RESULTS & DISCUSSION

CHAPTER – IV

RESULTS AND DISCUSSION

The results and discussion for the study "Impact of Vertical FDI Spillovers on the Productivity and Export Performance of Indian Manufacturing Firms" are summarised under the following headings.

4.1 Trends in FDI inflows in India

4.2 FDI and Economic Growth

4.3 Determinants of FDI in India

4.4 Vertical FDI Spillovers

4.5 Export Spillovers

4.1 Trends in FDI Inflows in India

FDI plays an important role in the long-term development of a country not only as a source of capital but by enhancing competitiveness of the domestic economy through transfer of technology and innovative ideas, strengthening infrastructure, raising productivity and generating new employment opportunities, improving country's trade balances, improving labour standards and skills and the general business climate. In India, FDI is considered as a developmental tool, which can help in achieving self-reliance in all the sectors of the economy (Narang and Singh, 2008). Capital penetration in India started with the establishment of Portuguese factory in the year 1500 at Calicut, followed by the British East India Company in 1599, Dutch East India Company in 1602 and French companies in 1614. After independence, compared to most industrialising economies, India followed a fairly restrictive foreign investment policy until 1991, when India changed tracks in 1990s and embarked on a broader process of reforms designed to increase her integration with the global economy. The New Economic Policy marked a major departure with respect to FDI with the abolition of industrial licensing system except where it was required for strategic or environmental grounds (Satyanarayan et.al., 2011). India has had a turbulent past and a long period of economic isolation but in the past twenty years it has experienced mass liberalisation, making it a stronger player in the global market (Baskaran and Chaarlas, 2010).

A number of studies in the recent past have highlighted the growing attractiveness of India as an investment destination (Nagaraj, 2003; Narang and Singh, 2008; Sidhu and Kaur, 2005; Baskaran and Chaarlas, 2010; Satyanarayan et.al., 2011; Barthwal and Yadav, 2009; Rizwanullah and Mangalani, 2009; and Ganpathi et.al., 2010). In this section an attempt was made to analyse the trends in FDI inflows in India in the post reform period ie., during 1990-91 to 2012-2013.

Table 4.1.1 shows the annual rate of FDI inflows and compound annual growth rate (CAGR) for the first decade (1991-2000) of economic reforms.

TABLE – 4.1.1

FDI INFLOWS IN INDIA (1991-2000)

Year	FDI Inflows (US$ Million)	Annual Rate of FDI Inflows (%)
1991	97	-
1992	129	32.99
1993	315	144.19
1994	586	86.03
1995	1314	124.23
1996	2144	63.17
1997	2821	31.58
1998	3557	26.09
1999	2462	-30.78
2000	2155	-12.47
CAGR (p.a)		**36.35%**

Source: Compiled from various issues of SIA Newsletters, published by the Department of Industrial Policy & Promotion, Government of India, Ministry of Commerce & Industry

From the table 4.1.1 it was evident that India attracted the highest FDI inflows during the period 1992-1993 at US $ 315 millions (144.19 per cent) and the next highest FDI inflows in India was recorded in the year 1994-1995 at US $ 1314 millions (124.23 per cent). This increase may be due opening up of automatic route (Narang and Singh, 2008). Also 100 per cent FDI has been allowed in a number of industries. In 1991 automatic approval of up to 51 per cent of foreign ownership was introduced in 34 priority sectors, mostly manufacturing industries and a few services sectors. In 1992-1993 Indian mining sector was opened to FDI and permission was granted to foreign investors and non-resident Indian (NRI) investors to repatriate their profits and capital. From 1994-95 to 1997-98 the FDI inflows showed a decreasing trend as indicated by the annual rate of FDI inflows. The reason behind this decrease was found to be the prohibition of FDI in certain sensitive sectors such as agriculture, retail trading, railways and real estate. Towards the end of the first decade of opening up of the Indian economy there was a negative annual rate of FDI inflows for the period 1998-99 and 1999-00 (-30.78 per cent and -12.47 per cent respectively). Similar finding was reported by Narang and Singh (2008). The most favourable years during the first decade of opening up were 1992-93 and 1994-95 recording highest FDI inflows. The compound annual growth rate for the decade 1990-91 to 1999-00 was 36.35 per cent. The positive growth rate in the first half of the reform period was substantiated by various studies (Choe, 2003; Balamurali and Bogahawatte, 2004; Wang, 2009; Abbas et.al., 2011; and Dash and Sharma, 2007).

Table 4.1.2 shows the annual rate of FDI inflows and the compound annual growth rate for the study period i.e., 2000-01 to 2012-13.

TABLE – 4.1.2

FDI INFLOWS IN INDIA (2001-2013)

Year	FDI Inflows (US$ Million)	Annual Rate of FDI Inflows (%)
2001	4029	86.96
2002	6130	52.15
2003	5035	-17.86
2004	4322	-14.16
2005	6051	40.00
2006	8961	48.09
2007	22826	154.73
2008	34843	52.65
2009	41873	20.18
2010	37745	-9.86
2011	34847	-7.68
2012	46556	33.60
2013	36860	-20.83
CAGR (p.a)		**18.56%**

Source: Compiled from various issues of SIA Newsletters, published by the Department of Industrial Policy & Promotion, Government of India, Ministry of Commerce & Industry

From the table 4.1.2 it is obvious that the FDI inflows were maximum during 2006-07 with US$ 22826 (154.73 per cent). The reason for this was that in March 2005, the government announced a revised FDI policy, an important element of which was the decision to allow FDI up to 100 per cent foreign equity ownership under the automatic route in townships, housing, built-up infrastructure and construction-development projects. The year 2005 also witnessed the enactment of the Special Economic Zones Act, which entailed a lot of construction and township development that came into force in February 2006. The next highest growth rate for the study period was during 2000-01 with US$ 4029 (86.96 per cent) FDI flowing into the country. Though the year 2006-07 witnessed the highest rate of FDI inflows, from the very next year ie., from 2007-08 FDI inflows into India fell steeply and the annual rate of FDI inflows became negative since 2009-10 till the end of the study period i.e., 2012-13 except during 2011-12. This may be attributed to the well known global meltdown or the global recession which affected the FDI inflows into India. In 2008 and early 2009, global FDI flows declined following a period of uninterrupted growth from 2003 to 2007. Shrinking corporate profits and plummeting stock prices greatly diminished the value of, and scope for, cross border Mergers and Acquisitions (M&A's), the main mode of FDI entry in developed countries, and increasingly in developing countries as well. Falling demand for goods and services caused companies to cut back their investment plans in general, including abroad, whether through cross-border M&A or Greenfield projects. The latter mode of investment began falling only in 2009. The RBI recorded an "almost 36 per cent" dip in inward FDI during April and September 2010. It was not a global phenomenon but was borne out of the fact that FDI inflow into other emerging economies during this period was up in the range of 6-53 per cent. FDI flows to major EMEs like China, Brazil, Mexico and Thailand recorded increases in the range of 6 to 53 per cent in 2010. Indonesia recorded about a three-fold rise in FDI inflows (Satyanarayan et.al., 2011). Thus, it was apparent that after the global financial crisis India failed to attract substantial FDI into the country. This may be due to the lacunae in the governmental policy reforms in attracting the foreign investors. The compound annual growth rate for the study period (2000-01 to 2012-13) was 18.56 per cent. This is just a half of the CAGR calculated for the period 1990-91 to 1999-00. To sum up during the study period i.e., 2000-01 to 2012-13 FDI inflows into India went down steeply.

Table 4.1.3 shows the trends in FDI inflows in India since globalisation i.e., for the period 1990-91 to 2012-13.

TABLE – 4.1.3

FDI INFLOWS IN INDIA (1991-2013)

Year	FDI Inflows (US$ Million)	Growth Rate of FDI Inflows (%)
1991	97	-
1992	129	32.99
1993	315	144.19
1994	586	86.03
1995	1314	124.23
1996	2144	63.17
1997	2821	31.58
1998	3557	26.09
1999	2462	-30.78
2000	2155	-12.47
2001	4029	86.96
2002	6130	52.15
2003	5035	-17.86
2004	4322	-14.16
2005	6051	40.00
2006	8961	48.09
2007	22826	154.73
2008	34843	52.65
2009	41873	20.18
2010	37745	-9.86
2011	34847	-7.68
2012	46556	33.60
2013	36860	-20.83
CAGR (p.a)		**29.47 %**

Source: Compiled from various issues of SIA Newsletters, published by the Department of Industrial Policy & Promotion, Government of India, Ministry of Commerce & Industry

The annual rate of FDI inflows in the table 4.1.3 revealed that the FDI inflows for the period 2006-2007 were the highest with 154.73 per cent (US$ 22826 millions). The next favourable year for FDI inflows were 1992-93 and 1994-95 with

144.19 per cent and 124.23 per cent respectively. The lowest FDI inflows into India in the post-globalised era was during 1998-99 and 2012-13 with negative annual rate of FDI inflows with -30.78 per cent and -20.83 per cent respectively. In the recent past, various economists, policymakers, academicians and corporate researchers suggested that India's regulatory policies in terms of procedural delays, complex rules and regulations related to land acquisition, legal requirements and environmental obligations played a role in holding the investors back from investing in India. The uncertainty created by the actions taken by policymakers led to unfriendly business environment in India. The compound annual growth rate of FDI inflows in the post-globalised era was 29.47 per cent.

Table 4.1.4 shows the sectors attracting highest FDI inflows during the period April 2000 and January 2014.

TABLE – 4.1.4

SECTOR-WISE DISTRIBUTION OF FDI INFLOWS

(APRIL 2000 TO JANUARY 2014)

Ranks	Sector	Cumulative FDI Inflows (US $ Million)	Percentage to Total Inflows (%)
1	Services sector	39039	18
2	Construction Development: Townships, Housing, Built-Up Infrastructure	23047	11
3	Telecommunications	13028	6
4	Computer Software & Hardware	13028	6
5	Drugs & Pharmaceuticals	12711	5
6	Chemicals (Other than fertilizers)	9376	4
7	Automobile industry	9344	4
8	Power	8538	4
9	Metallurgical industries	7939	4
10	Hotel & tourism	7013	3

Source: Factsheet on Foreign Direct Investment (January 2014), FDI Statistics, Department of Industrial Policy & Promotion, Ministry of Commerce & Industry, Government of India.

The table 4.1.4 shows that the services sector attracted highest FDI inflows (18 per cent) than any other sector, followed by construction (11 per cent), telecommunications and computer software and hardware (each six per cent). India's growth has been basically services-led growth, pulling up overall growth of the economy. The lowest share of FDI inflows was attracted by the hotel and tourism sector attracting about three per cent of the overall FDI inflows. Tourism is a big-ticket item which can, not only lead to higher growth but also more inclusive growth. With world tourist arrivals expected to increase by 43 million every year on an average from 2010 to 2030, a goldmine of opportunity in tourism is waiting for India which at present has a paltry share of 0.64 per cent in world tourist arrivals.

Table 4.1.5 shows the share of top investing countries in FDI inflows in India from April 2000 to January 2014.

TABLE – 4.1.5

COUNTRY-WISE DISTRIBUTION OF FDI

(APRIL 2000 TO JANUARY 2014)

Ranks	Country	Cumulative FDI Inflows (US $ Million)	Percentage to Total Inflows (%)
1	Mauritius	77779	37
2	Singapore	23139	11
3	U.K.	20735	10
4	Japan	15559	7
5	U.S.A	11842	6
6	Netherlands	10665	5
7	Cyprus	7353	3
8	Germany	6330	3
9	France	3861	2
10	U.A.E.	2652	1
Total FDI Inflows from All Countries		**212152**	**-**

Source: Factsheet on Foreign Direct Investment (January 2014), FDI Statistics, Department of Industrial Policy & Promotion, Ministry of Commerce & Industry, Government of India.
NA: The amount of FDI inflows includes for Government route (FIPB/SIA), RBIs automatic route and acquisition of shares.

From the table 4.1.5 it is clear that 37 per cent of the total FDI inflows into India were from Mauritius, 11 per cent from Singapore and 10 per cent were from U.K. About two per cent of the FDI inflows into India were from France and only one per cent of the FDI inflows were from U.A.E.

Although India could achieve commendable progress in the area of FDI, there is still a pressing need for continuous improvements in providing a more attractive policy environment to attract foreign investment. Whilst India is said to have one of the most transparent and liberal FDI regimes amongst developing countries, there still exist several hurdles and red tapes which need to be addressed. To attract high level of FDI, a conducive investment environment is the first pre-requisite. Factors that may positively influence an investor's decision include; reliability and stability of investment policies of the destination country, its strategic location, size of local as well regional markets, cost of inputs, abundance of raw materials including primary and intermediary goods, weather and climatic conditions and the cost of skilled labour force (Ghani, 2009).

4.2 FDI and Economic Growth

FDI is widely viewed as an important catalyst for the economic transformation of the transition economies. The most widespread belief among researchers and policy makers is that FDI boosts growth through different channels. It increases the capital stock and employment, stimulates technological change through technological diffusion and generates technological spillovers for local firms. As it eases the transfer of technology, foreign investment is expected to improve the existing stock of knowledge in the recipient economy through labour training, skill acquisition and diffusion. FDI contributes to introduction of new management practices and more efficient organisations of the production processes which, in turn, would improve productivity of host economies and stimulate economic growth (Srinivasan et.al., 2010). The empirical literature supported the modernisation view that FDI can exert a positive impact on economic growth in emerging economies. Studies like Blomstrom et.al., (1992), Borensztein et.al., (1998), Campos and Kinoshita (2002), Marwah and Tavakoli (2004), Lumbila (2005), Aghion et.al., (2006), Lensink and Morrissey (2006), Feridun and Sissoko (2006) and Har Wai Mun et.al., (2008) revealed a positive impact of FDI on GDP growth.

