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ECONOMIC GROWTH IN INDIA: DOES FOREIGN DIRECT INVESTMENT INFLOW MATTER?

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ECONOMIC GROWTH IN INDIA: DOES FOREIGN DIRECT INVESTMENT INFLOW MATTER?

Dukhabandhu Sahoo* and Maathai K Mathiyazhagan**

Abstract

This paper examines the role of Foreign Direct Investment (FDI) in promoting economic growth via export promotion by using quarterly data relating to the period 1991-I to 2000-IV. The study uses the Johansen co-integration test, and the results demonstrate that there is a long-run relationship between Gross Domestic Product (GDP), FDI, and Export (EX) and Industrial Production (IIP), FDI, and EX. However, the elasticity coefficients between FDI and GDP and FDI and IIP turned out to be negative but the elasticity coefficients between EX and GDP and EX and IIP are positive. It implies that FDI does not matter in the growth of the economy, but EX contributes to the growth in India. Therefore, in order to achieve higher economic growth, it is advisable to open up the export-oriented sectors in India.

Introduction

The main objective of this paper is to examine the role of Foreign Direct Investment (FDI) in the economic growth of India through export promotion. It is argued that FDI could play a vital role as a source of capital, management and technology in India. It has been argued that FDI could bring the technological diffusion to the economy through knowledge spillover and accelerate a faster rate of growth in India. It is important to note that the gain in the national income also depends on the size of the capital inflow and elasticity of demand for capital, which could increase the technological and managerial inputs and transfers and spillovers to local firm. Thus, it increases the production at a faster rate at national level. However, given the imperfect market conditions in India, FDI may lower the domestic saving and investment by extracting the capital through prepared access to local capital market by the foreign firms. It could be argued that the Multinational Enterprises (MNEs) in the

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name of FDI may drive out the local firms because of their oligopolistic power and also the repatriation of profit may drain out the capital of the host country. Both these positive and negative arguments are important in the Indian situation. India opened up its economy and allowed MNEs in the core sectors as a part of the reform process started in the beginning of the 1990s. Though India has attracted a lesser share of FDI flows to the developing countries, it has become one of the lucrative investment locations for the foreign investors (Table 1).

Table 1: FDI Flows to Developing Countries in 1998

Sl.No.	Country	FDI Flows (Rs In Crores)	Per cent of Total
1	China	45,460	24.8
2	Brazil	28,718	15.7
3	Mexico	10,228	5.6
4	Thailand	6,969	3.8
5	Argentina	5,697	3.1
6	Korea	5,143	2.8
7	India	2,258	1.2

Source: Report on Currency and Finance, RBI, 1998-1999.

The net FDI inflow has grown from Rs 174 crores in 1990-91 to Rs 10,686 crores in 2000-01, giving an annual average growth rate of 6 per cent (RBI, 2001). It is also important to note that the GDP and performance of export in India during this period have also registered a significant growth. The average GDP and export growth were around 6.3 per cent and 20.4 per cent respectively for the period between 1991 and 2000. It gives an impression that the growth of FDI inflows and export might have contributed significantly to the growth of the economy in India after the reform period. In this context, this paper highlights the role of FDI inflows in the growth of the Indian economy and examines the possible long run relationship among the two sets of variables like GDP, FDI, and Export (EX) and IIP, FDI, and EX.

Dimensions of FDI in India

The dimensions of the FDI flows into India could be explained in terms of its growth and size, sources and sectoral compositions. The growth of FDI inflows in India was not significant until 1991 due to the regulatory policy framework. However, under the new policy regime, it is expected to assume a much larger role in catalyzing Indian economic development. It could be observed that there has been a steady build up in the actual FDI inflows in the post-liberalization period (Table 2).

Table 2: FDI Flows to India from 1990-91 to 2000-01

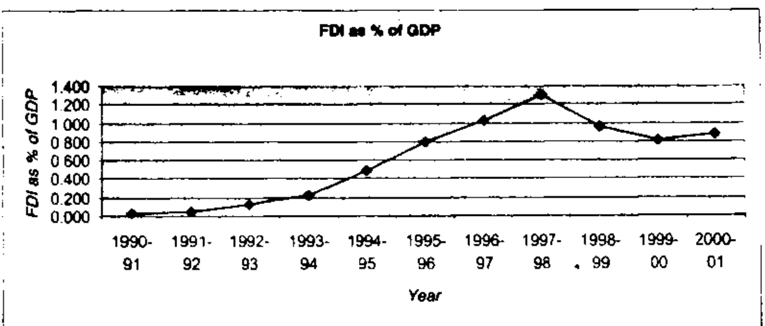
(Rs in crores)

Year	FDI	Annual growth rate	FDI as % of GDP	EX as % of GDP
1990-91	174		0.025	0.047
1991-92	316	0.816	0.045	0.063
1992-93	965	2.054	0.131	0.073
1993-94	1,838	0.905	0.235	0.089
1994-95	4,126	1.245	0.492	0.099
1995-96	7,172	0.738	0.797	0.118
1996-97	10,015	0.396	1.032	0.122
1997-98	13,220	0.320	1.301	0.128
1998-99	10,358	-0.216	0.956	0.129
1999-00	9,338	-0.098	0.811	0.139
2000-01	10,686	0.144	0.882	0.168

Source. Handbook of Statistics on Indian Economy, RBI, 2001.

