.23078
Decision	Reject H_0	Reject H_0	Reject H_0	Reject H_0
[a] The first test is a right-tail test; all other tests are left-tail tests. * Exceptions to all other statistics in the row.				

Source: own calculations based on RBI online database; UNCTAD (2000); CSO (var. iss.)

Table 6—Results of Full Panel Causality Tests[a]

Null hypothesis	Long-run	Short-run
H_0: Output does not Granger cause FDI	11.7506*	4.2864*
H_0: FDI does not Granger cause output	2.1569**	2.7564*
Critical F value	2.19	1.95
[a] Critical F values correspond to 1% level of significance. * significant at 1% level; ** significant at 5% level.		

Source: own calculations based on RBI online database; UNCTAD (2000); CSO (var. iss.)

Table 7— Results of Sector Level Causality Tests[a]

Hypothesis and critical F value	Long-run	Short-run
Agriculture and mining		
H_0: Output does not cause FDI	0.2321	1.6847
H_0: FDI does not cause output	4.3275	0.9746
Critical F value	5.42	4.01
Manufacturing		
H_0: Output does not cause FDI	3.5182*	0.9990
H_0: FDI does not cause output	4.0070*	3.1099*
Critical F value	3.21	2.59
Services		
H_0: Output does not cause FDI	2.4072***	4.6138*
H_0: FDI does not cause output	0.7077	3.6208*
Critical F value	3.85	2.98
[a] Critical F values are reported at 1% level. * significant at 1% level; *** significant at 10% level.		

Source: own calculations based on RBI online database; UNCTAD (2000); CSO (var. iss.)