On the other hand, FDI can exert a negative impact on economic growth of the recipient countries. FDI flows may have a negative effect on the growth prospects of a country if they give rise to substantial reverse flows in the form of remittances of profits and dividends and/or if the MNCs obtain substantial tax or other concessions from the host country. These negative effects would further be compounded if the expected positive spillover effects from the transfer of technology are minimised or eliminated altogether if the technology transferred is inappropriate for the host country's factor proportions (ie., too capital intensive) and overly restrictive intellectual property rights and/or prohibitive royalty payments and leasing fees charged by the MNCs for the use of the 'intangibles' which may also be the reason for the minimised benefits from FDI (Ramirez, 2000; Ram and Zhang, 2002). On the other hand, Haddad and Harrison (1993) and Mansfield and Romeo (1980) found no positive effect of FDI on the rate of economic growth in developing countries. Bacha (1974) revealed a negative relationship between FDI and host country's growth. Saltz (1992) indicated a negative correlation between FDI and growth. Early studies on FDI, such as Singer (1950), Prebisch (1968), Griffin (1970) and Weisskof (1972) supported the traditional view that the target countries of FDI receive very few benefits because most benefits are transferred to multinational companies.

From the above arguments, it appeared that the debate of whether FDI inflows are growth-enhancing or growth-retarding in the emerging economies remains largely an empirical question. Considerable research was conducted on the subject, but still there exists conflicting evidences in the literature regarding the FDI-growth relationship. Hence a study on FDI and economic growth was considered imperative.

Before exploring the relationship between FDI and economic growth, Augmented-Dickey Fuller (ADF) test was to done to confirm the stationarity of the time series variables i.e., lnf (FDI) and lng (GDP). The objective of unit root test was to know the stationarity of time series variables, as it is common for the time series data to demonstrate the signs of non-stationarity; typically both mean and variance of macroeconomic variables tend upwards over time. The study employed the Augmented Dickey Fuller Unit Root Test (Dickey and Fuller, 1979 and 1981; and Dickey et.al., 1986) to investigate the same. The results of the same are shown in Table 4.3.1. The results reflected that both the time series variables lnf and lng were non-stationary in the level form and in the first difference. But the variables were found stationary in the second differences. This implied that they were integrated of order I(2).

Since both the variables were integrated in the same order a possibility of cointegration between these variables existed. The study used the Johansen's cointegration test to test the presence of cointegration between the two time series variables Inf and Ing. The test was meant to know, whether the time series variables have different unit roots (non-cointegrated) or same unit roots (cointegrated). It clarifies the existence of long run equilibrium relationship between two time series variables. In other words, cointegrated variables, if disturbed, will not drift apart from each other and thus, possess a long run equilibrium relationship. Testing of the existence of cointegration among economic variables was widely used in the empirical literature to study economic interrelationships. The presence of cointegration indicates that two series would never drift too apart. A non-stationary variable tends to wander extensively over time, but a pair of non-stationary variables may have the property that a particular linear combination would keep them together, that is they do not drift too far apart. It is to be noted that equations estimated with stationary variables but without regard to the underlying cointegration are also inappropriate due to the model misspecification (i.e., an omitted-variable bias). Theoretically, cointegration between two time series variables can be obtained, if the linear combination of two non-stationary variables is stationary.

The results of the Johansen's cointegration test are given in table 4.2.1.

TABLE – 4.2.1

JOHANSEN'S COINTEGRATION TEST

Vector (r)	Trace Statistics	Max-Eigen Statistics	5% Critical Value for Trace Statistics	5% Critical Value for Max-Eigen Statistics	Remarks
H_0: r=0	23.845**	23.319**	15.494	14.264	Cointegrated
H_1: r≥1	0.526	0.526	3.841	3.841	

NB: **indicates significance at 5 per cent level. The significance of the statistics is based on 5 per cent critical values (p values) obtained from MacKinnon-Haug Michelis (1999). r is the number of cointegrating vectors. H_0 represents the null hypothesis of no cointegrating vector and H_1 represents the alternative hypothesis of presence of cointegrating vector.

Table 4.2.1 shows the Johansen's maximum eigen and trace statistics which indicated that the null hypothesis of no cointegrating vector (r=0) can be rejected at 5 per cent level of significance, and the alternative hypothesis of at most one cointegrating vector (r≥1) can be accepted. Therefore, the results supported the hypothesis of cointegration between FDI and GDP, implying stable long run relationships between the two variables. Similar results were found by Srinivasan et.al., (2010) in the case of five ASEAN countries.

After confirming the existence of single cointegrating vector among FDI and GDP, a search for proper vector error correction model (VECM) was conducted to determine the direction of long run causation. By using the definition of cointegration, the Granger Representation Theorem (Engle and Granger, 1987), stated that if some variables are cointegrated, then there exist valid error correction representations of the data. For the purpose, the VECM was estimated to investigate the causal nexus between FDI and economic growth. The VECM being sensitive to the selection of optimal lag length, the necessary lag length of FDI and GDP series was determined by the Schwarz Information Criterion (SIC).

Since the variables FDI and GDP were cointegrated in the same order, vector error correction model was estimated using model 1 and 2.

$$\Delta \ln FDI_t = c_1 + \sum_{k=1}^{n} \alpha_{1i} \Delta \ln FDI_{t-k} + \sum_{k=1}^{n} \beta_{2i} \Delta \ln GDP_{t-k} + \rho_1 ECT_{t-k} + \varepsilon_{fdit} \quad (1)$$

$$\Delta \ln GDP_t = c_2 + \sum_{k=1}^{n} \beta_{1i} \Delta \ln GDP_{t-k} + \sum_{k=1}^{n} \alpha_{2i} \Delta \ln FDI_{t-k} + \rho_2 ECT_{t-k} + \varepsilon_{gdpit}$$

(2)

where Δ is the first difference operator and ε_{fdit} and ε_{gdpit} are white noise disturbance terms. FDI_t and GDP_t are foreign direct investment and gross domestic product of India at time 't', respectively, and ECT_{t-k} is the lagged error correction term.

The results of VECM are presented in table 4.2.2.

In table 4.2.2, the VECM results shows that the error correction coefficient, ECT_{t-1}, (-0.238) in FDI equation was negative and statistically significant at five per cent level. The results suggested the validity of long run equilibrium relationship among the variables. It also implied that over 23 per cent of disequilibrium from the previous period's shock converges back to the long run equilibrium in the current period. Since the error correction coefficient was significant in the FDI equation it could be confirmed that there exists uni-directional long run causality from GDP to FDI. The results suggested that the enhancement of country's economic growth performance was much needed to attract FDI flows rather than liberalised FDI-oriented policy efforts.

TABLE – 4.2.2

CAUSAL NEXUS BETWEEN FDI AND GDP

Regression Equation	C	Δlnf_{t-1}	Δlnf_{t-2}	Δlng_{t-1}	Δlng_{t-2}	ECT_{t-1}	Inference
∆lnf on ∆lng	0.0004 (0.094) [0.01]	0.228 (0.185) [1.23]	-	4.678 (3.003) [0.01]	-	-0.238** (0.074) [-3.23]	lng→lnf (GDP→FDI)
∆lng on ∆lnf	0.012 (0.006) [1.93]	-0.010 (0.012) [-0.79]	-	0.295 (0.205) [1.44]	-	-0.120 (0.066) [-1.82]	

NB: Optimal lag length is determined by the Schwarz Information Criterion (SIC)

lnf and lng are FDI and GDP respectively

***** denotes the significance at 5 per cent level***

Figures in the parentheses ( ) show the standard error

Figures within square brackets [ ] are z statistics

The results also made it clear that there was no reverse causality (i.e., from FDI to GDP). It was evident from the results that it was economic growth that promotes FDI inflows in the economy and hence, support GDP-driven FDI hypothesis. On the contrary, FDI inflows do not promote economic growth and hence rejected FDI-driven GDP hypothesis. But that does not mean FDI has no contribution to economic growth. FDI may affect economic growth indirectly via productivity spillovers and export spillover effect, which is the main focus of this study. Similar results were found by Pradhan (2008). He tried to explore the promotion of FDI towards economic growth (and vice versa) by investigating two Asian countries namely India and Malaysia and confirmed that it was economic growth that promoted FDI in both the countries. But, FDI does not promote economic growth in the Indian and Malaysian economies and he justified the possible reasons for the same and strongly argued that FDI promotes economic growth indirectly via productivity spillovers and export spillover effects. However, the economic growth of India promotes FDI only in the long run and not in the short run. This was because, all other variables i.e., the differenced and the lagged variables except the error correction term were insignificant. Since these variables showcase the short run causality between variables, their insignificance clearly rejected any short run causality between FDI and GDP.

There are various reasons why FDI does not promote economic growth directly in India. The possible reasons are low inflows of FDI, which is due to high tariff barriers, low openness, slow financial integration, low infrastructure, lack of tax breaks and low benefits from FDI spillovers. The Indian economy has to maintain a steady economic growth to attract FDI inflows in the economy. At the same time, attractive policies has to be designed to bring more FDI inflows in the economy and that has to be channelised efficiently so that FDI inflows can affect economic growth directly. Pradhan (2008) observed that for fuller utilisation of FDI much emphasis should be given for outward oriented trade policies, boosting infrastructure, flexible labour laws, favourable regulatory tax treatment of foreign firms and high-skilled labour as it maximises the benefits from FDI technological spillovers.

The efficiency of the vector error correction model was checked by testing for the residual autocorrelation and by testing whether the error term was normally distributed.

The results of the same are given in table 4.2.3 and table 4.2.4 respectively.

TABLE – 4.2.3

LAGRANGE-MULTIPLIER TEST FOR RESIDUAL AUTOCORRELATION

lag	Chi-Square	df	Probability
1	4.1161	4	0.39052
2	2.1433	4	0.70943

Source: Estimated based on the CMIE Prowess Database

To test for the residual autocorrelation the Lagrange Multiplier (LM) test was done using the stata command veclmar. This test was done to ensure the goodness of the model. The null hypothesis, that no autocorrelation at lag order was tested. From the table 4.2.3 it was obvious that since the probability value was more than 0.05 the null hypothesis was accepted. Hence it was concluded that there was no residual autocorrelation.

The result for the Jarque-Bera test for normal distribution is shown in table 4.2.4.

To test if the disturbances are normally distributed Jarque-Bera test was performed using the stata command vecnorm,jbera. Since the probability values were greater than 0.05 the null hypothesis that the random errors are normally distributed was accepted.

TABLE – 4.2.4

JARQUE-BERA TEST FOR NORMAL DISTRIBUTION OF DISTURBANCES

Equation	Chi-Square	df	Probability
D_lnf	0.244	2	0.88496
D_lng	0.646	2	0.72384
ALL	0.891	4	0.92588

Source: Estimated based on the CMIE Prowess Database

Hence it was concluded that the disturbance term is normally distributed. Since the error term was normally distributed and there was no residual autocorrelation, the vector error correction model (VECM) could be considered as a good fit.

4.3 Determinants of FDI in India

To attract high level of FDI, a conducive investment environment is an important pre-requisite. Factors that may positively influence an investor's decision include; reliability and stability of investment policies of the destination country, its strategic location, size of local as well regional markets, cost of inputs, abundance of raw materials including primary and intermediary goods, its weather and climatic conditions and the cost of skilled labor force (Ghani, 2009).

The current study attempted to analyse the determinants of FDI inflows into India. The following model 3 was used to identify the determinants of FDI in India.

$$lnf_t = \beta_0 + \beta_1 lng_{t-1} + \beta_2 lnt + \beta_3 lner + \beta_4 cad + \beta_5 lnei + \varepsilon_t \quad (3)$$

The variables used in the model are explained as follows. lnf is the natural logarithm of foreign direct investment, that is the total FDI inflow in the economy (in $ mn). FDI inflow is the dependent variable used in the model.

Artige and Nicolini (2005) stated that market size as measured by GDP or GDP per capita seems to be the most robust FDI determinant in econometric studies. FDI will move to countries with larger and expanding markets and greater purchasing power, where firms can potentially receive a higher return on their capital. Charkrabarti (2001) stated that the market-size hypothesis supports the idea that a large market was required for efficient utilisation of resources and exploitation of economies of scale; as the market-size grows to some critical value, FDI will start to increase thereafter with its further expansion. This variable representing the size of the host country market has come out as an explanatory variable in nearly all empirical studies on the determinants of FDI. Bevan and Estrin (2004) identified market size or GDP to be the principal determinant of FDI inflows. Parletun (2008) found that the variable GDP was positive and statistically significant at less than one per cent level. Hence, GDP was included as a determinant of FDI inflows into India. The relationship between GDP and FDI inflows was expected to be positive. However, Nurudeen et.al., (2011) have found a negative relationship between GDP and FDI inflows. lng_{t-1} is the natural logarithm of lagged value of gross domestic product (in rupees crores).

