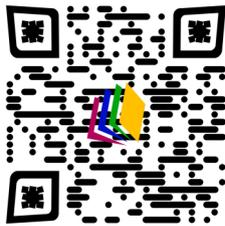


e-ISSN: 2582-502X

Asiatic Society for Social Science
Research. 2(2): Dec 2020, 116-143.

Research Article



www.asssr.org

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(Peer Reviewed)

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Received on 29.11.2020

Modified on 30.12.2020

Accepted on 08.01.2021

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A Review of Determinants for the Spillover Effects of FDI in the Industrial Sector: Evidence from the Recent Studies in India

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ABSTRACT:

The purpose of this study is to provide recent literature review on determinants of the spillover effects of FDI in the manufacturing sector in India. This study is, therefore, an attempt to provide the recent literature findings on the determinants representing the foreign presence in the form of foreign firms and its effects on the domestic firms, mainly resulting in the horizontal, backward and forward integration in the industrial sector. It further tries to explore the determinants that are in line with various theoretical backgrounds of FDI and tries to find out best explaining the theoretical model to the spillover effects of FDI in the industrial sector. Content analysis is used for the available literature to streamline various related theories and to identify the research gap in the said area. The importance of the literature review is reflected in the predominance of spillover studies in developed countries and evidence that most of the studies are based on empirical data and used industry specific but not firm-specific variable and provides more on the industry, product, and country-specific variable though which technology gets transferred from the foreign firm to the domestic firm.

KEY WORDS: FDI, Manufacturing Industry, Spillover Effects, Literature Review, Technology Transfer.

1. Introduction

The recent world has witnessed major changes that are taking place in the fields of technology, Foreign Direct Investments (FDIs), trade and development strategies. Capital movements across countries in the form of FDI have been one of the prime features of global economic integration. (G. and Reddy, 2018, p.56.) The benefits from FDI are reflected in the form of increase in exports and higher employment level in the host economy. Nonetheless, there is an entire phenomenon of indirect benefits visible in the form of productivity, operational efficiency, and profitability of the firms in the host economies. This

phenomenon of indirect benefits takes place through positive externalities and can be termed as the spillover effect of the foreign presence in the form of the FDI. As a result of these positive technological spillovers, FDI can be seen as a major source of technology and other firm-specific benefits (networks, organisational skills, etc) which result in increasing productivity and competitiveness among the domestic manufacturing firms. (Mondal and Pant, 2014, p.57.) The purpose of this study is an attempt to synthesize the recent literature findings on the determinants of the spillover effects of the FDI in Indian manufacturing sector. From the outset of the Second Five-Year Plan (1956-61), the industrial sector has always played a pivotal role in shaping the growth prospects of the Indian economy, according to The Economic Times (2019) it is the FDI in the manufacturing sector that is going to drive Indian economic growth the following decade. The government policy pursued until 1990 generally restricted FDI to technology-intensive branches of manufacturing industry. (Kumar, 1998, p.1325.).

A great deal of interest in attracting FDI with the hope of gaining substantially from it in the form of transfer of technology and knowledge lies with the industrial sector of the developing countries. The sub-section 1.1 begins with the definition of FDI in the Indian context. The literature on studies exploring the relationship between FDI and economic growth is presented in sub-section 1.2. The significant literature which provide the explanation and reflects the major approaches to lay the economic theories explaining the theoretical determinants of FDI is presented in sub-section 1.3. Section 2 sheds lights on spillover effects of FDI and the subsection 2.1 presents with channels with which these indirect effects takes place. In the section 2.2, a brief discussion has been made on the

significant studies on the spillover effects of FDI. The literature review representing the foreign presence and its effects on the domestic firms resulting in the horizontal, backward and forward integration in the industrial sector are discussed in the section 2.3 that also explore the determinants that are in line with various theoretical backgrounds. The concluding remarks of the study are presented in section 3.