Actual inflows have steadily increased from Rs 174 crores in 1990-91 to Rs 10,686 crores in 2000-01. Indeed, the forecasted estimate was that FDI inflow into India was likely to touch Rs 45,000 crores by 2000 (World Investment Report, 1998). However, the pace of FDI inflows to India has definitely been slower than some of the smaller developing countries like Indonesia, Thailand, Malaysia and Vietnam (World Investment Report, 1998). In fact, India has registered a declining trend of FDI inflows and the FDI-GDP ratio (Figure 1) from 1998, which could be attributed to many factors, including the US sanctions imposed in the aftermath of the nuclear tests, the East Asian melt-down and the perceived Swedish image of the central government. It is also important to note that the financial collaboration has outnumbered the technical collaboration over the years.

Figure 1: FDI as a percentage of GDP



The analysis of the origin of FDI inflows to India shows that the new policy has broadened the source of FDI into India. There were 86 countries in the year 2000 as compared to 29 countries in 1991, whose FDI was approved by the Indian Government. Thus, the number of countries investing in India has increased during the period of reform. But still a lion's share of FDI comes from only a few countries (RBI, 2001).

Table 3 shows the actual investment flows of top ten countries (and the respective growth rates) during the period January 1991 to December 2000. The FDI inflow from Mauritius is the largest (39%), even though the US alone accounted for nearly a quarter (24%) of the total FDI inflows (Figure 2). The other five countries viz., UK, Japan, Germany, South Korea and Australia collectively shared 28 per cent of the total actual FDI inflows to India. It is important to note that more than 90 per cent of the FDI inflows came from only seven countries in the last decade (Figure 2). Nevertheless, the geographic concentration of FDI inflows in the reform period is lower than in the pre-reform period.

Figure 2: Source Country-wise FDI stock from 1991 to 2000

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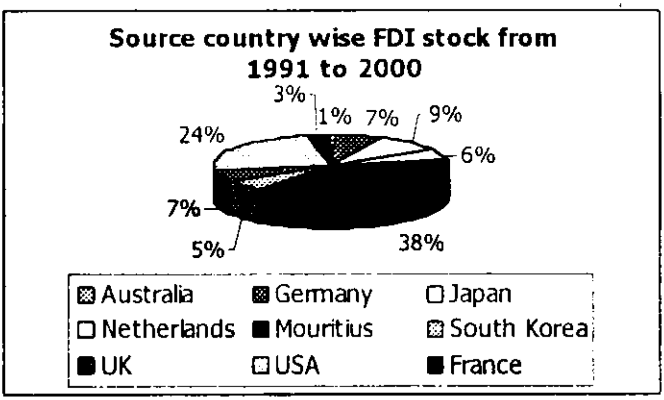

In 1990, only six countries, viz. the US, the UK, Germany, Japan, Italy and France were responsible for over two-thirds of the total FDI inflows in India (Economic Survey, 1998). The country-wise annual growth rate of the FDI inflows shows that Mauritius, which was not in the picture till 1992, has the highest growth rate (Table 3). A lion's share of such investment is represented by the holding companies of Mauritius set up by the US firms. It means that investment flowing from the tax havens is mainly the investment of the multinational corporations headquartered in other countries. Now an important question arises as to why the US