Charkrabarti (2001) stated that there was mixed evidence concerning the significance of openness, which is measured mostly by the ratio of exports plus imports to GDP, in determining FDI. According to Saskia and Morgan (1998) governmental fitness reflected in economic openness with only minimal trade and exchange rate controls, and/or strong rule of law and low corruption, and transparency is an important determinant of FDI inflows. When investments are market-seeking, trade restrictions (less openness) can have a positive impact on FDI. The argument for this is that foreign firms that seek to serve local markets may decide to set up subsidiaries in the host country if it is difficult to import their products to the country. In contrast, MNEs engaged in export-oriented investments may prefer to invest in a more open economy since trade protection generally imply higher transaction costs associated with exporting. Anyanwu (1998), Khan and Bamou (2007), Ian and Peter (2001) found openness as a potential determinant of FDI. Hence the variable trade openness was included in the model as a determinant of FDI inflows. It was expected that there would be a positive relation between trade openness and FDI inflows. lnt is the natural logarithm of trade openness (as a proxy to globalisation), which was measured as a percentage of total volume of trade (exports and imports) to GDP.

Ian and Peter (2001), Wafure and Abu (2010), Nurudeen et.al., (2011) among various other authors found exchange rate to be a potential determinant of FDI. Hence, exchange rate as a determinant of FDI was included in the model. lner, the natural logarithm of average exchange rate is the dollar value of Indian rupee. It refers to the rate at which the domestic currency (Rupee) is converted to the US dollar.

Current account deficit as a determinant of FDI inflows was studied by Pradhan (2008). Hence, the study included current account deficit in balance of payments as one of the determinants of FDI inflows in India. However, Pradhan

(2008) found a negative association between FDI inflows and current account deficit in balance of payments. cad is the natural logarithm of current account deficit in balance of payments, which was measured as total CAD as percentage of GDP.

Infrastructure is considered as a pacesetter of economic growth and one of the most important determinants of economic development in the developing countries (Pradhan, 2008). Infrastructure itself does not produce any goods and services in the economy, but is an essential input for all other economic activities. It raises the productivity of other factors including labour and capital and thus, is called the unpaid factor of production, since its availability leads to higher returns obtainable from capital and labour (Khader, 1998). From the Chinese economy it could be understood that reliable and efficient infrastructure facilities are essentially needed in the economy to boost FDI inflows. Infrastructure helps in reducing cost and ensuring timely inflow of FDI in the economy, as per the economy's expectation and requirements (Pradhan, 2008). Narayanamurthy et.al., (2010) and Campos and Kinoshita (2007) have found infrastructure to be the most significant determinant of FDI inflows. Khan and Bamou (2007) indicated that the level of infrastructure development to be the most important determinant of FDI. Hence, the variable infrastructure as a determinant of FDI inflows was included in the model. The relationship between infrastructure and FDI inflows was expected to be positive. lnei is the natural logarithm of infrastructure, which was measured as government expenditure towards economic infrastructure (energy and transport). 't' denotes the time period from 1990-91 to 2012-13, β_0, β_1, β_2, β_3, β_4, and β_5 are the parameters to be estimated, and ε_t is the error term. All the above mentioned variables were deflated using the GDP deflator except the variable cad as it was measured as a per cent of GDP.

The variables identified as the determinants of FDI inflows in India were of time-series nature. Hence there was a need to test for the stationarity of the variables. The stationarity of the variables were tested using Augmented Dickey-Fuller test. The following null hypothesis was tested and the results for the same are given in the table 4.3.1.

Null Hypothesis (H_0): The test variable has a unit root.

Table 4.3.1 shows the ADF test statistic and the probability values for all the chosen variables. Since the ADF test statistic was less than the probability value at five per cent level of significance, the null hypothesis was rejected. Hence it was concluded that the identified variables does not have a unit root. Therefore the data for the variables chosen were stationary.

TABLE – 4.3.1

RESULTS OF THE AUGMENTED DICKEY-FULLER TEST FOR MODEL 3

Test Variable	Level Data	First Difference Level	Second Difference Level
	ADF Statistics	ADF Statistics	ADF Statistics
lnf	-2.4221	-2.6168	-4.0246**
lng_{t-1}	-1.6013	-2.7600	-4.0246**
lnt	-1.8481	-4.6007**	-
lner	-3.8570**	-	-
cad	-1.1546	-6.1602**	-
lnei	-0.1624	-4.2584**	-

Source: Estimated using data from Handbook of Statistics on the Indian Economy (2012-13), Reserve Bank of India

NB: ** denotes significance at 5 per cent level of significance

Before running the regression, the test for multicollinearity and heteroscedasticity was done using the regression post estimation command estat vif and estat hettest respectively in stata 12 version.

Table 4.3.2 shows the results for the test on multicollinearity for model 3.

TABLE – 4.3.2

TESTING FOR MULTICOLLINEARITY FOR MODEL 3

Variable	Variance Inflation Factor (VIF)
lnei	5.42
lng	3.60
lner	2.77
cad	1.88
lnt	1.61
Mean VIF	3.06

Source: Estimated using data from Handbook of Statistics on the Indian Economy (2012-13), Reserve Bank of India , Data Tables, Planning Commission, Government of India, Data Compiled from various issues of SIA Newsletters, published by the Department of Industrial Policy & Promotion, Government of India, Ministry of Commerce & Industry

NB: As a rule of thumb, a variable is said to be highly collinear if its VIF exceeds 10. The VIF of a variable will exceed 10 if its R^2 exceeds 0.90 (Gujarati, 2010)

The results presented in the table 4.3.2 clearly indicated the non-existence of multicollinearity among the predictor variables used in the model 3 because the variance inflation factor was less than 10.

Table 4.3.3 shows the results for the test on heteroscedasticity for model 3.

TABLE – 4.3.3

TESTING FOR HETEROSCEDASTICITY FOR MODEL 3

Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity	
H_0: Constant Variance Variables: Fitted Values of lnf	
Chi2(1) = 0.05	Prob>Chi2 = 0.8177

Source: Estimated using the data from CMIE Prowess Database

Heteroscedasticity causes standard errors to be biased. So, Breusch-Pagan / Cook-Weisberg test for heteroscedasticity was done using the post estimation command estat hettest, after regressing model 3. The results presented in table 4.3.3 indicated the non-existence of heteroscedasticity. Since the estimated value (0.05) was less than the probability value (0.8177) the null hypothesis was accepted. Hence it was concluded that the error term has constant variance.

The study employed the Ordinary Least Squares (OLS) to estimate the relationship between FDI and its potential determinants. The results of the same are presented in the table 4.3.4.

The regression results revealed that the explanatory variables jointly account for 91 per cent changes in FDI inflows in India. The Durbin-Watson statistic indicated the absence of autocorrelation. The estimation results show that gross domestic product has a negative influence on FDI inflows. Surprisingly, the results revealed that the host market size or the gross domestic product has a negative and significant effect on FDI inflows. For instance, a one percent increase in the host country’s market size or GDP leads to a decrease in FDI inflows by 0.58 per cent as indicated by the coefficient (-0.5883). This result was against the expectation that GDP and FDI has a positive relation. Similar results were found by Nurudeen et.al., (2011) that the host country’s market size (GDP) has a significant negative effect on FDI.

TABLE – 4.3.4

DETERMINANTS OF FDI IN INDIA (1991-2013)

Independent Variables	Coefficient
lng	-0.5883** (0.2135)
lnt	7.1684** (1.1684)
lner	4.7503** (0.9280)
cad	-0.0210 (0.0615)
lnei	0.9658** (0.3808)
R-Squared	0.9170
Adjusted R-Squared	0.8963
Durbin-Watson Statistic	1.8531
Observations	21

Source: Estimated using data from Handbook of Statistics on the Indian Economy (2012-13), Data Tables published by Planning Commission and SIA Newsletters.
Dependent Variable: lnf
NB: ** denotes significance at 5 per cent level
: Figures in parentheses are White heteroscedasticity-consistent standard errors

Table 4.3.5 shows the sector-wise share of GDP to total GDP.

TABLE – 4.3.5

SECTOR-WISE SHARE OF GDP TO TOTAL GDP

(IN PER CENT)

Year	Agriculture	Industry	Manufacturing	Services
2001	22	32	18	59
2002	22	30	17	58
2003	18	30	17	58
2004	18	29	16	55
2005	16	28	15	53
2006	15	27	15	52
2007	13	26	14	49
2008	12	24	14	46
2009	10	22	12	44
2010	9	21	12	42
2011	8	19	11	39
2012	8	18	10	36
2013	7	16	9	34

Source: Estimated using data from Data-book Compiled for use of Planning Commission, Data Tables, Planning Commission, Government of India.

From table 4.3.5 it was evident that for all the years in the study period, the share of GDP from the services sector to the total GDP was more than that of the agricultural, industrial and the manufacturing sector. When the agricultural sector and the manufacturing sectors were considered it was interesting to observe that from 2001 to 2006 the share of agricultural GDP was more than the share of the manufacturing GDP. From 2007 to the end of the study period the manufacturing GDP showed only a marginal increase in relation to the agricultural GDP. The performance of the manufacturing sector was much below its potential and requirement. Unless the contribution of the manufacturing sector to the total GDP of India increases, GDP as a variable to influence the FDI inflows will continue to be negative. Government and policy makers should continue to encourage the production sector of the economy so as to attain higher level of GDP. This can be achieved through production incentives/subsidies such as low lending rates, low import duties on essential raw materials and equipments, lower excise duties, tax holidays and so on (Nurudeen et.al., 2011). If the GDP is high i.e., if the market size of India is high, then it would probably attract the foreign investors considering India to be a market for their products.

From the table 4.3.4 it was evident that trade openness was significant and positively influenced FDI inflows into India. The results suggested that as India opens up by lowering trade restrictions and exchange controls it increases the FDI inflows as shown by the significant and positive coefficient (7.1684). A one per cent, increase in openness to trade caused FDI inflows to rise by 7.16 per cent. This result was as expected. Similar results were reported by Kravis and Lipsey (1982), Culem (1988), and Edwards (1990) as they found a strong positive effect of openness on FDI. Likewise, Elijah (2006), Marial and Ngie (2009), and Nurudeen et.al., (2011) found a positive link between FDI and trade openness. To further cash on the openness of the economy, the government should employ trade liberalisation policies in order to (cautiously) open up the economy to trade so that the country can attract more FDI (Nurudeen et.al., 2011). However, Schmitz and Bieri (1972) found a weak positive link between openness and FDI inflows. Narayanamurthy et.al., (2010) examined the determinants of FDI in BRIC countries and found trade openness to be an insignificant variable in explaining inflows into the BRIC countries.

The results also indicated that the exchange rate depreciation had a significant and positive influence on FDI inflows. This was evident by the exchange rate coefficient (4.7503). A one per cent increase in the exchange rate depreciation results in approximately 4.75 per cent increase in FDI inflows. If a country's exchange rate depreciates, it will reduce the dollar price of its domestic currency, thus attracting foreign investors who may take advantage of the lower prices in the form of merger and/or acquisition (Nurudeen et.al., 2011). However, Khan and Bamou (2007) found exchange rate to be insignificant in FDI inflows. According to Fuat and Ekrem (2002) exchange rate instability have negative effects on FDI. Similarly, Elijah (2006) found real exchange rate to be negatively related to FDI inflows in the short-run and long-run. Hence the monetary authorities may have to accommodate depreciation of the currency (rupee) so as to encourage further inflows of FDI. It was argued that depreciation may encourage foreign firms to merge and/or acquire domestic industries (Nurudeen et.al., 2011).

Development of infrastructure has a close link with inflow of FDI in the economy. From the results it was apparent that there was a significant and positive relationship between infrastructure and FDI inflows in India. The coefficients (0.9658) of the variable (infrastructure) indicated that one per cent increase in the government's expenditure on the economic infrastructure of the country increases the FDI inflows by 0.96 per cent. This result gives a clear policy indication that the government should increase its spending in the area of infrastructural development such as roads, power, telecommunications and so on. This will reduce the cost of doing business and increase the profitability of investment, thus attracting FDI. Similar results have been found by Fuat and Ekrem (2002), Marial and Ngie (2009), and Nurudeen et.al., (2011). Getinet and Assefa (2006) concluded that poor infrastructure have a negative effect on FDI. Contrary to this result, Pradhan (2008) found a significant negative impact on FDI inflows in India which implies that increase in infrastructure investment will lead to decrease in FDI inflows in the economy.

Though all other variables included in the model came out to be significant, cad or the coefficient of current account deficit was negative (-0.0210) and not statistically significant. Pradhan (2008) found a negative relationship between current account deficit of balance of payments but the results were statistically insignificant. The share of the current account deficit to GDP is a reason to worry as long as the current account deficit is financed particularly through the inflows of foreign direct investments. FDI in short run compensate an existing current account deficit caused by import of consumption or capital goods (Krkoska, 2001; Yalta, 2011). However, in long run, the FDI repercussions on current account balance (CAB) might occur through several channels. First, FDI inflow generally boosts exports through gross capital formation, transfer of technology, enhanced productivity and competitiveness, introduction of newer production methods and products, better managerial techniques, greater access to new markets etc., (Borensztein et al, 1998; Dunning and Rugman, 1985; Krkoska, 2001; UNCTAD, 2002), which improves the CAB. Secondly, the foreign firms entering the recipient country may decide to import key inputs from their established global suppliers or pay royalties to the parent corporation for technical know-how, leading to an increase in imports (Onwuka and Zoral, 2009; Williams and Williams, 1998). As a result, the CAB is likely to worsen. Finally, the profit repatriation of foreign investors appears in the current account of BOP and greater outflow on this front also worsens the CAB (Yalta, 2011). The overall impact of FDI inflow on the CAB of a particular country is therefore a function of the relative strengths of these three effects.