1.1 Definition

The OECD's *Benchmark Definition of Foreign Direct Investment (2008)* and the IMF *Balance of Payments Manual (2009)* has acted as a fundamental guide to define FDI to match the best international practices which made *Master Directions* of RBI accordingly to state that FDI is the investment through capital instruments by a person resident outside India (a) in an unlisted Indian company; or (b) in 10 percent or more of the post issue paid-up equity capital on a fully diluted basis of a listed Indian company. Following Standard Statistical Requirements of OECD and BPM, RBI's *Report of the Committee on Compilation of FDI in India (2002)* marked that FDI has following three components namely (i) *Equity Capital* which is the foreign direct investor's purchase of shares of an enterprise in a country other than its own. (ii) *Reinvested Earnings* comprising the direct investors' share (in proportion to direct equity participation) of earnings not distributed as dividends by affiliates, or earnings not remitted to the direct investor. Such retained profits by affiliates are reinvested and (iii) *Intra-company Loans or Intra-company Debt Transactions* referring to short-term or long-term borrowing and lending of funds between direct investors (parent enterprises) and affiliate enterprises.

1.2 FDI and Economic Growth

From the outset of the current millennium, literature on the FDI and economic growth based on the empirical evidence in the developed as well as the developing countries gives the impression of increased emphasis and a predisposition to the frameworks of theories of the economic growth. The neo-classical growth model put forward by Solow-Swan (1956,1957) assigned the exogenous factors such as inputs i.e. capital input and labour input along with the technology transfers brought by FDI to the host economies mainly responsible for economic growth in the host economies. According to this theory increases in the capital stock in the host country; and this would in turn, affect economic growth. (Mahembe and Odhiambo,2014, p.64).

The policies based on neo-classical growth model treated technological transfer as an exogenous variable laid a greater role on the quantity of FDI i.e. an increase in the amount of the FDI suffices for the economic growth but irrespective of its popularity, a better version of the explanation of the long run economic growth has been offered by Romer (1990) by pointing at the construct of knowledge based innovation explained with the help of education and R&D expenses of the host economies. Nair-Reichert and Weinhold (2001) argued that as per the conditions of the new endogenous growth models, long run economic growth is to be presented as a function of technological progress incurred through technology transfer, diffusion and spillover effects. Under the umbrella of the endogenous growth theory widely cited studies on the empirical analysis on the relationship between FDI inflows and economic growth in the developing as well as developed nations include Balasubramanyam et al. (1996) finding a positive relation between FDI and growth

on the basis of trade policy, Borensztein et al (1998);Olofsdotter (1998) and De Mello (1997,1999) emphasizing the role of human capital and absorptive capacity while addressing on the positive relation between growth and FDI. With a predominant focus on the aggregate variables in the economy, Nair-Reichert and Weinhold (2001) reflected on the macroeconomic role of Gross Domestic Product, trade orientation and inflation in generating a positive relation of FDI and growth whereas Bengoa and Sanchez-Robles (2003) pointed at liberalization and stability at the macroeconomic level as crucial elements while suggesting a positive relation between growth and FDI. Alfaro et al. (2004) and Durham (2004) acknowledged the role of the financial markets as the promoter of FDI induced economic growth. In Li & Liu (2005), FDI and technology gap shared a significant negative relationship while FDI and economic growth via human capital showed a significant positive relationship.

Economic and institutional factors explained the positive relation between FDI and growth in Vu, Gangnes and Noy (2008). In fairly recent studies, Iamsiraroj &Ulubaşoğlu (2015), Pegkas (2015) and Sunde (2017) confirmed FDI led growth hypothesis in the host country. On the other hand, there are studies that put forward negative and mixed results while inspecting a relationship between and growth ,for instance, Carkovic and Levine (2002) concluded that microeconomic studies shed pessimistic evidence on the growth-effects of FDI in general while many macroeconomic studies find a positive link between FDI and growth;Herzer (2012) remarked that negative effect of FDI found for many countries could be well rectified with the economic reforms aimed at political and economic stability; Belloumi (2014) emphasized on regional integration, educational reforms and financial

system reforms, and infrastructure for eliminating the negative relation between FDI and growth; and Gunby et al. (2017) could not find any significant evidence of a positive relationship between accumulation of FDI and economic growth. Unanimously, these studies suggest determinants of the FDI being able to get influenced factors such as the level of the human capital, presence of higher absorptive capacity, presence of the liberalised financial market, domestic investment, export orientation, technical gap, institutional quality, market distortions, property rights etc. in the host economies. Also, contributions to the literature, provided with the observations referring at the methodological problems pertaining to the use of different samples, choice of theoretical framework and the empirical model to be estimated that might be leading to failure in identifying the essential factors ensuing omitted determinants that could influence the results of explaining the relationship between FDI and economic growth thereof.