Table 3: Source Countrywise FDI Inflows and the Growth Rates

(Rs in Crores)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Australia	0.00	0.03	2.51 (94.8)	1.88 (-0.3)	36.59 (18.4)	53.93 (0.5)	23.18 (-0.6)	63.72 (1.8)	90.02 (0.4)	36.00 (-0.6)
Germany	6.98	61.31 (7.8)	41.11 (-0.4)	139.64 (2.4)	265.61 (0.9)	493.95 (0.8)	622.59 (0.3)	674.16 (0.1)	205.27 (-0.7)	362.78 (0.8)
Japan	5.94	71.79 (11.1)	82.84 (0.2)	275.83 (2.4)	254.35 (-0.8)	314.56 (0.2)	647.33 (1.1)	839.40 (0.3)	658.00 (-0.2)	740.99 (0.1)
Netherlands	1.55	14.93 (8.6)	165.06 (10.1)	149.06 (-0.1)	138.61 (-0.1)	490.72 (2.5)	573.49 (0.2)	400.16 (-0.3)	371.84 (-0.1)	351.56 (-0.1)
Mauritius	0.00	0.00	3.77	90.37 (23)	1835.34 (19.3)	2338.55 (0.3)	4112.22 (0.8)	3121.01 (-0.2)	1957.48 (-0.3)	3402.47 (0.7)
South Korea	0.00	8.38	6.59 (-0.2)	33.58 (4.1)	58.40 (0.7)	166.09 (1.8)	1344.55 (7.1)	471.95 (-0.6)	171.79 (-0.6)	82.75 (-0.5)
UK	50.63	87.25 (0.7)	247.90 (1.8)	497.06 (1.0)	250.48 (-0.5)	189.10 (-0.2)	363.73 (0.9)	237.46 (-0.3)	410.11 (0.7)	279.57 (-0.3)
USA	29.19	115.02 (2.9)	463.48 (3.0)	373.11 (-0.2)	758.48 (1.0)	974.25 (0.3)	2893.36 (1.9)	1474.48 (-0.5)	1875.29 (0.3)	1568.46 (-0.2)
France	6.46	26.72 (3.1)	32.32 (0.2)	29.18 (-0.1)	269.48 (8.2)	100.66 (-0.6)	122.95 (0.2)	170.77 (0.4)	271.81 (0.6)	328.19 (0.2)
Malaysia	0.00	0.00	0.63	9.41 (14.0)	23.57 (1.5)	12.58 (-0.5)	56.17 (3.4)	40.78 (-0.2)	20.44 (-0.5)	49.09 (1.4)

Source: *SIA Newsletters* various issues.

Note: Figures in the parentheses show the annual growth rates.

companies have routed their investment through Mauritius. Firstly, since the US companies like to invest somewhere, they have positioned their funds in Mauritius. Secondly, the tax treaty between Mauritius and India stipulates a dividend tax of five per cent, while the treaty between Indian and the US stipulated a dividend tax of 15 per cent (World Investment Report, 1999). It is also important to note that the growth rate of the FDI inflows of the other major country is declining (Table 3).

The analysis of sector-wise FDI inflows shows that transport, electrical, service telecommunication, chemicals, and fuel and power sector attracted more FDI, which together accounted for more than 50 per cent of total FDI inflows in the post reform period (Figure 3). Among these core sectors, chemicals (other than fertilizers) accounted for 19 per cent followed by the transport and electrical sectors with 9 per cent and 8 per cent, and the telecommunication sector with 7 per cent of total investment. It is important to note that though the food-processing sector attracted less FDI inflows; it recorded a significant share in attracting total FDI inflows to India. However, the growth rate of the FDI inflows to different sectors is not so much appreciating baring the food-processing sector (Table 4). The growing importance of the food-processing sector could be attributed to the agrarian nature of the Indian economy.

Figure 3: Sector wise FDI Stocks

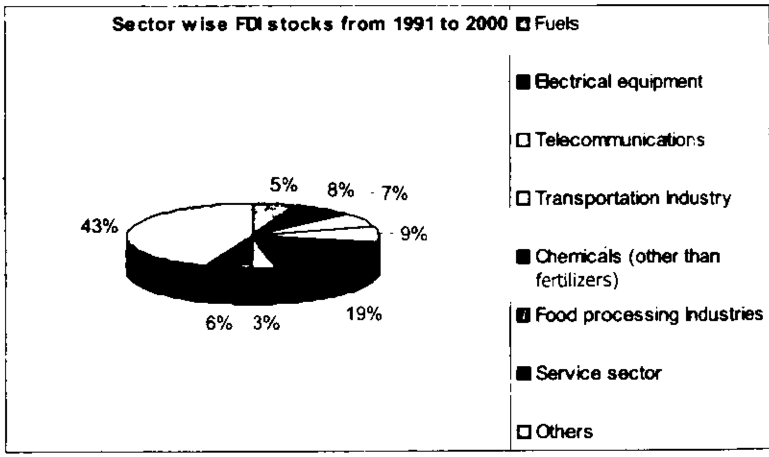

Table 4: Sectorwise FDI inflows from 1991 to 2000

(Rs in Crores)