4.4 Horizontal and Vertical FDI Spillovers

Of late, almost all countries in the world are vying to attract foreign investments from abroad by providing attractive incentives and by formulating many policies to facilitate foreign investment. The major argument in favour of such generous foreign investment policies is the expectation of the possible externalities generated by foreign affiliates on domestic producers (Smarzynska, 2004). Such externalities are known as ‘Spillovers’.

Many researchers attempted to study the horizontal and vertical spillovers from foreign firms viz., Wei & Liu (2006), Halpern and Murakozy (2007), Reganati and Sica (2007), Blalock and Gertler (2008) Wang and Zhao (2008), Marcin (2008), Liu (2008), Javorcik and Spatareanu (2008), Alvarez and Lopez (2008), Javorcik and Spatareanu (2009), Anwar and Nguyen (2010), Le and Pomfret (2011), Gerschewski (2013), and Gorodnichenko et.al., (2014). The literature on the impact of FDI on the productivity of domestic firms show mixed evidence. Liu et.al., 2000 (U.K), Haskel et.al., 2007 (U.K), Keller and Yeaple, 2009 (U.S), and Abraham et.al., 2010 (China) found positive spillovers from FDI on the productivity of domestic firms. Haddad and Harrison, 1993 (Morocco), Konings, 2001 (Central and Eastern Europe, Bulgaria, Romania and Poland), Hale and Long, 2007 (China), Barbosa and Eiriz, 2009 (Portugal) found that there were no productivity spillovers from the foreign firms to the indigenous firms. Mullen and Williams, 2007 (U.S) found evidence that the inward FDI may actually reduce the productivity of the domestic firms.

In the Indian context, Joseph (2007), Thakur and Burange (2014) and Malik (2015) found that there were positive productivity spillovers from foreign firms to domestic firms and the spillovers mainly occurred through vertical spillovers i.e., backward and forward spillovers. Mishra (2011) however, found positive productivity spillovers through horizontal channels. Sasidharan (2006), Sasidharan and Ramanathan (2007) found no significant horizontal spillovers and they also found negative vertical spillovers. Mishra (2011) found that the productivity of local firms decreases as foreign presence in upstream or downstream sector increases. Hence the evidence is mixed.

The current study attempted to identify and estimate the FDI spillovers through two different means, namely the intra-industry and inter-industry spillovers. Horizontal spillovers are intra-industry spillovers from MNEs to domestic firms in the same industry. Inter-industry spillovers or vertical spillovers are where the externalities accrue via supply chain. Vertical spillovers can be either from backward linkages or from forward linkages between domestic firms and foreign firms. Externalities generated from downstream multinationals to upstream local suppliers in the supply chain are known as spillovers due to backward linkages or spillovers. Spillovers from forward linkages happen when domestic firms are customers to foreign firms in the local market. A supply chain is usually classified into two main parts: an ‘upstream’ part that refers to the suppliers in the chain, and a ‘downstream’ part, where it refers to the customers. However, the potential benefits are very limited for domestic firms if the host country firms have poor absorptive capacity (Joseph, 2007).

FDI spillovers are not automatic. The host country should characterise with certain “pre-requisites” needed for technology to flow from foreign companies to domestic firms. The literature has identified them as absorptive capacity. FDI spillover effects depend on the characteristics of domestic firms, industries and indeed the host country. These characteristics can be categorised as absorptive capacity, which includes the stock of human capital, level of financial market development and technology gap. Sjoholm (1999) argued that the absorptive capacity of a host country plays an important role in capturing the full benefits of FDI-generated spillovers.

The present study analysed the impact of horizontal and vertical FDI spillovers on (a) all domestic firms (b) low technology domestic firms (c) high technology domestic firms and (d) all domestic firms based on the structure of foreign ownership.

a. Impact of horizontal and vertical FDI spillovers on all domestic firms

The impact of horizontal and vertical FDI Spillovers on the total factor productivity of the Indian manufacturing firms was analysed using model 4. The variables used in model 4 are in logarithmic form. A log-linear expression has a number of advantages as it allows for diminishing heteroscedasticity among firms as extreme observations are flattened with respect to average observations and for interpreting estimated coefficients as elasticities (Joseph, 2007).

$$tfp_{ijt} = \beta_0 + \beta_1 lnb_{jt} + \beta_2 lnf_{jt} + \beta_3 lnh_{jt} + \beta_4 lnhin_{jt} + \beta_5 lnrin_{ijt} + \beta_6 lntin_{ijt} + \beta_7 lneix_{ijt} + \varepsilon_{ijt} \quad (4)$$

Before running the regression, the test for multicollinearity, heteroscedasticity and autocorrelation were performed. Variance inflation factor was computed to test for multicollinearity using the post estimation command estat vif and Breusch-Pagan / Cook-Weisberg test was done to test for heteroscedasticity using the post estimation command estat hettest. Wooldridge test for autocorrelation in panel data was done using the stata command xtserial.

Table 4.4.1 shows the variance inflation factors for the variables used in model 4.

TABLE – 4.4.1

TESTING FOR MULTICOLLINEARITY FOR ALL DOMESTIC FIRMS USING MODEL 4

Variable	Variance Inflation Factor (VIF)
lnb	2.72
lnhin	2.49
lnf	1.73
lnh	1.55
lnrin	1.14
lneix	1.08
lntin	1.06
Mean VIF	1.68

Source: Computed using data from CMIE Prowess Database

NB: As a rule of thumb, a variable is said to be highly collinear if its VIF exceeds 10. The VIF of a variable will exceed 10 if its R^2 exceeds 0.90 (Gujarati, 2010)

The results presented in table 4.4.1 clearly indicated the non-existence of multicollinearity among the predictor variables used in model 4, because the values for VIF was less than 10 for all the variables used in the model.

Stata includes options with most routines for estimating robust standard errors. Heteroscedasticity causes standard errors to be biased. OLS assumes that errors are both independent and identically distributed; robust standard errors relax either or both of those assumptions. Hence, when heteroscedasticity is present, robust standard errors tend to be more trustworthy. The use of robust standard errors does not change coefficient estimates, but the test statistics will give reasonably accurate p values. The use of weighted least squares (WLS) will also correct the problem of bias in the standard errors, and will also give more efficient estimates (i.e. WLS will give estimates that have the smallest possible standard errors). But, WLS requires more assumptions and is more difficult to implement, so robust standard errors seem to be a more common and popular method for dealing with issues of heteroscedasticity.

Table 4.4.2 shows the results for the Breusch-Pagan/Cook-Weisberg test for heteroscedasticity.

TABLE – 4.4.2

TESTING FOR HETEROSCEDASTICITY FOR ALL DOMESTIC FIRMS USING MODEL 4

Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity	
H_0: Constant Variance Variables: Fitted Values of tfp	
Chi2(1) = 42.91	Prob>Chi2 = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.4.2 indicated the presence of heteroscedasticity. Since the estimated value (42.91) was greater than the probability value (0.0000) the null hypothesis was rejected. Hence it can be concluded that the error term does not have constant variance.

The relationship between a given variable and itself over various time intervals is known as autocorrelation or serial correlation. Serial correlations are often found in repeating patterns when the level of a variable affects its future level.

Table 4.4.3 shows the results for the Wooldridge test for autocorrelation using model 4.

TABLE – 4.4.3

TESTING FOR AUTOCORRELATION FOR ALL DOMESTIC FIRMS USING MODEL 4

Wooldridge Test for Autocorrelation in Panel Data	
H_0: No First-Order Autocorrelation	
F(1,166) = 145.107	Prob>F = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in the table 4.4.3 indicated the presence of serial correlation or autocorrelation. Since the estimated value (145.107) was greater than the probability value (0.0000) the null hypothesis was rejected.

To examine how changes in productivity in domestic firms are related to the presence of foreign firms, model 4 was estimated using panel data techniques. There are two statistical formulations of panel data model commonly used in the empirical literature. These are known as fixed effects (FE) or least squares dummy variables (LSDV) model and random effects (RE) model. These two models differ mainly in their assumptions concerning the error term, ε_{it} .

It is assumed that ε_{it} in Model 4 (and in Model 5) can be decomposed into two independent components,

$$\varepsilon_{it} = u_i + v_{it}$$

where u_i is time-invariant and accounts for any unobservable firm specific effects or characteristics not included in the regression. The v_{it} term represents the remaining disturbance, and varies over time and across firms. It can be thought of as the usual disturbance in a regression. In the ordinary least squares (OLS) model, the u_i is constrained into the constant β_0 . In the FE model the unobserved firm-specific characteristics are controlled by including firm-specific dummies in the regressions. The fixed effects model assumes that differences across firms can be captured through differences in the constant term. This will indeed reduce the correlation between the regressors and the error term, ε_{it} . Unlike in the FE model, the RE procedure utilises variation in the data both between firms at a given point in time as well as within each firm through time to estimate the coefficients. The FE technique considers only the variability of the data within each firm through time, not the variance in the data across firms at any given point in time. Moreover, the FE model is less efficient than the RE model because of the lost degrees of freedom. Unlike the FE model, the RE model relegates unobservable effects into the error term and assumes that they are uncorrelated with regressors. However, the violation of this assumption may lead the RE model to produce biased and inconsistent estimates. As long as there is no correlation between the regressors and either v_{it} or u_i the RE technique will provide consistent and efficient estimates of the parameters and hence is preferred. However, if correlation between the regressors and the error term is present, then the FE specification is theoretically superior because it can provide consistent estimates. Traditionally, the way to choose between these two models is to employ the Hausman specification (HS) test, which measures the distance between the estimated FE and RE coefficients. If the Hausman statistic is very large (that shows there are systematic differences between the coefficients of these two models), the random effects can be easily rejected in favour of the fixed effects specification (Joseph, 2007).

The present study employed Hausman test to choose between fixed effects regression and random effects regression. The results of the Hausman test is given in table 4.4.4.

TABLE – 4.4.4

HAUSMAN TEST PERFORMED ON MODEL 4 FOR ALL DOMESTIC FIRMS

Hausman Test	
H_0: Difference in Coefficients Not Systematic	
chi2(7) = 8.45	Prob>chi2 = 0.2948

Source: Computed using the data from CMIE Prowess Database

Since the probability value was greater than 0.05, the Hausman test clearly rejected the use of fixed effects regression in estimating model 4 and favoured the use of random effects regression. Feasible Generalised Least Squares (FGLS) regression was used in the place of random effects regression because FGLS was preferred over OLS under heteroscedasticity or serial correlation (Baltagi, 2008). However, if classical assumptions of OLS are met, then least squares may be more efficient than FGLS (Greene, 2003). FGLS estimators might be inconsistent if there are individual specific fixed effects (Hansen, 2007). Hence the cross-sectional time-series FGLS regression was used because there was evidence of heteroscedasticity and serial correlation in estimating model 4.

The results of the FGLS regression on model 4 are summarised in table 4.4.5.

TABLE – 4.4.5

REGRESSION RESULTS OF ALL DOMESTIC FIRMS (2001-2013)

Independent Variables	All Firms
lnb	0.0259** (0.0053)
lnf	0.0020 (0.0036)
lnh	0.0302** (0.0088)
lnhin	0.0076 (0.0107)
lnrin	-0.0017 (0.0023)
lntin	-0.0037** (0.0013)
lneix	-0.0025 (0.0027)
Constant	0.3729** (0.0437)
Year Dummies	Yes
Firm Dummies	Yes
Wald Chi-Square	118.69**
Observations	1749

Source: Computed using data from CMIE Prowess Database

NB: Figures in parentheses are standard errors

***** denotes significance at 5 per cent level***

Dependent Variable: tfp

Table 4.4.5 shows the regression results of model 4 run on all the domestic firms (1749 firms). The estimated coefficient of backward FDI (0.0259) was positive and statistically significant which suggested that about two per cent of the domestic firms' TFP increased due to one unit increase in the output of foreign firms in downstream industries. From the results it was apparent that the presence of foreign firms in the downstream industries benefits the domestic firms through backward vertical linkages. The results suggested that the MNEs who procure inputs from the domestic firms are demanding i.e., they expect better quality and the indigenous firms are compelled to meet the stringent norms set by the foreign affiliates. Thus, it would have helped the domestic firms to improve their productivity. Similar results were found by Lall (1980) who observed that MNEs contribute to raising the productivity and efficiency of the local suppliers by helping them to set up production facilities, providing them with technical assistance to improve the quality of products or to facilitate innovations, assisting them in purchasing raw materials and intermediates, and providing training and other organisational help.

The same way one unit increase in the output of the foreign firms in the same industry as that of the domestic firms increases the TFP of the domestic firms by three per cent, since the coefficient of the horizontal FDI (0.0302) was positive and statistically significant. This implies that the knowledge spillover takes place from the foreign firms in the same industry to the domestic firms and this may be because the technology of the foreign firms may not be protected by intellectual property rights and also because of employee turnover from foreign firms to domestic firms.

The foreign firms in the upstream industry do not influence the productivity of the domestic firms since the coefficient of forward FDI (0.0020) was positive but not statistically significant. This result made it clear that the domestic firms do not have the absorptive capacity to absorb the technology embodied in the products of the MNEs.