1.2 An overview on the Theories of FDI

This section tries to provide the fundamental literature on FDI theories, that would provide us to identify the major elements that affected new approaches to FDI via the investing agents, and lay the economic theories acting as an explanation to the theoretical determinants of FDI, which are driven by the behaviour and the motivations of the investing agents or MNEs (Multinational Enterprises). In order to understand the identifiable factors of FDI it must be understood that the concerned literature does not support the existence of a general theory of FDI but as a journey of the evolution of various theories as a repeated process of attaching some new basics to the existing ideas and the disapproval of the previous assumptions. Therefore, it is important to go through the basic theories of FDI in order to get the essence of the

factors explaining the relationship hypothesized in the form of the constructs and the determinants. Table 1.1 provides a chronological rundown of description of various authors and their contributions to the theory of FDI. The standard classification of the theoretical responses to the exploration of various school of literature for FDI, has been incorporated by the Agarwal (1980); Moosa (2002); Denisia (2010); and Bajrami & Zeqiri (2019) into two main categories comprising of i) *theories assuming the perfect markets*; according to which FDI was driven by the profitability abroad, with the assumption of perfect competition in the goods and factor market that majorly include the earlier trade based models proposed by Heckscher-Ohlin (1933); Mundell (1957); Aliber (1970,1971); and Tobin (1958) & Markowitz (1959) whereas ii) *theories assuming the imperfect markets* were majorly reflected in the studies of Hymer (1976) highlighting the firm specific advantages; first identified by Bain (1956) and extended by Kindleberger (1969).

However, Dunning's (1977,1979) *Eclectic Paradigm* as acted as the guide for explaining the *Ownership, Locational and Internalisation* specific determinants of FDI. The literature also pointed to the fact that, earlier studies harnessed the cross-sectional data following exogenous growth model of Solow-Swan (1956,1957), but with the increased emphasis on considering technology being an endogenous factor explained by the human capital, better estimates of the growth, productivity and competitiveness etc. have been disposed by panel data analysis. With *New Growth Theory* acting as a guiding principle, growth promoting factors are increasingly being identified with treatment of endogeneity of the variables in the methodology itself in the ongoing studies..