Sector	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fuels	2.6	9.0 (-2.4)	70.4 (6.9)	79.8 (0.1)	325.8 (3.1)	1085.3 (2.3)	979.8 (-0.1)	451.7 (-0.5)	835.9 (0.9)	392.8 (-0.5)
Electrical equipment	20.5	126.0 (5.2)	213.4 (0.7)	295.1 (0.4)	622.9 (1.1)	771.0 (0.2)	1271.9 (0.6)	908.7 (-0.3)	531.5 (-0.4)	1363.7 (1.6)
Telecom	NA	1.0	0.7 (-0.2)	27.1 (36.6)	289.9 (9.7)	658.6 (1.3)	1737.0 (1.6)	1149.2 (-0.3)	184.8 (-0.8)	1126.9 (5.1)
Transport	6.1	115.7 (17.9)	72.5 (0.4)	115.8 (0.6)	432.4 (2.7)	457.4 (0.1)	1795.2 (2.9)	1702.9 (-0.1)	1141.8 (-0.3)	864.8 (-0.2)
Chemicals (other than fertilizers)	46.4	159.9 (2.4)	188.5 (0.2)	411.5 (1.2)	326.1 (-0.2)	750.4 (1.3)	807.9 (0.1)	1100.8 (0.4)	247.0 (-0.8)	497.5 (1.0)
Food processing	2.1	82.2 (37.8)	141.3 (0.7)	199.6 (0.4)	285.2 (0.4)	832.3 (1.9)	342.1 (-0.6)	94.8 (-0.7)	444.1 (3.7)	188.1 (-0.6)
Service sector	4.8	11.5 (1.4)	137.0 (11.0)	423.9 (2.1)	1008.2 (1.4)	852.8 (-0.2)	588.0 (-0.3)	849.1 (0.4)	250.0 (-0.7)	293.9 (0.2)

Source: SIA Newsletters various issues.

Note: Figures in the parentheses show the annual growth rates.

FDI and Growth: A Review of the Theories

In order to support the results of empirical analysis of this paper, it is necessary to review the existing theories of investment and growth and relate to FDI inflows and its impact in the economy. This has been explained through three main models: the Harrod and Domar, Neo-classical and endogenous growth models. Indeed, the theoretical rationale of the FDI flows and growth are based on these growth models. The pioneering growth models such as Harrod (1939) and Domar (1946) looked at capital formation for their explanation of rising standards of living, resulting in the growth of economy. The Harrod-Domar model basically compared the natural and warranted rates in growth. It emphasis that natural growth as a result of increase in labour force with the absence of technological change compared to the warranted rate of growth depends on the saving and investing habits of households and firms. Thus, the Harrod-Domar Model studies long-run problems of the economy by using the short-run tools. However, this model was criticized by the neo-classical economist Solow (1956) for the assumption of fixed proportions of production, with a contention that there is no possibility of substituting labour for capital in production. Solow (1956) argued that the capital deepening could cause labour productivity to rise in a dynamic process of investment and growth. Solow also accepts the assumptions of the Harrod-Domar model of long-run growth without any fixed proportions. Solow considers an economy that combines capital and labour to produce a single homogenous commodity through savings, which are proportional to income and labour productivity and results in growth as an exogenous rate. In this context, knowledge has been considered as an important input in the production process, which has not been considered in the Solow Model. It is also imperative to note that knowledge might accumulate firms to engage in new activities (Arrow, 1962). The state of knowledge is the cumulative amount of investment at a particular time that had taken place somewhere in the economy. Indeed, knowledge contributes to the productivity of resources in subsequent manufacturing activities as firms generate additional knowledge in the course of manufacturing capital goods and thus cannot prevent this knowledge from flowing into the public domain.

In the later stage, Romer (1986), Lucas (1988) and Rebelo (1991) developed the endogenous growth model. The main assumption in these models was that capital was considered as knowledge rather than just plant and equipment, as it creates research and development processes that use the same inputs and same proportions as the production of tangible commodities. In fact, the resource productivity varies positively with the stock of public knowledge through the investments of the firm in terms of additional knowledge. It implies that technological progress is not only an accidental consequence of the firm's private investment decision but also considered as an endogenous factor in determining the capital formation of the country. However, the different strands of this literature used different mechanisms in order to explain the sustainable growth. In this context, most of the models introduced some type of capital whose accumulation is not subject to the assumption of diminishing returns. Few broaden the definition of capital to include human capital accumulation (Lucas, 1988; Rebelo, 1991; and Stokey, 1991) and others incorporate the accumulation of knowledge, either through learning by doing (Romer, 1986) or through research and development (Romer, 1990; Grossman and Helphman, 1991; Aghion and Howit, 1992). However, the recent models used population growth as an endogenous variable by incorporating the fertility choice in the neoclassical model. The new research also includes models of diffusion of technology by economists like Kremer (1996), Berthelemy and Varondakis (1996) and Li (1996).

To sum up, all these theories demonstrate that simple change to the production function or the definition of capital (like human capital or knowledge) could drastically alter the predictions about the relationship between investment and economic growth. It implies that policy changes towards FDI inflows could offer a change in the economic growth of the concerned economy. In fact, if the assumption of knowledge has spillover effects or results in learning by doing, then investment in capital could itself result in new technology and knowledge. With the capital exhibiting such increasing returns to scale, changes in the investment rate could have long-run implications for economic growth.