The coefficient of the technology import intensity (-0.0037) was negative but statistically significant. This implies that the imported technology has not been transmitted to the domestic firms because of lack of absorptive capacity among the Indian manufacturing firms. The domestic firms could not completely reap the benefits of the imported technology may be because of lack of technical and managerial expertise. Another reason for the negative influence on the productivity of Indian firms may be due to high cost of technology imports and lower output of the indigenous firms. Subrahmanian et.al., (1996) found no clear empirical evidence of any complementary relationship between technology import (especially through FDI) and domestic technological efforts. According to Kokko (1996) the more the local firm invests in learning, the more knowledge it was able to absorb. The improvement in local technology in turn reduces the technology gap, and forces foreign firms to import new technology to remain competitive and profitable in the host market.

All the other firm-specific and time-variant control variables, namely R&D intensity, export intensity and industry specific control variable such as the Herfindahl index does not have any significant effect on Indian manufacturing firms. From the results it could be confirmed that the domestic firms' R&D expenditure and exports does not have any influence on their productivity. The analysis also confirmed that the level of competition in the industry does not affect the productivity of the domestic firms.

b. Impact of horizontal and vertical FDI spillovers on domestic low technology firms

The impact of horizontal and vertical FDI spillovers on the total factor productivity of the low technology intensive Indian manufacturing firms was analysed using model 4.

Table 4.4.6 shows the results for the test on multicollinearity using model 4 for the low technology domestic firms.

TABLE – 4.4.6

TESTING FOR MULTICOLLINEARITY FOR DOMESTIC LOW TECHNOLOGY FIRMS USING MODEL 4

Variable	Variance Inflation Factor (VIF)
lnhin	4.31
lnb	3.83
lnf	2.60
lnh	1.63
lneix	1.26
lntin	1.13
lnrin	1.08
Mean VIF	2.26

Source: Computed using data from CMIE Prowess Database

NB: As a rule of thumb, a variable is said to be highly collinear if its VIF exceeds 10. The VIF of a variable will exceed 10 if its R^2 exceeds 0.90 (Gujarati, 2010)

The results presented in table 4.4.6 clearly indicated the non-existence of multicollinearity among the predictor variables used in the regression model 4, since the values of VIF was less than 10.

Table 4.4.7 shows the result for the test on heteroscedasticity using model 4 for the low technology domestic firms.

TABLE – 4.4.7

TESTING FOR HETEROSCEDASTICITY FOR DOMESTIC LOW TECHNOLOGY FIRMS USING MODEL 4

Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity	
H_0: Constant Variance Variables: Fitted Values of tfp	
Chi2(1) = 45.93	Prob>Chi2 = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.4.7 indicated the presence of heteroscedasticity. Since the estimated value (45.93) was greater than the probability value (0.0000) the null hypothesis was rejected. Hence it can be concluded that the error term does not have constant variance.

Table 4.4.8 show the result for the test on autocorrelation using model 4 for the low technology firms.

TABLE – 4.4.8

TESTING FOR AUTOCORRELATION FOR DOMESTIC LOW TECHNOLOGY FIRMS USING MODEL 4

Wooldridge Test for Autocorrelation in Panel Data	
H_0: No First-Order Autocorrelation	
F(1,68) = 60.900	Prob>F = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.4.8 indicated the presence of serial correlation or autocorrelation. Since the estimated value (60.900) was greater than the probability value (0.0000) the null hypothesis that there was no first-order autocorrelation was rejected.

The result of the Hausman test is given in table 4.4.9. Hausman test was done to choose between fixed effects regression and random effects regression.

TABLE – 4.4.9

HAUSMAN TEST PERFORMED ON MODEL 4 FOR DOMESTIC LOW TECHNOLOGY FIRMS

Hausman Test	
H0: Difference in Coefficients Not Systematic	
chi2(7) = 15.97	Prob>chi2 = 0.0254

Source: Computed using the data from CMIE Prowess Database

Table 4.4.9 shows that since the probability value was greater than 0.05, the Hausman test clearly rejected the use of random effects regression in estimating model 4. Hence the study used fixed effects regression with Driscoll-Kraay standard errors. The stata program, xtscc was used to estimate fixed effects (within) regression models with Driscoll and Kraay standard errors.

Driscoll-Kraay standard errors are well calibrated when cross-sectional dependence is present. Most empirical studies provide standard error estimates that are heteroscedastic and autocorrelation consistent, but cross-sectional or “spatial” dependence was largely ignored. Assuming that the disturbances of a panel model are cross-sectionally independent is often inappropriate. Provided that the unobservable common factors are uncorrelated with the explanatory variables, the coefficient estimates from standard panel estimators viz., fixed effects (FE) estimator, random effects (RE) estimator, or pooled ordinary least-squares (OLS) estimation are still consistent (but inefficient). However, standard error estimates of commonly applied covariance matrix estimation techniques viz., OLS, White, and Rogers or clustered standard errors are biased, and hence statistical inference based on such standard errors is invalid. Fortunately, Driscoll and Kraay (1998) proposed a nonparametric covariance matrix estimator that produces heteroskedasticity and autocorrelation-consistent standard errors that are robust to general forms of spatial and temporal dependence. In contrast to Driscoll and Kraay's original contribution that considers only balanced panels, their estimator was adjusted for use with unbalanced panels and use Monte Carlo simulations to investigate the adjusted estimator's finite sample performance in case of medium and large-scale (microeconometric) panels (Hoechle, 2007).

The results of the regression test run on 750 low technology intensive firms using the fixed effects regression with Driscoll-Kraay standard errors are presented in table 4.4.10.

The results presented in table 4.4.10 show that none of the variables used in the model 4 influenced the total factor productivity of the domestic firms in the low technology industries. The coefficient of backward FDI spillovers i.e., spillovers from the foreign firms in the downstream industry was negative (-0.0933) and not statistically significant. The coefficient of forward FDI spillovers was positive (0.1085) but not statistically significant.

TABLE – 4.4.10

REGRESSION RESULTS OF DOMESTIC LOW TECHNOLOGY FIRMS (2001-2013)

Independent Variables	Low Technology Firms
lnb	-0.0933 (0.0516)
lnf	0.1085 (0.0584)
lnh	-0.1021 (0.0685)
lnhin	-0.1175 (0.0744)
lnrin	0.0055 (0.0162)
lntin	0.0006 (0.0020)
lneix	0.0094 (0.0088)
Constant	-0.3931 (0.5591)
Year Dummies	Yes
Firm Dummies	Yes
R^2	0.0161
F-Statistic	53.44**
Observations	750

Source: Computed using data from CMIE Prowess Database

NB: Figures in parentheses are Driscoll/Kraay standard errors

***** denotes significance at 5 per cent level***

Dependent Variable: tfp

The horizontal spillover coefficient of the foreign firms in the same industry as that of the domestic firms was negative (-0.1021) and not statistically significant. The other industry specific variable Herfindahl index was negative (-0.1175) and statistically insignificant. All other firm-specific and time-control variables viz., R&D intensity (0.0055), technology import intensity (0.0006) and the export intensity (0.0094) were positive but statistically insignificant. This was a clear indication that the Indian firms in the low technology industry do not have the absorptive capacity or the R&D intensity to absorb the horizontal and vertical (backward and forward) spillovers from the foreign affiliates.

c. Impact of horizontal and vertical FDI spillovers on domestic high technology firms

The impact of horizontal and vertical FDI spillovers on the total factor productivity of the high technology intensive Indian manufacturing firms was analysed using model 4.

Table 4.4.11 shows the results for the test on multicollinearity using model 4 for the high technology domestic firms.

TABLE – 4.4.11

TESTING FOR MULTICOLLINEARITY FOR DOMESTIC HIGH TECHNOLOGY FIRMS USING MODEL 4

Variable	Variance Inflation Factor (VIF)
lnb	9.68
lnf	7.26
lnh	3.23
lnhin	2.55
lnrin	1.26
lntin	1.21
lneix	1.08
Mean VIF	3.75

Source: Computed using data from CMIE Prowess Database

NB: As a rule of thumb, a variable is said to be highly collinear if its VIF exceeds 10. The VIF of a variable will exceed 10 if its R^2 exceeds 0.90 (Gujarati, 2010)

The results presented in table 4.4.11 clearly indicated the non-existence of multicollinearity among the predictor variables used in the regression model 4 because the values of VIF were less than 10.

Table 4.4.12 shows the results for the test on heteroscedasticity for model 4 for domestic high technology manufacturing firms.

The results presented in table 4.4.12 indicated the absence of heteroscedasticity. Since the estimated value (0.09) was lesser than the probability value (0.7702) the null hypothesis was accepted. Hence it can be concluded that the error term has constant variance.

TABLE – 4.4.12

TESTING FOR HETEROSCEDASTICITY FOR DOMESTIC HIGH TECHNOLOGY FIRMS USING MODEL 4

Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity	
H_0: Constant Variance Variables: Fitted Values of tfp	
Chi2(1) = 0.09	Prob > chi2 = 0.7702

Source: Computed using the data from CMIE Prowess Database

Table 4.4.13 shows the results for the test on autocorrelation using model 4 for the domestic high technology firms.

TABLE – 4.4.13

TESTING FOR AUTOCORRELATION FOR DOMESTIC HIGH TECHNOLOGY FIRMS USING MODEL 4

Wooldridge Test for Autocorrelation in Panel Data	
H_0: No First-Order Autocorrelation	
F(1,97) = 105.207	Prob>F = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.4.13 indicated the presence of serial correlation or autocorrelation. Since the estimated value (105.207) was greater than the probability value (0.0000) the null hypothesis stating that there was no first-order autocorrelation was rejected.

The results of the Hausman test performed on model 4 for the domestic high technology firms are given in table 4.4.14.

TABLE – 4.4.14

HAUSMAN TEST PERFORMED ON MODEL 4 FOR DOMESTIC HIGH TECHNOLOGY FIRMS

Hausman Test	
H0: Difference in Coefficients Not Systematic	
chi2(7) = 14.64	Prob>chi2 = 0.0409

Source: Computed using the data from CMIE Prowess Database

Table 4.4.14 show that since the probability value was greater than 0.05, the Hausman test clearly rejected the use of random effects regression in estimating model 4. Hence the study used fixed effects regression with Driscoll-Kraay standard errors.

The regression results run on 1020 high technology intensive Indian manufacturing firms are presented in table 4.4.15.

TABLE – 4.4.15

REGRESSION RESULTS OF DOMESTIC HIGH TECHNOLOGY FIRMS (2001-2013)

Independent Variables	High Technology Firms
lnb	0.2148** (0.0613)
lnf	-0.2804** (0.1143)
lnh	0.2766** (0.0418)
lnhin	0.1494** (0.0291)
lnrin	-0.0066 (0.0093)
ltin	0.0048 (0.0042)
lneix	-0.0030 (0.0079)
Constant	0.2871 (0.5788)
Year Dummies	Yes
Firm Dummies	Yes
R^2	0.0493
F-Statistic	57.05**
Observations	1020

Source : Computed using data from CMIE Prowess Database

NB : Figures in parentheses are Driscoll/Kraay standard errors

***** denotes significance at 5 per cent level***

Dependent Variable: tfp

Table 4.4.15 shows that there were both horizontal and vertical (backward and forward) spillovers from the foreign affiliates to the Indian manufacturing firms in high technology intensive industry. This was in line with the results of many earlier research studies. The spillovers from the downstream or procuring foreign firms was positive and statistically significant at five per cent level as indicated by its coefficient (0.2148). This implies that one per cent increase in the output of the foreign affiliates increases the productivity of the Indian manufacturing firms by 21 per cent. As discussed already this increase in the productivity of the domestic firms may be due to the stringent quality standards set by the MNEs when they procure intermediate inputs from the domestic firms. Consequently, the domestic firms are compelled to meet the standards set by the MNEs which make them more efficient in supplying the inputs required by the foreign affiliates. Thus, as the foreign firms procure more inputs from the domestic firms the productivity of the later improves.

Contrary to the backward FDI spillovers, the spillovers from the upstream or supplying foreign firms to the domestic firms has a negative influence on the productivity of the Indian manufacturing firms. This was shown by the coefficient of forward FDI or the spillovers from the upstream foreign firms (-0.2804) which was negative but statistically significant. This result implies that one percent increase in the output of the foreign firms in the supplying or upstream industry decreases the productivity of the domestic firms by 28 per cent. From the result it was evident that though the domestic firms in the high technology industry succeed in meeting the quality requirements set by the procuring foreign firms they are still incompetent or they lack sufficient absorptive capacity to decipher the technology embodied in the products supplied by the foreign manufacturers. Wang and Blomstrom (1992) pointed out that the majority of spillovers do not arise automatically from the presence of foreign firms. Instead, to benefit, indigenous firms need to invest in “learning activities”.