Table 1.1: The fundamental theories of FDI and MNCs

| S.No. | Author (Year) | Theoretical Contribution |
|-------|-----------------------------------|--|
| 1. | Heckscher-Ohlin (1933) | Gave the Factor-Price Equalisation theorem and implied that with factor mobility, capital should flow mainly from capital-intensive countries to capital-poor countries having low capital-output ratio so that relative as well as absolute factor prices (for e.g. wages and rent) are in an equilibrium. |
| 2. | Bain (1956) | Brought forward the idea of <i>incumbent oligopolists behaving collusively</i> and the theory of firm reflected extensively in Hymer's (1976) study of locational advantages. |
| 3. | Mundell (1957) | Tried to explain the FDI through a model of international trade involving two countries, two goods, two production factors and two identical production functions in both countries, where production of a good requires a higher proportion of a factor than the other. |
| 4. | Solow-Swan (1956,1957) | Pioneered <i>exogenous growth theory</i> or the <i>neo classical growth model</i> latter used to explain the relation between FDI as exogenous factor for economic growth of a country. |
| 5. | Tobin (1958) and Markowitz (1959) | <i>With Theory of Portfolio Selection</i> , FDI was explained to take place due to difference in the rate of return and risk diversification among different countries. |
| 6. | MacDougall (1960) | Viewed FDI through MNCs taking place in the host countries on the account of capital arbitrage. |
| 7. | Jorgenson (1963) | Tested the Market Size Hypothesis and that stated that volume of FDI in the host country depends on its market size measured by sales or the GDP of that country. |
| 8. | Vernon (1966) | Stated the locational motive of FDI through <i>Product life-cycle</i> theory, reflected that MNCs set up production facilities abroad for products that had already been standardized and matured in the home markets. |
| 9. | Aharoni (1966) | Formulated the <i>Behaviour theory</i> of FDI claiming that foreign investment was induced by the loss of competitiveness. |
| 10. | Kindleberger (1969) | Extended Hymer's <i>Industrial Organisation Hypothesis</i> by incorporating firm specific comparative advantage. |
| 11. | Johnson (1970) | Provided the <i>Knowledge</i> theory of FDI, explaining the pattern of international production in terms of the distribution of knowledge between firms of different nationalities. |
| 12. | Aliber (1970,1971) | Emphasized on the relative strength of various currencies based on their economic stability, as important factor in attracting FDI. |
| 13. | Knickerbocker (1973) | Developed the theory of <i>oligopolistic reaction</i> in explaining the FDI as a reaction to rival firms investing in the home country. |
| 14. | Caves (1971, 1974) | Considered the formulation of theories of FDI focusing on the product differentiation, entrepreneurial capacity and multi-plant economies etc. |
| 15. | Williamson (1981) | Put forward the Coase's (1937) <i>Transaction Cost</i> theory of FDI in describing the motives and determinants underlying the FDI. |
| 16. | Hymer (1976) | Laid the milestone in theorising the need of FDI based on the microeconomic aspects of firm-specific advantages such as superior technology, brand name, know-how, patents, management skills, superior organizational set-up and monopolistic power etc. with an emphasis on the ownership advantages. |
| 17. | Buckley and Casson (1976) | Introduced the phenomenon of the market failure and the creation of the internal market, leading to the formulation of theory of <i>Internalisation</i> . |
| 18. | Kojima (1973,1975,1985) | Hypnotised the macroeconomic approach classifying FDI as means of transferring capital, technology and managerial skills from the home country to the host country. |
| 19. | Hirsh (1976) | Put forward the <i>International Trade and Investment theory</i> with firm as the decision-maker to invest in the host economy. |
| 20. | Dunning (1977,1979) | Developed the eclectic paradigm or the OLI paradigm with <i>Ownership</i> (O) advantage (industrial organisation theory), <i>Location</i> (L) advantages (international immobility of some factors of production) and <i>Internalisation</i> (I) advantage (transaction cost economics) explaining different types of FDI. |
| 21. | Rugman (1980) | Given <i>Risk Diversification</i> theory of the firm explaining risk as an important locational factor in explaining FDI. |
| 22. | Hennart (1982,1991) | Brought forward the concept of <i>horizontal integration</i> as well as the vertical internalisation on the basis of thee technology transfer |
| 23. | Ethier (1986) | Applied the Coase (1937) approach to FDI and stated that the optimal degree of internalization, reflects a balance between the transactions costs of using the market and the organizational costs of a firm. |
| 24. | Romer (1990) | Contributed to the development of the <i>New Growth Theory</i> with <i>endogenous</i> technological change explaining effects of internal processes such as human capital, innovation and investment capital in host economies in the recent studies. |
| 25. | Lael (1997) | Developed <i>Proximity-Concentration trade-off</i> theory between the advantage of market <i>Proximity</i> through FDI and the <i>Concentration</i> of production facilities. |
| 26. | Petit and Sanna-Randaccio (2000) | Emphasized on the tendency of MNCs as the major investor of R&D, advertising promoting knowledge and goodwill. |
| 27. | Dunning (2001) | Proposed for internationalization of R&D aimed at increasing the existing knowledge capital advantages created at home country also known as asset creating whereas asset-exploiting R&D signified MNE using technological and capital knowledge created at home to increase value creation. |

Source: Compiled by the author.