FDI and Growth: A Review of Empirical Literature

This section reviews the empirical studies on the relation between FDI and economic growth, which could facilitate in identifying the issues related to the impact of FDI on economic growth. In the empirical literature, few studies had shown that FDI has a negative impact on the growth of the developing countries (Singer 1950; Griffin 1970; Weissskopf 1972). The main argument of these studies was that FDI flows to Less Developing Countries (LDCs) were mainly directed towards the primary sector, which basically promoted the low market value of this sector. Since these primary products are exported to the developed countries and are processed for import, the primary sector receives a lower price for its primary product. It could create a base for the negative impact of FDI flows in the economy. On the other hand, Rodan (1961), Chenery and Strout (1966) in the early 1960s argued that foreign capital inflows have a favorable effect on the economic efficiency and growth towards developing countries. It was explained that FDI could have a favorable short-term effect on growth as it expands the economic activity. However, in the long run it reduces the growth rate due to dependency, particularly due to 'decapitalization' (Bornschler, 1980). This is due to the reason that foreign investors repatriate their investment by contracting the economic activities in the long run. The studies that used the endogenous growth theory challenged this view in explaining the long run growth rate of the economy by using endogenous variables like technology and human capital (Barro and Martin, 1995; Helpman and Grossman, 1991). FDI is an important vehicle for the transfer of technology and knowledge and demonstrates that it can have a long run effect on growtn by generating increasing return in production via positive externalities and productive spillovers. Thus, FDI can lead to a higher growth by incorporating new inputs and techniques (Feenstra and Markusen, 1994).

A recent study by Kasibhatla and Sawhney (1996) in the US supports a unidirectional causality from GDP to FDI and not the reverse causation. This may be due to the fact that for a developed country, FDI follows GDP, as GDP is an indicator of the market size. Aitken, et al., (1997) showed the external effect of FDI on export with the example of Bangladesh, where the entry of a single Korean Multinational in garment exports led to the establishment of a number of domestic export firms, creating the country's largest export industry. The recent study by Chen, Chang and Zhang (1995), using time series data for the period of 1979-93, estimated the regression between GNP, domestic saving in one period lag, and FDI in one period lag (all in logarithmic value). The results of the study show that there is a positive relationship between FDI and GNP and it is significant at 5 per cent level for the Chinese economy. Hu and Khan (1997) attribute the spectacular growth rate of Chinese economy during 1952 to 1994 to productivity gains largely due to market oriented reforms, especially expansion of the non-state sector, as well as China's 'open-door' policy, which brought about a dramatic expansion in foreign trade and FDI. Study by Sahoo et al., (2002) also supports the long-run relationship between FDI and GDP in the Chinese economy. Further, Basir (1999) examined the relationship between FDI and growth empirically in some MENA countries, using panel data. The study found that FDI leads to economic growth; the effect however varies across regions and over time. Xu (2000) has investigated the US MNEs as a channel of international technology diffusion in 40 countries from 1966 to1994, using panel data. This study found a strong evidence of technology diffusion from US MNEs affiliated in developed countries (DCs) but weak evidence of such diffusion in the less developed countries (LDCs). The result for the DCs indicates that US MNEs are almost as important as international trade for technology spillover. Nearly 40 per cent of the total factor productivity (TFP) of DCs is attributable to technology transfer of US affiliates. Further, the study also found that the level of human capital is crucial for a country to benefit from technology spillovers of MNEs. A country needs to achieve a human capital threshold of about 1.9 years (in terms of male secondary school attainment) to benefit from the technology transfer by the MNEs. The results are consistent with the findings of a single country study that the technology spillover effects of

MNEs are positive in advanced countries but are insignificant in less developed countries.

The studies on FDI and economic growth in India are very limited. The only study by Dua and Rasid (1998) demonstrates that there is no significant growth rate supported by FDI for the post reform period in India. Further, this study also explains that Indian economy does not support a unidirectional causality from FDI to Index of Industrial Production (IIP), where IIP is taken as the proxy for GDP. In fact, this study used the monthly data for IIP and GDP, which may include the seasonal component in its variation. There is a need to de-seasonalise the data and use the recent methodology in order to validate the results of this study.

The above discussion raises the question whether FDI should be encouraged in the developing economies, particularly an economy like the Indian economy, which is intending for further liberalization of some sectors. It is also imperative to note that very few studies have been undertaken for the Indian economy in order to examine FDI as an important vehicle of growth. However, most of the existing international studies and Indian studies were undertaken without checking the time series properties of data, which raise the doubt about the inferences of these studies. Since FDI is the major factor in liberalization and globalization policies, the present study is an endeavor to examine the impact of FDI on the growth rate in India, by using the precise techniques in order to validate the results of the analysis, as India proposes to further open up her economy.