However, divergent to the results of the earlier studies the results of the current study provide sufficient proof of the existence of horizontal FDI spillovers from the foreign firms functioning in the same industry as that of their domestic counterparts. The coefficient of the horizontal spillover was positive (0.2766) and statistically significant which suggested that one per cent increase in the output of foreign firms in the same industry increases the productivity of the domestic firms by 27 per cent. The horizontal FDI spillovers from the foreign firms may be possible because of the weak intellectual property right (IPR) protection for the MNEs’ products or it may be due to high employee turnover from the foreign firms to the domestic firms.This result can be validated by the fact that the domestic firms which are in the high technology industry are able to withstand the competition from the foreign firms as indicated by the coefficient of the Herfindahl index (0.1494) which was positive and statistically significant at five per cent level. The Herfindahl index shows that as the competition in the industry increases, the productivity of the domestic manufacturing firms increases by 14 per cent. Since the domestic firms are in the high technology industry they may have sufficient resources to employ highly skilled managers to withstand the competition from their foreign counterparts. The coefficients of the other firm-specific and time-control variables viz., R&D intensity, technology import intensity and export intensity were statistically insignificant.

d. Impact of horizontal and vertical FDI spillovers on all domestic firms on the basis of structure of foreign ownership

The impact of horizontal and vertical FDI spillovers on the total factor productivity of all domestic manufacturing firms was analysed on the basis of the structure of foreign ownership in affiliates using model 5. The regression on model 5 was not done for the low technology and high technology firms due to multicollinearity.

$$tfp_{ijt} = \beta_0 + \beta_1 lnmjb_{jt} + \beta_2 lnmnb_{jt} + \beta_3 lnmjf_{jt} + \beta_4 lnmnf_{jt} + \beta_5 lnmjh_{jt} + \beta_6 lnmnh_{jt} + \beta_7 lnhin_{jt} + \beta_8 lnrin_{ijt} + \beta_9 lneix_{ijt} + \beta_{10} lntin_{ijt} + \varepsilon_{ijt} \quad (5)$$

Table 4.4.16 shows the results for the test on multicollinearity for all domestic manufacturing firms using Model 5.

TABLE – 4.4.16

TESTING FOR MULTICOLLINEARITY FOR ALL DOMESTIC FIRMS USING MODEL 5

Variable	Variance Inflation Factor (VIF)
lnmjf	4.37
lnmnb	3.82
lnmjb	3.80
lnmnf	3.78
lnmnh	3.23
lnmjh	2.67
lnhin	2.19
lnrin	1.46
lneix	1.23
lntin	1.20
Mean VIF	2.78

Source : Computed using data from CMIE Prowess Database

NB : As a rule of thumb, a variable is said to be highly collinear if its VIF exceeds 10. The VIF of a variable will exceed 10 if its R^2 exceeds 0.90 (Gujarati, 2010)

The results presented in table 4.4.16 clearly indicated the non-existence of multicollinearity among the predictor variables used in model 5 because the values of VIF were less than 10.

Table 4.4.17 shows the results for the test on heteroscesaticity for all domestic manufacturing firms using the model 5.

TABLE – 4.4.17

TESTING FOR HETEROSCEDASTICITY FOR ALL DOMESTIC FIRMS USING MODEL 5

Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity	
H_0: Constant Variance Variables: Fitted Values of tfp	
Chi2(1) = 14.32	Prob>Chi2 = 0.0002

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.4.17 indicated the presence of heteroscedasticity. Since the estimated value (14.32) was greater than the probability value (0.0002), the null hypothesis was rejected. Hence it can be concluded that the error term does not have constant variance.

Table 4.4.18 shows the results for the test on autocorrelation for all domestic manufacturing firms using Model 5.

TABLE – 4.4.18

TESTING FOR AUTOCORRELATION FOR ALL DOMESTIC FIRMS USING MODEL 5

Wooldridge Test for Autocorrelation in Panel Data	
H_0: No First-Order Autocorrelation	
F(1,134) = 132.048	Prob>F = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.4.18 indicated the presence of serial correlation or autocorrelation. Since the estimated value (132.048) was greater than the probability value (0.0000) the null hypothesis that there was no first-order autocorrelation was rejected.

The result of the Hausman test performed on model 5 for all domestic manufacturing firms are given in table 4.4.19.

TABLE – 4.4.19

HAUSMAN TEST PERFORMED ON MODEL 5 FOR ALL DOMESTIC FIRMS

Hausman Test	
H0: Difference in Coefficients Not Systematic	
chi2(10) = 58.81	Prob>chi2 = 0.0000

Source: Computed using the data from CMIE Prowess Database

Table 4.4.19 show that since the probability value was lesser than 0.05, the Hausman test clearly rejected the use of random effects regression in estimating model 5. Hence the study used fixed effects regression with Driscoll-Kraay standard errors.

The regression results for all domestic manufacturing firms on the basis of the structure of foreign ownership using model 5 are presented in table 4.4.20.

Table 4.4.20 shows the regression results of model 5. The coefficients of the minority-owned foreign firms (0.1694) in the downstream industries are positive and statistically significant. From the results it was clear that one per cent increase in the output of the minority-owned foreign firms in the downstream industries increases the productivity of the domestic firms by 16 per cent. This implies that the foreign firms in the minority-owned foreign affiliates source more intermediate inputs than the majority-owned foreign affiliates. The productivity of the domestic firms increases because when the minority-owned foreign affiliates source inputs from the Indian firms they may demand higher product quality and on-time delivery, which provide incentives to domestic suppliers to up-grade their production management or technology; and the multinational entry increase the demand for intermediate products, which allows local suppliers to reap the benefits of scale economies (Javorcik, 2004 and Joseph 2007).

But the coefficients of the minority-owned foreign firms in the supplying industries or the upstream industries was negative (-0.0863) and statistically significant. The results indicated that one per cent increase in the output of the minority-owned foreign firms in the upstream industries or supplying industry decreases the productivity of Indian manufacturing firms by eight per cent. Technology spillovers via forward linkages from foreign firms occur when foreign firms provide knowledge embodied in products, process, and technology to the domestic customers at the downstream industries, which help domestic firms to boost up their productivity (Blomstrom and Kokko, 1998).

TABLE – 4.4.20
REGRESSION RESULTS FOR ALL DOMESTIC FIRMS ON THE BASIS OF STRUCTURE OF FOREIGN OWNERSHIP (2001-2013)

Independent Variables	All Firms
lnmjb	-0.0267 (0.0365)
lnmnb	0.1694** (0.0437)
lnmjf	0.1167 (0.0644)
lnmnf	-0.0863** (0.0242)
lnmjh	0.0363** (0.0104)
lnmnh	0.0536 (0.0290)
lnhin	0.0724** (0.0282)
lnrin	-0.0033 (0.0107)
ltin	-0.0009 (0.0033)
leix	0.0028 (0.0072)
Constant	2.1390** (0.3772)
Year Dummies	Yes
Firm Dummies	Yes
R^2	0.0666
F - Statistic	158.30**
Observations	1434

Source: Computed using data from CMIE Prowess Database

NB : Figures in parentheses are Driscoll/Kraay standard errors

***** denotes significance at 5 per cent level***

Dependent Variable: tfp

The forward FDI or the FDI spillovers from the upstream minority-owned foreign firms to the domestic firms was negative which implies that though the technology was embodied in the products supplied by the foreign affiliates, the domestic firms do not have the absorptive capacity or they are not able to decipher the technology embodied in the products supplied by the foreign firms

Perez (1997) looked at the relationship between the technology gap and technology spillovers from foreign to UK-owned firms and found that a firm's capability to absorb foreign technology depends on its existing level of technological competence, and its learning efforts. He argued that the ability of indigenous firms to 'catch-up' depends on their level of technological competence. This competence is characterised by 'path-dependency', the absorptive capacity of indigenous firms depends on their past accumulation of technology. Spillovers increase as the technology gap widens up to a certain critical level. Beyond this level spillovers begin to fall because technological competence by indigenous firms will be too low to exploit fully the technological opportunities arising from foreign presence, and at some still higher level may become negligible or even negative.

From the results it was apparent that the technology spillover both backward and forward had taken place through the minority-owned foreign firms and not majority-owned foreign affiliates because the local ownership was more in the minority-owned foreign firms. The positive productivity impact of foreign presence on domestic firms in the same industry as well as in other industry sectors largely depends on the technological capability of the domestic firms. In other words, domestic firms with increased investment in their R&D capability significantly benefit from the larger presence of foreign firms in improving their productivity performance (Joseph 2007).

The coefficient of the majority-owned foreign firms in the same industry as that of the domestic firms was positive (0.0363) and statistically significant at five per cent level. This implies that the existence of foreign firms in the same industry increased the productivity of the domestic firms i.e., one unit increase in the output of foreign affiliates in the same industry increases the productivity of indigenous firms by three per cent. This refutes the earlier claim that the foreign firms have the tendency to prevent the technology leakage to domestic firms since both operate in the same industry.

The coefficients of the Herfindahl index was positive (0.0724) and statistically significant which means that the increase in competition in the industry increases the productivity of the domestic firms by seven per cent. The results suggested that to withstand the competition from the MNEs the domestic firms try to be efficient. Davies and Caves (1987) explained why some British industries performed better than others relative to their American counterparts. They emphasised the influence of competitive forces in the form of foreign rivals in both home and export markets. In these contested markets, U.K. firms were under pressure to promote efficiency and increase their productivity.

To sum up, there were significant positive technology spillovers from the downstream or purchasing foreign firms to the Indian manufacturing firms and significant positive horizontal spillovers from the MNEs functioning in the same industry as that of the domestic firms. Also the Herfindahl index was positive and significant indicating the ability of the domestic firms in the high technology industry to face the competition from the foreign affiliates. But the spillovers from the upstream or supplying foreign firms was negative and it had negative impact on the productivity of Indian manufacturing firms. All these spillovers were found in the high technology Indian manufacturing firms. The results on the basis of the structure of foreign ownership showed that the positive spillovers from the downstream or procuring foreign firms and the negative spillovers from the upstream or supplying foreign firms mainly took place due to the minority-owned foreign firms and the positive horizontal spillovers took place due to the majority-owned foreign firms.

4.5 Export Spillovers

There are a number of empirical literature that examined the impact of FDI on the productivity of domestic firms. But very few empirical studies were done to investigate the export spillovers from foreign firms. The export intensity and the domestic firms' decision to export as a result of the spillovers from foreign firms has long been a neglected area of research. It is a most commonly accepted fact that the level of exports of a country is an indicator of economic development. Many studies found that exporting firms usually perform better than domestic market oriented firms. While a large number of existing studies viz., Kokko et.al., (1996), Aitken and Harrison (1999), Fosfuri et.al., (2001), Konings (2001), Javorcik (2004), Mullen and Williams (2007), Parameswaran (2007), Haskel et.al., (2007), Halpern and Murakozy (2007), Reganati and Sica (2007), Javorcik and Spatareanu (2008), Liu (2008), Javorcik and Spatareanu (2009), Keller and Yeaple (2009) Pant and Mondal (2010) considered the impact of FDI and FDI-linked spillovers on productivity and technology transfer, relatively few empirical studies have been done to study the impact of FDI linkages on the export performance of host countries.

Researchers abroad analysed the impact of FDI spillovers on the export performance of the host country. But, the results of these studies show mixed evidence with regard to the impact of FDI spillovers on the export performance of domestic firm. Greenaway et.al., 2004 (UK), Lemi, 2004 (US and Japan), Vuksic, 2005 (Croatia), Zhang, 2005 (China), Kneller and Pisu, 2007 (Britain), Buck et.al., 2007 (China), Gu et.al., 2008 (China), Sun, 2010 (China), Anwar and Nguyen, 2011 (Vietnam), Nguyen and Sun, 2012 (Vietnam), Sun, 2012 (China) and Chen et.al., 2013 (China) found that the existence of the multinational firms positively affected the exports of the domestic firms. However, Ruane and Sutherland, 2005 (Ireland) found that the export intensity of host-country enterprises was negatively associated with the export-sales ratios of foreign owned enterprises. Nguyen (2008) found that the domestic firms in Vietnam had no benefits from backward linkages to enter export markets as well as to increase their export value. Uddin (2010) confirmed that FDI cause export growth in long run and does not have any short run influence in Bangladesh and Pakistan. Phillips and Ahmadi-Esfahani (2010) found that foreign ownership neither increases nor decreases the probability that a firm will be involved in exporting in Australia.

Among Indian studies Aggarwal (2002), Banga (2006), Joseph and Reddy (2009), Prasanna (2010), Kuntluru et.al., (2012), Barua (2013) and Kemme et.al., (2014) analysed the impact of FDI spillovers on the export performance of domestic firms. Prasanna (2010), Barua (2013) and Kemme et.al., (2014) found that FDI positively affects the export performance of domestic firms. However, Aggarwal (2002) could not find any evidence of a positive relationship between foreign equity share and export performance of firms. Banga (2006) showed that FDI from the US has led to diversification of India’s exports; however Japanese FDI had no significant impact on India’s exports. Joseph and Reddy (2009) indicated that domestic firms were not benefitted in improving their export performance through any buyer-supplier linkages with the MNEs. Kuntluru et.al., (2012) showed that foreign ownership had a negative impact on export performance. The literature on the impact of FDI spillovers via backward and forward linkages on the productivity and export performance of Indian manufacturing sector is limited.

As it is clear from the theoretical work of Rodriguez-Clare (1996) FDI can also affect the export activities of domestic firms in upstream and downstream industries through vertical linkages. But many studies have focused on the export performance of domestic firms through horizontal linkages with foreign firms. Empirical studies viz., Kokko et.al., (2001), Alvarez and Lopez (2008) have found the impact of horizontal linkages on export performance to be positive and statistically significant which suggested that the presence of foreign firms promotes the export activities of domestic firms in the same sector. On the other hand, some studies like Aitken and Harrison (1999); Djankov and Hoekman (2000), Lutz et.al., (2003), Greenaway et.al., (2004) have found the impact on export performance to be zero or negative. Many studies viz., Blomstrom & Kokko (2003), Gorg and Greenaway (2004), Greenaway and Kneller (2004), Kneller and Pisu (2007), Sun (2009) have suggested that linkages between domestic and foreign firms can also affect the export performance of domestic firms (Anwar and Nguyen, 2011). Hence the empirical evidence is mixed.