2. What are the Spillover Effect of FDI?

The foreign presence of various MNCs has a direct as well as an indirect effect on the domestic or the indigenous firms. In Buckley et al. (2007), the direct effect of inward FDI refers to its impact on the productivity of FDI-recipient firms, while the indirect effect refers to the impact of foreign firms' presence on the productivity of indigenous firms i.e., productivity spillovers from foreign to indigenous firms. The spillover effects are the positive externalities of the source economy's capabilities taking place in the host economy's firms and then industry as a result of foreign presence in the form of MNEs, allowing the exchange and diffusion of knowledge, technology, and experience from the source economies to the host country. The spillover effect process, as suggested by various studies, is induced in the form of technological linkages that occur with the foreign entry and foreign presence in the form of MNEs in the host countries.

Recently, Rijesh (2015) identified three types of spillover effects, (i) the *productivity spillovers* defined as the externalities from FDI, not internalized by the MNEs, leading to increase in the productivity of domestic firms as studied by Aitken & Harrison (1999); Torlak (2004); and Proenca, Fontoura, and Crespo (2006). Acknowledging the indirect benefits (ii) *market access spillovers* which also studied by in Blomstrom & Kokko, (1998) takes place when the presence of FDI generates an opportunity for domestic firms to access international markets and (iii) the *pecuniary spillovers* as noted by Gorg & Strobl (2005), incur if the existence of FDI affects the profit functions of domestic firms through a reduction in costs or an increase in revenues. The channels of these spillover effects are discussed in the next section.

2.2 Channels of Technological Spillover Effects of FDI

According to Blomström *et. al.* (1999) in order to examine the spillover effects through statistical studies, the potential transmission channels are needed to be studied. Therefore, for the spillover effects to occur channels and linkages between domestic and foreign firms taking place in the host economy have to be noted. Crespo and Fontoura (2007) broadly identified five of such major channels for the transfer of productivity spillovers namely demonstration or imitation effect; labor mobility; exports; competition; backward and forward linkages between foreign and domestic firms in the host country. These channels are collectively manifested by horizontal and vertical linkages between the domestic firms and multinationals resulting in horizontal and vertical spillovers. While the horizontal spillover refers to the spillover of the technology within the industry where the foreign investment takes place, vertical spillovers focus on the transfer and diffusion of technology among the industries. (Pant and Srivastava, 2015, p.184). Therefore, the major categories of technological spillover effects can be classified as following:-

(i) Horizontal (intra-industry) Spillovers

The entry of foreign firms may lead to increases in the productivity of the domestic firms in the same industry through various means. These intra-industry spillover effects, according to Blomström *et al.* (1999) might occur, due to channels of (i) *Competition* (ii) *Demonstration and Imitation effects* (iii) *Transfer of technology and R&D* (iv) *Human Capital and Labour turnover* (v) *Industrial management*. Among these channels, when the domestic firms face competition from more productive foreign-owned firms and are bound to improve their own performance in order to survive

and compete with the foreign-owned firms successfully, competition effects take place. As studied by Aitken and Harrison (1999), competition from the foreign firm has the potential to put a negative impact on indigenous firms' productivity, especially in the short run. Then, it is through *demonstration effects* that learning of domestic firms through imitation from foreign-owned firms let them to observe MNEs operating at a higher level of technology and with *labor mobility effects*, spillovers may occur whereby workers trained by or working in multinationals decide to leave and join an existing domestic firm or open up a new enterprise taking knowledge and training of the multinational. These people make a substantial contribution by raising productivity when working for local firms or when setting up new entrepreneurial businesses. (Sinani & Meyer, 2004, p.448.)

(ii) Vertical (inter-industry) Spillovers

The vertical or inter-industry spillover arise mainly by the customer-supplier relationship operating both at the upstream sector resulting in forward spillover and downstream sector resulting in backward spillover.

(a) Backward Spillovers

Backward spillovers take place when backward channels result in multinationals assisting the local suppliers by sourcing raw materials and components from them and compelling them to pursue competence with technological assistance and training programs.