Analytical Framework

The growth theories demonstrate that changes to the production function with the human capital or knowledge could alter the long-run relationship between production and capital. This may exhibit increasing returns to capital by increasing the productivity of capital. Thus, a higher growth rate to the economy could be achieved. Accordingly, this paper assumes that FDI inflows into India (which is a form of long-term capital inflow) could raise the productivity in India through the transfer of technology and knowledge. This in turn will result in a higher growth rate of the economy by increasing the returns to the capital. It is also argued in the spirit of the export-led growth that an increase in the export (EX) of an economy leads to the overall growth of the economy. Therefore, it is assumed that there is a long-run relationship among GDP, FDI inflows and EX. In order to test this linkage, the paper uses the Johansen's cointegration method. The economic interpretation of cointegration is that if two or more series can be linked to form an equilibrium linear long-run relationship spanning over a period of time, then the given series will nevertheless move closer together over time, irrespective of the given series themselves may containing stochastic trends. The difference between the given series will be stable (i.e., stationary). It means that there exists a meaningful long-run relationship between the given series. The Engle and Granger (1987) approach for testing the cointegration may analyze the long-run relationship of the given series. However, the Engle-Granger test may not be used as it does not have a systematic analysis for the separate estimation of the multiple co-integrating vectors: it may be possible to have more than one integrating vectors in tests using three or more variables. Therefore, in order to estimate the possible presence of multiple co-integrating vectors among the two sets of variables GDP, FDI, and EX and IIP, FDI, and EX, the Johansen co-integration technique is used. For a long run relationship, the co-integration technique assumes that the data series must be integrated of the same order. If the series are all integrated of order d, I(d), and a vector β can exist whereby the series will be linearly combined to produce residuals integrated of order zero I(0), i.e., residuals that are stationary, then there exists a long-run relationship among the variables. This long-run relationship could be stated as follows:

$$\beta_1 \chi_{1t} + \beta_2 \chi_{2t} + \beta_3 \chi_{3t} = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots [1]$$

Where, x_{1t}, x_{2t} and x_{3t} stand for FDI, GDP and EX and FDI, IIP and EX respectively in time period t.

In order to find out the growth of the Indian economy as a consequence of the increased FDI inflows into the economy, this paper uses the quarterly time series data for FDI and GDP from 1991 to 2000. A recent study relating to the Indian economy has used IIP as a proxy for GDP (Dua and Rasid 1998). In this context, it is argued that most of the FDI inflows into India are directed towards the industrial sector, which is expected to affect the industrial production more than the aggregate economy as a whole. Thus, IIP could be used as a proxy for GDP. However, estimates of the industrial sector suggest that industrial production contributes only less than a quarter of the GDP (RBI, 2001). It implies that IIP as a proxy for GDP underestimates the overall growth of the economy. Nevertheless, in order to check the comparative contribution of FDI on IIP and GDP, the paper uses another set of variables as FDI, IIP and EX along with GDP, FDI and EX. It is important to note that the quarterly data for GDP in India is not available from 1990-91 to 2000-01. In order to convert the annual frequency GDP data into the quarterly frequency, the cubic spline[1] technique is used in literature (Kumar et al., 2002). It adopts the same methodology for getting the quarterly frequency of the GDP data. The choice of the period of study is 1990-91 to 1999-2000, which is also due to the opening up of the Indian economy in 1991 and as a consequence India became lucrative for most of the international investors.

It is necessary to deseasonalise the series before using the co-integration technique to establish the long run relationship among the variables. Indeed, the series used in the analysis are of quarterly frequencies and it is reasonable to expect the presence of the seasonal component in them. It is also important to check the stationarity properties of these variables in order to establish a reliable long run relationship through co-integration. In this context, the simple OLS procedure has been used to check the threshold level of DW statistic. The equation for OLS regression is:

$$GDP_t = \alpha + \beta_1 FDI_t + \beta_2 EX_t + \beta_3 T + \mu_t. \quad .... [2a]$$

Further the same equation (2a) has been estimated by taking the logarithmic of the variables, which may be written as:

$$LGDP_t = \alpha + \beta_1 LFDI_t + \beta_2 LEX_t + \beta_3 T + \nu_t. \quad .... [2b]$$

Where 'L' represents values in the logarithmic form. The variable 'T' in both the equations represents time. This variable is introduced in the regression equations in order to eliminate the impact of time on the dependent variables. However the Sargan's criteria is used to choose between the alternative equations of 2a and 2b. The Sargan's criteria is:

$$S = \left\{ \overset{*}{\delta}_\mu \, / \, g \overset{*}{\delta}_\mu \right\}^T$$

Where 'g' is the geometric mean of the dependent variable of equation 2b; when S<1, the linear form should be preferred and when S>1, the log linear form is preferred.