The literature shows that there exists a high degree of persistence in the export behaviour of firms and suggested that it is related with sunk costs of export market entry. These sunk costs might include the establishment of distribution channels, international market research, and development of new product for global market (Kneller and Pisu, 2007). Foreign multinationals usually have better knowledge about international markets and foreign consumers than domestic firms do. However, such knowledge-based assets have public-good characteristics which the foreign multinationals find it hard to fully internalise them (Ruane and Sutherland, 2005). In other words, knowledge spillovers from FDI can reduce the entry cost of foreign market access for domestic firms, which can facilitate domestic firm's export market participation (Kneller and Pisu, 2007). These knowledge spillovers can occur between firms in the same industry, indicating intra-industry (horizontal) spillovers, and between firms in different industries, indicating inter-industry (vertical) spillovers (Kaiser, 2002).

In the current study the impact of horizontal and vertical FDI spillovers on the export performance of all domestic firms were analysed as follows: (a) the impact of horizontal and vertical FDI spillovers on the export participation and export share of all domestic firms (b) the impact of horizontal and vertical FDI spillovers on the export participation and export share of all domestic firms on the basis of structure of foreign ownership.

a. Impact of horizontal and vertical FDI spillovers on the export participation and export share of all domestic firms

Exporting activities involve a two stage decision process: (i) the firm decides whether to export or not and, (ii) then the amount that it is willing to export (export intensity). Therefore, to take into account the two stage process, the study adopted the standard Heckman selection model (Heckman 1979). The impact of horizontal and vertical FDI spillovers on the export participation and export share of all domestic firms were analysed using the following export decision and export intensity models 6 and 7.

$$dexp_{ijt} = \beta_0 + \beta_1 lnk_{ijt} + \beta_2 lnh_{jt} + \beta_3 lnb_{jt} + \beta_4 lnf_{jt} + \beta_5 lnhin_{jt} + v_i \quad (6)$$

$$lneix_{ijt} = \beta_0 + \beta_1 lnh_{jt} + \beta_2 lnb_{jt} + \beta_3 lnf_{jt} + \beta_4 lnhin_{jt} + \beta_5 lnrin_{ijt} + \beta_6 lntin_{ijt} + u_i \quad (7)$$

where subscript i refers to firm, j to industry and t to time. Moreover, $v_i \sim N(0,1)$ and $u_i \sim N(0,\delta)$. In the first equation the dependent variable ($dexp_{ijt}$) is a binary variable which is assigned value 1 if firms report positive exports and 0 in all other cases. In the second equation, the dependent variable is measured as export intensity (ei_{ijt}). The distribution of the error terms is assumed to be bivariate normal with correlation ρ. It means that the two equations are related if $\rho \neq 0$. It is for these reasons that estimating just the export intensity would lead to sample selection bias since the study was analysing how the presence of MNEs affects the export behaviour of all firms, not just the export oriented firms alone. Therefore, using simple OLS methodology to estimate the export intensity regression would result in inconsistent and biased coefficient estimates (Heckman, 1979).

The models 6, 7 and models 8, 9 were estimated using Heckman selection maximum likelihood methodology instead of the Heckman selection two step procedure since the maximum likelihood method is more efficient (Kneller and Pisu, 2007). The econometric analysis involves a two-stage decision process, using Heckman's maximum likelihood estimation to control for selection bias. The export intensity function estimated on selected samples of only exporters do not estimate population export intensity function. The presence of foreign multinationals affects the export decision behaviour of all domestic firms, not only exporting domestic firms (Greenaway et al., 2004). Therefore, if functions of export participation decision and export intensity decision of a firm are separately estimated, the problem of selection bias rises. Thus, jointly estimating the export intensity and the export propensity functions can avoid the sample selection bias.

In addition to the spillover variables the industry-level control variable such viz Herfindahl index (HHI) was included in both the equations ie., export participation decision and export intensity. The entry of multinational firms may decrease industry concentration, resulting in more competition. This competition effect forces domestic firms to improve their productivity, which may increase the probability of exporting as well as export intensity. Thus, the competition effect was separated from the spillover effects by including the Herfindahl index. The firm's capital was included only in export participation decision since this variable was more likely to influence the decision to export, but not export intensity. Capital implies the capital intensity which is more related to the possibility of exporting. In the export intensity equation firm level control variables like R&D intensity and technology import intensity are included since the firm's R&D activities and the firm's imported technology either by way of capital goods or foreign exchange spending on royalty/technical know-how may make the domestic firms competent to produce high technology and high quality products at competitive prices, which enable them to win the race in the global markets where giant MNEs are present.

Before using the Heckman selection maximum likelihood methodology for models 6 and 7 the models were tested for multicollinearity, heteroscedasticity and autocorrelation. The impact of horizontal and vertical FDI spillovers on the export performance were analysed only for all domestic firms and were not analysed for low technology firms and high technology firms due to multicollinearity. Though the test results for heteroscedasticity and autocorrelation for the models 6, 7 and models 8, 9 indicated the existence of heteroscedasticity and autocorrelation the Heckman selection maximum likelihood method was used for models 6 and 7; and models 8 and 9 because Schaffner (1999) argued that allowing for heteroscedasticity appears much more important than allowing for selection rule non-normality, and in which allowing for selection rule heteroscedasticity causes estimates of some parameters to become much more robust. Moreover, robust standard errors take care of the problem of heteroscedasticity. Further Klaauw and Koning (2003) put forth that in most cases the parameter estimates do not seem very sensitive to the distributional assumptions of the disturbances. Even in the event that the disturbances do not follow a normal distribution, maximum likelihood under the assumption of normality provide estimates close to true values.

Table 4.5.1 shows the results for the test on multicollinearity for all domestic firms using model 6.

TABLE – 4.5.1

TESTING FOR MULTICOLLINEARITY FOR ALL DOMESTIC FIRMS USING MODEL 6

Variable	Variance Inflation Factor (VIF)
lnb	2.37
lnhin	2.04
lnf	1.91
lnh	1.46
lnk	1.04
Mean VIF	1.76

Source: Computed using data from CMIE Prowess Database

NB: As a rule of thumb, a variable is said to be highly collinear if its VIF exceeds 10. The VIF of a variable will exceed 10 if its R^2 exceeds 0.90 (Gujarati, 2010)

The results presented in table 4.5.1 clearly indicated the non-existence of multicollinearity among the predictor variables used in model 6 since the values of VIF was less than 10.

Table 4.5.2 shows the results for the test on heteroscedasticity for all domestic firms using model 6.

TABLE – 4.5.2

TESTING FOR HETEROSCEDASTICITY FOR ALL DOMESTIC FIRMS USING MODEL 6

Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity	
H_0: Constant Variance Variables: Fitted Values of tfp	
Chi2(1) = 373.44	Prob>Chi2 = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.5.2 indicated the presence of heteroscedasticity. Since the estimated value (373.44) was greater than the probability value (0.0000) the null hypothesis was rejected. Hence it can be concluded that the error term does not have constant variance.

Table 4.5.3 shows the results for the test on autocorrelation for all domestic firms using model 6.

TABLE – 4.5.3

TESTING FOR AUTOCORRELATION FOR ALL DOMESTIC FIRMS USING MODEL 6

Wooldridge Test for Autocorrelation in Panel Data	
H_0: No First-Order Autocorrelation	
F(1,438) = 52.692	Prob>F = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.5.3 indicated the presence of serial correlation or autocorrelation. Since the estimated value (52.692) was greater than the probability value (0.0000) the null hypothesis that there was no first-order autocorrelation was rejected.

Table 4.5.4 shows the results for the test on multicollinearity for all domestic firms using model 7.

TABLE – 4.5.4

TESTING FOR MULTICOLLINEARITY FOR ALL DOMESTIC FIRMS USING MODEL 7

Variable	Variance Inflation Factor (VIF)
lnb	2.72
lnhin	2.46
lnf	1.70
lnh	1.53
lnrin	1.12
lntin	1.05
Mean VIF	1.76

Source : Computed using data from CMIE Prowess Database

NB: As a rule of thumb, a variable is said to be highly collinear if its VIF exceeds 10. The VIF of a variable will exceed 10 if its R^2 exceeds 0.90 (Gujarati, 2010)

The results presented in table 4.5.4 clearly indicated the non-existence of multicollinearity among the predictor variables used in model 7, because the values for VIF was less than 10 for all the variables used in the model.

Table 4.5.5 shows the results for the test on heteroscedasticity for all domestic firms using model 7.

TABLE – 4.5.5

TESTING FOR HETEROSCEDASTICITY FOR ALL DOMESTIC FIRMS USING MODEL 7

Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity	
H_0: Constant Variance Variables: Fitted Values of tfp	
Chi2(1) = 1.49	Prob>Chi2 = 0.2223

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.5.5 indicated the presence of heteroscedasticity. Since the estimated value (1.49) is greater than the probability value (0.2223) the null hypothesis was rejected. Hence it can be concluded that the error term does not have constant variance.

Table 4.5.6 shows the results for the test on autocorrelation for all domestic firms using model 7.

TABLE – 4.5.6

TESTING FOR AUTOCORRELATION FOR ALL DOMESTIC FIRMS USING MODEL 7

Wooldridge Test for Autocorrelation in Panel Data	
H_0: No First-Order Autocorrelation	
F(1,166) = 20.364	Prob>F = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.5.6 indicated the presence of serial correlation or autocorrelation. Since the estimated value (20.364) was greater than the probability value (0.0000) the null hypothesis was rejected.

The results of the Heckman selection maximum likelihood methodology for the model 6 and 7 for all domestic firms are presented in table 4.5.7.

TABLE – 4.5.7

RESULTS OF HECKMAN SELECTION MAXIMUM LIKELIHOOD METHODOLOGY FOR ALL DOMESTIC FIRMS (2001-2013)

Variables	Export Participation	Export Share
lnk	0.4184** (0.0182)	
lnh	0.0082 (0.0266)	-0.1999** (0.0389)
lnb	0.0469 (0.0250)	0.0458 (0.0383)
lnf	0.0691** (0.0150)	0.1337** (0.0195)
lnhin	-0.2312** (0.0590)	-0.3957** (0.0915)
lnrin		0.1244** (0.0267)
lntin		0.0924** (0.0237)
Observations	2914	2914
Wald test	210.76**	210.76**
Log Pseudolikelihood	-5023.87	-5023.87
ρ	0.13	0.13

Source : Computed using CMIE Prowess Database

NB: Figures in parentheses are Robust Standard Errors

***** denotes significance at 5 per cent level***

The results of the Heckman selection model using maximum likelihood method for export participation decision and export intensity for all the 2914 domestic firms shown in table 4.5.7 revealed that the domestic firms' capital positively influenced the host country's decision to export. An increase in capital of all the domestic firms' increased their probability to export (0.4184) by 41 per cent. Capital was considered to be positively related to both decision to export and export intensity (Franco and Sasidharan, 2009). Increase in capital of the domestic firms may help them to meet their sunk entry costs. Entry costs are typically the costs of gathering information needed to successfully export, such as information about foreign customer requirements, regulations, and distribution networks, as well as the costs of adjusting product characteristics to comply with product standards, developing a marketing strategy to attract customers, and negotiating contracts with foreign clients (Moxnes, 2010).

As far as the spillover variables were concerned the coefficient of the horizontal FDI spillovers though positive (0.0082) was statistically insignificant implying that the foreign firms in the same industry as that of the domestic firms do not affect the export decision of domestic firms. However the export share of all domestic firms was negatively influenced by the existence of foreign firms in the same industry implying that one per cent increase in the output of the foreign firms in the same industry decreases the export intensity of domestic firms (-0.1999) by 19 per cent. Joseph and Reddy (2009) found similar results which suggested that though both the domestic as well as the foreign firms belong to the same industry the foreign firms with their edge over the domestic firms with regard to production technology and management know-how, export more than the indigenous firms. Thus the MNEs try to crowd out the domestic firms in the same industry from the foreign markets. This may be because of the fact that since the foreign firms exist in the same industry as that of the domestic firms, they vie and succeed to capture markets in the foreign soil. Unlike the domestic firms, the foreign firms have better knowledge about the global markets and have the required technical and managerial know-how and hence succeed in exporting. Contrary to this, Anwar and Nguyen (2011) stated that the export share of domestic firms is greater in sectors where the presence of foreign firms is strong.

Further, the forward linkages tend to positively influence the domestic firms' decision to export. One unit increase in the output of the foreign firms in the upstream industries increases the probability of the domestic firms to export (0.0691) by six per cent. Likewise, the forward linkages positively influence the export share of all domestic firms (0.1337) by 13 per cent. The estimated results show that the domestic firms can gain access to new, improved, or less costly intermediate inputs produced by foreign firms. The foreign firms in the upstream industries supply quality inputs at competitive prices to the domestic firms and this helps the indigenous firms to produce goods at low prices. When the domestic firms' use quality inputs produced by foreign firms, the quality of the final products produced by the indigenous firms also improves. This again enhances the competency and competitiveness of the indigenous firms and encourages them to export more. As a result, the forward linkages can encourage domestic firms to enter the export market and helps them to increase their exports. Hence, the forward linkages of foreign firms with the domestic firms encourage the later to export by making their goods competitive in the export market (Anwar and Nguyen, 2011).