(b) Forward Spillovers

With the forward linkage, foreign firms or the multinationals sell their products for input production in local-buyer firms in the host country and with high-quality materials local buyer firms

are able to extract productivity benefits resulting in forward spillovers.

2.3 Major Studies on the Spillover Effects

The early traces of the existence of the literature on questioning the determinants explaining the indirect effects of the FDI through multinational corporations can be found in *Theory of Industrialization Organization* by Hymer (1976). However, the presence of widely cited literature on the spillover effects provides an insight into understanding the nature of the determinants based on either the firm specifications or the industry specifications which are to be employed while analyzing the spillover effects due to foreign presence. Among the major studies, Caves (1971,1974); Globerman (1979); Blomström and Persson (1983); and Blomström (1986) represent works with the cross-sectional data finding positive horizontal spillover effects with emphasis on the industry specific variables.

Furthermore, Chuang and Lin (1991), Blomström and Wolff (1994), Kokko (1994), Blomström and Sjöholm (1999), Kokko (1996), Sjöholm (1999a) (1999b) Driffield (2001), Liu et al. (2001) Li et al. (2001), Buckley et al. (2002) and Schoors and Van der Tol (2002) put no end to the cross-sectional investigations as most of them found the evidence of positive productivity spillover resulting from the presence of horizontal channels in the domestic firms of the host countries.

However, the insufficiencies of the cross-sectional data due to the presence of endogenous factors led to the adoption of the panel database focusing on the firm specific variables, for instance, Haddad and Harrison (1993); Aitken and Harrison (1999); Flores, Fontoura and Santos (2000); Djankov and Hoekman (2000); Girma et al. (2001);

Konings (2001);and Barrios and Strobl (2002) found the results turning out to be either contradictory, inconclusive and mixed as compared to cross-sectional data based findings of other studies. Besides, the prominent studies targeting the existence of backward and forward linkages such as Yudeva et al. (2003); Javorcik and Spatareanu (2003); Javorcik (2004); Harris and Robinson (2004); Blalock and Gertler (2005); Schoors and Van der Tol (2002) ;and Merlevede and Schoors (2005) also focused on the firm specific variables.

2.4 Literature review of the Studies on the Determinants of Spillover Effect of FDI in Indian Industries.

In the table 2.1, the literature review of the diverse recent studies on spillovers effects of FDI in various sectors of the Indian industry is presented. The studies prior to the year 2000 have not been emphasized on the account of greater leniency towards the recent and important studies selected from the beginning of the current millennium. These studies are fundamental in understanding the factors and determinants and explaining technological paradigm shifts and changes especially in the Indian context. The Table 2.1 summarises each of the select studies starting with the name of the author (the year of publication) and put forward the level of aggregation i.e. nature of the data used in the respective studies along with the number of observations at the firm/industry level in India. Furthermore, the methodology mentions the econometric methods used in quantifying the data to arrive at the findings whereby the conclusion sums up the main findings of the select studies.

It is the result of such exploration that determinants of FDI spillovers in the case of the industrial sector

in India can be identified for further exploration in the Table 2.2 on the basis of variables. With the focus on the the macroeconomic determinants of FDI inflows,in the Table 2.1, Ranjan and Agarwal (2011) identified ranging from market size, trade openness, labor cost, infrastructural facilities etc. in the BRIC economies for 1975 to 2009 to analyse the role of the financial markets whereby at the microeconomic level, Ghosh and Roy (2013); Goldar and Banga (2020); Goldar and Sharma (2015); Goldar et al.(2004); Jadhav and Reddy (2013); Kuntuluru et al.(2013) to name a few also considered the inclusion of financial determinants such as credit, leverage, liquidity, debt--equity ratio, asset turnover rate, return on capital employed, market intensity, operating profit, tax provision etc. to assess the impact of FDI inflows on the profitability of the domestic firms. There are studies in table 2.1 that reflect on the role of New Economic Reforms 1991, as with the policies of liberalisation, privatization and globalisation, greater foreign presence was felt after a prolonged phase of restrictions, in this regards, Driffield and Kambhampati (2003) found an increase in overall efficiency in the post-reform period as a result of domestic market competition and deregulation for 1987-1994 , whereas ,Goldar (2004) noticed a decline in the productivity growth rate in the post-reform period while studying for 1981-82 to 1997-98 data in the Indian manufacturing industries.