Results and Discussion

The Johnson co-integration method has been used in order to examine the long-run relationship among the variables for the FDI function specified in equation 1. All the variables namely, GDP, FDI, EX and IIP are deseasonalised before they are used for analysis. In order to validate the threshold level of the DW statistic for co-integration test, the OLS method has been used. The Sargan's criteria shows that the value of S is $(393164)^{40}$ and this S value is greater than 1. Thus, the OLS regression of equation 2b is used and the results are given in Tables 5 and 6. Since the series are in logarithmic values, the coefficients of the independent variables could be interpreted in elasticity. The results show that there is negative relationship between LFDI and LGDP and it is significant at 5 per cent level (Table 5). The same negative significant relation is also found between LFDI and LIIP (Table 6). However, the coefficient of the other variable LEX has turned to be positive and significant in both cases. The results show a good statistical fit as reflected by high-adjusted R^2, but the low value of DW statistics shows that the relationship between LFDI, LGDP and LFDI, LIIP may be spurious due to the possibility of the presence of autocorrelation. It also reflects a non-stationary nature of the data, which needs to be made stationary for validation of the results. However, the results (Tables 5 and 6) of the variables at the level demonstrate that the DW value exceeds the critical value of 0.511 (at 1 per cent level) as tabulated by Engle and Granger (1987). It implies that the presence of long run relationship among variables could be estimated through the co-integration method.

Table 5: Regression Results of Equation 2b with Dependent variable as LGDP

Variable	Coefficient	Standard Error	T- Ratio
CON	6.79	1.32	5.14*
LFDI	-.07	.022	-3.2**
LEX	.71	.16	4.34 *
TIME	.006	.003	1.85***
R^2 = 0 .874 DW Statistic = 0.604			

Note: * Significant at 1 per cent level
** Significant at 5 per cent level
*** Significant at 10 per cent level

Table 6: Regression Results when LGDP is replaced with LIIP in Equation 2b

Variable	Coefficient	Standard Error	T- Ratio
CON	1.12	.21	5.38*
LFDI	-.021	.007	-2.9**
LEX	.236	.058	4.01*
TIME	.004	.005	8.64*
R^2 = 0 .969 DW Statistic = 0.839			

Note: * Significant at 1 per cent level
** Significant at 5 per cent level

The results of the stationarity test by using Augmented Dickey-Fuller (ADF) unit root test and the Phillips-Perron (PP) unit root test are presented in Table 7. The results of these tests reveal that they are stationary at first difference. The null hypothesis of the unit root is rejected for all variables in their first difference for the ADF test, which hence concluded that all variables are integrated of order 1, that is, I (1). Indeed, the results are also consistent with the PP test, where it has not rejected the null hypothesis and shown as stationary.

After confirming the order of integration of each variable, the Johansen maximum likelihood co-integration test for LGDP, LFDI and LEX has been estimated and reported in Table 8. The results show that since 62.86 exceeds the 95 per cent critical value of the λ_{trace} statistic (critical value is 39.33), it is possible to reject the null hypothesis of no co-integrating vectors and accept the alternative of one or more co-integrating vectors. Further, it could use the λ_{trace} (1) statistic to test the null of $r \leq 1$ against the alternative of two or three co-integrating vectors. The results show that the λ_{trace} (1) statistic of 30.36 is greater than the 95 per cent critical value and λ_{trace} (2) statistic of 9.91 is less than the 95 per cent and 90 per cent critical values. Thus, it concludes that there are two co-integrating vectors.

Table 7: PP and KPSS Unit Root Tests of the variables (LFDI, LEX, LIIP & LGDP)

Variable	ADF Statistic		PP Statistic	
	Level	First difference	Level	First difference
LFDI	-1.63	-4 82*	-1.69	-6.83*
LEX	-1.70	-5.04*	-2.03	-7.81*
LIIP	-2.92	-6.19*	-3.40	-10.82*
LGDP	-3.28	-4.30*	-2.33	-4.88*

Note: * Significant at 1 per cent level.

Table 8: Johansen Co-integration Test among LFDI, LEX and LGDP

Null hypothesis	Alternative hypothesis		95 % critical value	90 % critical value
λ_{trace} test		λ_{trace} values		
R=0	r>0	62.86	39.33	36.28
R≤1	r>1	30.36	23.83	21.23
R≤2	r>2	9.91	11.54	9.75
λ_{max} test		λ_{max} value		
R=0	r=1	32.49	24.35	22.26
R=1	r=2	20.45	18.33	16.28
R=2	r=3	9091	11.54	9.75

Note: r refers to number of co-integrating vectors.