The results of the backward spillovers in table 4.5.7 revealed that the presence of foreign firms in the downstream industries does not influence the export participation and export intensity of domestic firms because the coefficients of backward linkages are positive but not statistically significant.

As far as the industry-level control variable Herfindahl index was concerned an increase in this index indicates a higher degree of industry concentration which reflects less competition (Malik, 2015). Hence, a decline in competition in the home market reduces incentives for exporting. The coefficient of the Herfindahl index was negative for the domestic firms' export decision (-0.2312) and export intensity (-0.3957) models which implies that a decrease in competition in the industry reduces the domestic firms' probability to export by 23 per cent and its export share by 39 per cent. The results indicated that less competition in the industry will make the domestic firms comfortable in the home market without exploring a market abroad.

To operate and compete in international markets, firms need to produce technologically advanced quality products. Hence, the level of technological activities (both the domestic firms' in-house research and development expenditure and their technology import intensity) was anticipated to have a positive and significant influence on the competitiveness (Franco and Sasidharan, 2009) of the domestic firms in the foreign markets. The firm specific variables viz., R&D intensity shown in table 4.5.7 was positive and statistically significant for all domestic firms. This implied that an improvement in the firm's in-house technology (R&D intensity) i.e., an increase in the R&D expenditure of the domestic firms increases (0.1244) the export share of all domestic firms by 12 per cent. Moreover, the indigenous firms' import of capital goods and expenditure on royalty and technical know-how increases the export intensity of all domestic firms (0.0924) by nine per cent. This result implies that an increase in the R&D intensity and technology import intensity improve the absorptive capacity of the indigenous firms which enable them to absorb the knowledge spillovers or export spillovers from their MNE counterparts.

b. Impact of horizontal and vertical FDI spillovers on the export participation and export share of all domestic firms on the basis of structure of foreign ownership

The impact of horizontal and vertical FDI spillovers on the export participation and export share of all domestic firms on the basis of structure of foreign ownership was analysed using the following export decision and export intensity models 8 and 9.

$$dexp_{ijt} = \beta_0 + \beta_1 lnk_{ijt} + \beta_2 lnmjh_{jt} + \beta_3 mnh_{jt} + \beta_4 lnmjb_{jt} + \beta_5 lnmnb_{jt} + \beta_6 lnmjf_{jt} + \beta_7 lnmnf_{jt} + \beta_8 lnhin_{jt} + v_i \quad (8)$$

$$lneix_{ijt} = \beta_0 + \beta_1 lnmjh_{jt} + \beta_2 mnh_{jt} + \beta_3 lnmjb_{jt} + \beta_4 lnmnb_{jt} + \beta_5 lnmjf_{jt} + \beta_6 lnmnf_{jt} + \beta_7 lnhin_{jt} + \beta_8 lnrin_{ijt} + \beta_9 lntin_{ijt} + u_i \quad (9)$$

Before using the Heckman selection maximum likelihood methodology for models 8 and 9 the models were tested for multicollinearity, heteroscedasticity and autocorrelation. The impact of horizontal and vertical FDI spillovers on the export performance on the basis of structure of foreign ownership were analysed only for all domestic firms and were not analysed for low technology firms and high technology firms due to multicollinearity.

Table 4.5.8 shows the results for the test on multicollinearity for all domestic firms using model 8.

TABLE – 4.5.8

TESTING FOR MULTICOLLINEARITY FOR ALL DOMESTIC FIRMS USING MODEL 8

Variable	Variance Inflation Factor (VIF)
lnmjf	3.72
lnmnf	3.57
lnmnb	3.20
lnmjb	3.05
lnmnh	3.01
lnmjh	2.61
lnhin	2.19
lnk	1.02
Mean VIF	2.80

Source: Computed using data from CMIE Prowess Database

NB: As a rule of thumb, a variable is said to be highly collinear if its VIF exceeds 10. The VIF of a variable will exceed 10 if its R^2 exceeds 0.90 (Gujarati, 2010)

The results presented in table 4.5.8 clearly indicated the non-existence of multicollinearity among the predictor variables used in the regression model 8 since the values of VIF was less than 10.

Table 4.5.9 shows the results for the test on heteroscedasticity for all domestic firms using model 8.

TABLE – 4.5.9

TESTING FOR HETEROSCEDASTICITY FOR ALL DOMESTIC FIRMS USING MODEL 8

Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity	
H_0: Constant Variance Variables: Fitted Values of tfp	
Chi2(1) = 395.36	Prob>Chi2 = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.5.9 indicated the presence of heteroscedasticity. Since the estimated value (395.36) was greater than the probability value (0.0000) the null hypothesis was rejected. Hence it can be concluded that the error term does not have constant variance.

Table 4.5.10 shows the results for the test on autocorrelation for all domestic firms using model 8.

TABLE – 4.5.10

TESTING FOR AUTOCORRELATION FOR ALL DOMESTIC FIRMS USING MODEL 8

Wooldridge Test for Autocorrelation in Panel Data	
H_0: No First-Order Autocorrelation	
F(1,359) = 38.856	Prob>F = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.5.10 indicated the presence of serial correlation or autocorrelation. Since the estimated value (38.856) was greater than the probability value (0.0000) the null hypothesis that there was no first-order autocorrelation was rejected.

Table 4.5.11 shows the results for the test on multicollinearity for all domestic firms using model 9.

TABLE – 4.5.11

TESTING FOR MULTICOLLINEARITY FOR ALL DOMESTIC FIRMS USING MODEL 9

Variable	Variance Inflation Factor (VIF)
lnmjf	4.34
lnmnb	3.82
lnmjb	3.80
lnmnf	3.78
lnmnh	3.10
lnmjh	2.53
lnhin	2.17
lnrin	1.41
lntin	1.20
Mean VIF	2.91

Source: Computed using data from CMIE Prowess Database

NB: As a rule of thumb, a variable is said to be highly collinear if its VIF exceeds 10. The VIF of a variable will exceed 10 if its R^2 exceeds 0.90 (Gujarati, 2010)

The results presented in table 4.5.11 clearly indicated the non-existence of multicollinearity among the predictor variables used in the model 9, because the values for VIF was less than 10 for all the variables used in the model.

Table 4.5.12 shows the results for the test on heteroscedasticity for all domestic firms using model 9.

TABLE – 4.5.12

TESTING FOR HETEROSCEDASTICITY FOR ALL DOMESTIC FIRMS USING MODEL 9

Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity	
H_0: Constant Variance Variables: Fitted Values of tfp	
Chi2(1) = 108.58	Prob>Chi2 = 0.0000

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.5.12 indicated the presence of heteroscedasticity. Since the estimated value (108.58) was greater than the probability value (0.0000) the null hypothesis was rejected. Hence it can be concluded that the error term does not have constant variance.

Table 4.5.13 shows the results for the test on autocorrelation for all domestic firms using model 9.

TABLE – 4.5.13

TESTING FOR AUTOCORRELATION FOR ALL DOMESTIC FIRMS USING MODEL 9

Wooldridge Test for Autocorrelation in Panel Data	
H_0: No First-Order Autocorrelation	
F(1,134) = 14.821	Prob>F = 0.0002

Source: Computed using the data from CMIE Prowess Database

The results presented in table 4.5.13 indicated the presence of serial correlation or autocorrelation. Since the estimated value (14.821) was greater than the probability value (0.0002) the null hypothesis was rejected.

The literature suggested that the existence of foreign firms may influence the productivity and export performance of the indigenous firms. Such spillovers may come from the majority-owned foreign firms or from the minority-owned foreign firms. Hence, the current study analysed as to which type of foreign firm i.e., the majority-owned foreign firms or the minority-owned foreign firms which causes the spillover effects. Therefore, the export participation decision and export share of the domestic firms were investigated with the structure of foreign firms.

Table 4.5.14 shows the results of the Heckman selection maximum likelihood methodology using model 8 and 9 for all domestic firms.

Table 4.5.14 shows the export performance of the domestic firms on the basis of the structure of foreign ownership. The results revealed that capital positively influenced the export decision of the domestic firms. The findings suggested that one per cent increase in the capital of the domestic firms increased their export participation (0.3845) by 38 per cent. This implies that the increase in capital helps the domestic firms to meet the sunk entry costs in exporting and encourages them to explore the foreign markets. The coefficients of the Herfindahl index was negative both for the export participation and export intensity models which implied that as the competition in the industry decreases, the domestic firms' export participation reduces (-0.5493) by 54 per cent and the export share diminishes (-0.4529) by 45 per cent. The results indicated that less competition in the industry will not induce the

TABLE – 4.5.14

RESULTS OF HECKMAN SELECTION MAXIMUM LIKELIHOOD METHODOLOGY FOR ALL DOMESTIC FIRMS ON THE BASIS OF STRUCTURE OF FOREIGN OWNERSHIP (2001-2013)

Variables	Export Participation	Export Share
lnk	0.3845** (0.0208)	
lnmjh	-0.0730** (0.0258)	-0.3578** (0.0394)
lnmnh	-0.2963** (0.0413)	-0.5102** (0.0600)
lnmjb	-0.0702** (0.0308)	0.0304 (0.0487)
lnmnb	0.1561** (0.0356)	0.0371 (0.0609)
lnmjf	-0.1310** (0.0253)	0.0968** (0.0392)
lnmnf	0.2647** (0.0411)	0.0023 (0.0687)
lnhin	-0.5493** (0.0702)	-0.4529** (0.1170)
lnrin		0.1947** (0.0323)
lntin		0.0655** (0.0270)
Observations	2329	2329
Wald test	369.83**	
Log Pseudolikelihood	-3883.59	
ρ	0.23	

Source : Computed using CMIE Prowess Database

NB : Figures in parentheses are Robust Standard Errors

***** denotes significance at 5 per cent level***

domestic firms to explore a market abroad. When it comes to the R&D intensity and the technology import intensity in the export share model, the coefficients of both these variables were positive and statistically significant indicating that one per cent increase in the domestic firms' R& D expenditure increases their export share (0.1947) by 19 per cent and a per cent increase in the technology imports of the domestic firms increases their export intensity (0.0655) by six per cent. It is a well known fact that the technology intensity of the domestic firms helps them to absorb the spillovers from the foreign counterparts and reap the benefits of such spillovers. One important observation from the result was that the domestic firms' in-house R&D capabilities help them to increase their quantum of exports more, than by importing technology.

As far as the spillover variables were concerned the horizontal spillovers both from the majority-owned and minority-owned foreign firms had a negative influence on the export participation and export intensity of the domestic firms because the spillovers from foreign firms in the same industry would be less when compared to the vertical spillovers from the upstream or downstream industries. The majority-owned foreign firms in the same industry as that of the domestic firms reduced the export participation (-0.0730) by seven per cent and decreased the export share (-0.3578) by 35 per cent. The minority-owned foreign firms in the same industry reduced the export participation (-0.2963) by 29 per cent and decreased the export share (-0.5102) by 51 per cent. The results indicated that the foreign firms will have the tendency to prevent the technology leakage to domestic firms since both operate in the same industry (Malik, 2015).

With regard to the backward FDI spillovers, it was the spillovers from the minority-owned foreign firms that positively influenced the export performance of the indigenous firms. This implies that an increase in the output of the minority-owned foreign firms in the downstream industry increases the export participation of indigenous firms (0.1561) by 15 per cent. This may be because of more local participation in minority-owned foreign firms which allows for spillovers when they procure intermediate inputs from indigenous firms. But, the existence of the majority-owned foreign firms in the downstream industry reduces the export participation of domestic firms (-0.0702) by seven per cent. However, the backward FDI spillovers do not have any influence on the export share of the domestic firms since the coefficients of the majority-owned and minority-owned foreign firms are positive but not statistically significant.

Considering the forward FDI linkages, it was observed that it was the spillovers from the minority-owned foreign firms which positively influenced the export decision of the domestic firms. The results showed that one per cent increase in the output of the minority-owned foreign firms in the upstream industries increased the export participation of the domestic firms (0.2647) by 26 per cent. This may be due to the majority local participation in the minority-owned foreign firms which causes the spillovers to occur. On the other hand, one per cent increase in the output of the majority-owned foreign firms in the supplying industry reduces the export participation of the indigenous firms (-0.1310) by 13 per cent. The reason was obvious that the local ownership in the majority-owned foreign firms was less which hinders the spillover effect. Contrary to this result, the export spillovers from the majority-owned foreign firms had a positive influence on the export intensity of the domestic firms i.e., one per cent increase in the output of the majority-owned foreign firms in the upstream industry increases the export share of the indigenous firms (0.0968) by nine per cent. The reason for this may be accorded to the intensive exporting activity of the majority-owned foreign firms. It is a well known fact that the foreign-owned firms apart from marketing within the host country they may try to find markets across the world. Since the foreign ownership in the majority-owned foreign firms was high the MNEs with their knowledge on the foreign markets, superior technology and high quality products stand out in the foreign markets. The firms in the host country follow these MNEs either by imitating or by observing their exporting activities. Hence it could be concluded that the export participation of the domestic firms was influenced by the minority-owned foreign firms in the upstream and downstream industries. However, the export share of the indigenous firms was influenced by the majority-owned foreign firms.