On the other hand, if it uses the λ_{max} results, the null hypothesis of no co-integrating vectors (r = 0) against the specific alternative r = 1 is also clearly rejected as the calculated value λ_{max} (0,1) = 32.49 exceeds the 95 per cent and 90 per cent critical values. Thus, it rejects the null hypothesis of no co-integration. In order to test r = 1 against the alternative of r = 2, the calculated value of λ_{max} (1, 2) is 20.45 whereas the critical values at the 95 per cent significance level is 18.33, which thus conclude the presence of two co-integrating vectors. The presence of the co-integrating vectors shows that there exists a long run relationship between the variables concerned. Since results confirm that there are two co-integrating vectors, the two normalized co-integrating vectors β's and the associated speed of adjustment vector α are displayed in Table 9 and the long run equilibrium relationship is established in the following way:

$$\beta_1 \ - GDP_t \ - .05FDI_t + .59EX_t = 0 \ \ldots\ldots\ldots\ldots \ (i)$$

$$\beta_2 \ - GDP_t \ - .61FDI + 3.99EX_t = 0 \ \ldots\ldots\ldots\ldots \ (ii)$$

Table 9: Beta and Alpha vectors for LFDI, LEX and LGDP

β1	α1	β2	α2
-1.00	-4.71	-1.00	0.83
-0.05	-0.26	-0.61	0.50
0.59	2.80	3.99	-3.32

Note: Beta is the single normalized co-integrating vector.
Alpha is the associated speed of adjustment vector.

The values of α are such that the coefficients on the error correction term in the dLGDP, dLFDI, and dLEX equations are -4.71, -0.26, and 2.80 for the first vector and 0.83, 0.50 and -3.32 for the second vector respectively. However, the Johansen co-integration confirms only one co-integrating vector among IIP, FDI and EX (Table 10).

Table 10: Johansen Co-integration Test among LFDI, LEX and LIIP

Null hypothesis	Alternative hypothesis		95 % critical value	90 % critical value
λ_{trace} test		λ_{trace} values		
R=0	r>0	66.82	39.33	36.28
R≤1	r>1	17.70	23.83	21.23
R≤2	r>2	5.20	11.54	9.75
λ_{max} test		λ_{max} value		
R=0	r=1	49.12	24.35	22.26
R=1	r=2	12.50	18.33	16.28
R=2	r=3	5.20	11.54	9.75

Note: r refers to number of co-integrating vectors.

Table 11: Beta and Alpha vectors for LFDI, LEX and LIIP

Beta	Alpha
1.000	-0.261
-.356	.18
21.24	104.7

Note: Beta is the single normalized co-integrating vector.
Alpha is the associated speed of adjustment vector.

The single normalized co-integrating vector β and the associated speed of adjustment vector α are presented in Table 11. Thus, the results of the co-integration indicate that there is a long run relationship between the variables such as GDP, FDI and Export (EX) and the variables such as IIP, FDI and EX. It implies that FDI does not matter in the growth of the economy but it contributes significantly to the export in India. It could be observed from the co-integration analysis that the variables are co-integrated and the OLS estimation shows that FDI has a significant negative impact on both GDP and IIP. It implies that India's progress towards 'market oriented economy' through major policy reforms in 1991, laying greater emphasis on individual incentives and market forces, has not worked properly. In fact, the higher growth rate of the FDI in the Indian economy has resulted in a change in the export of the economy, which has increased steadily after the reform period. The gradual increase in the exports of the economy indicates that FDI is playing a major role in improving the Balance of Payments (BOP) of the Indian economy. Further, the increase in exports and the percentage of export to GDP (Table 2) may also be attributed to the increase in export oriented FDI inflows into India. In the long run, the growth of the export sector will lead to the overall growth of the economy as evidenced from the co-integration results (Tables 9 and 11). Further, an increase in the export will help in financing the deficits in the BOP of the economy, which in the long run will improve. In this context, it could be suggested that India should encourage the FDI inflows for significant growth of the export sector. However, FDI as an aggregate entity has not only got a negative impact on the GDP but also on the IIP of the economy. Thus, there is a need to cautiously step towards FDI policy in order to further open up the economy in the part of Indian reform process. This is because the growth of the economy is positively influenced by the export but not by the aggregate FDI inflows. In this context, it would be wise to give a boost to the export sector by inviting FDI into it. This may help the economy to achieve higher growth in the long run by expanding its export sector. Thus, it is advisable to open up the export oriented sectors so that a higher growth of the economy could be achieved through the growth of these exports-oriented sectors.

Note

1 In spline interpolation, an interval [a, b] is partitioned into n smaller intervals $[x_{i-1}, x_i]$ by n+1 interpolation nodes x_i, i=0: n. Here we let the index start with 0. A spline s(x) of degree d is a piece-wise polynomial in C^{d-1}. Thus, a cubic spline which slice an interval into four parts will be a piece-wise polynomial in the translated form:

$$P_j(\chi) = \alpha_j \; \beta_j \; (\chi - \chi_j) + \gamma_j (\chi - \chi_j)^2 + \delta_j \; (\chi - \chi_j)3$$

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