In studying the effects of foreign presence on the productivity levels in the post- liberalisation period, out of the selected literature , Pradeep et al.(2004); Ray (2004,2006); Behera et al.(2012b);Sahu and Solarin (2014); Mondal and Pant (2014,2018); Thakur and Burange (2015);Klein (2017);and Murthy et al.(2019) found positive effects of the foreign presence on the productivity spillovers, particularly in terms of demonstration effects of the

intra-industry spillovers and backward linkages effects of the inter-industry spillovers ;and while studying the manufacturing industries any evidence of positive productivity spillover effects of FDI, were not found in Kathuria (2000,2001,2002,2010); Sasidharan and Ramanathan (2007); and Mishra (2011). In the Indian pharmaceutical industry, Bergman (2006) found insignificant effects of productivity spillover. On the other hand, Banga (2004); Siddharthan and Lal (2004);Patibandla and Sanyal (2005) ;and Goldar and Banga (2020) provided mixed results indicating at positive and negative contribution of foreign presence in domestic firms in terms of horizontal and vertical spillover effects as inspected in the subparts of the studies on the basis of different sample.

In the post-liberalisation period, apart from productivity levels of the domestic firms in India, the indirect effects of foreign presence have also been investigated on the export performance of the domestic firms. In Ghosh and Roy (2018), mixed results on the export performance in the Indian manufacturing sector during the post-reform period were observed from 1991-2010 on the account of the firm specific variables; while in Goldar and Sharma (2015) insignificant effects of FDI on the export performance were realised in India from 2001-02 to 2011-12. Then, there are the studies that found a negative impact of FDI on the exports of the domestic firms in India, in this context Kuntuluru et al.(2012) inferred negative effects of foreign presence on the export performance of firms operating in the Indian pharmaceutical industry and Sur and Nandy (2018),in the Indian automobile sector declared a negative relationship between technical efficiency and export orientation. These studies primarily contradicted the results made by Ray (2006) on Indian engineering firms. All such reservations were addressed by

Siddharthan and Nollen (2014), who emphasized on probing the characteristics of particular firms to understand the behaviour of export intensities pertaining to them. A significant finding on the *technology intensity*, was made by Joseph and Reddy (2009) for Indian manufacturing industry with positive effects of the *technology import intensity and R&D intensity* on the export performance of the domestic firms in the manufacturing sector.

In contrast to the earlier practices of considering productivity as the only explained variable Hasan (2002) found significant impact of *technology imports (especially the disembodied technology imports)* on productivity but negligible effects of *R&D activities* for the manufacturing industries in India were witnessed; similar to it positive effects of R&D expenses on the technical efficiency was witnessed by Driffield and Kambhampati (2003); but on the contrary, Goldar et al. (2004) and Ray (2006) did not find any evidence of R&D intensity having any influence on technical efficiency of the domestic firms .Of the studies mentioned in Table 2.1 ,some of the authors has measured technology intensity on the basis of its respective components i.e. R&D activities and Technology Imports. Kathuria (2000) regressed FDI on R&D investment and noted that Indian firms resorted to technology imports instead of investing in R&D on the account of easier access to imported technology where as Kathuria (2001) analysed the role R&D activities and disembodied technology import as a source of knowledge spillovers and found presence of knowledge spillovers in domestic firms (non-FDI), from the level of disembodied technology imports only which further dependent on the capabilities of the firms engaged in R&D activities.

The relevance of absorptive capacity in order to extract the indirect benefits of FDI in the domestic firms has been emphasized in Kathuria (2002,2010);Parameswaran (2009);Marin and Sasidharan (2010);Keshari (2013);Mondal and Pant (2014);Malik (2015);Rijesh (2015);Pradeep et al. (2017);and Pant and Mondal (2020) who incorporated the variables such as embodied technology imports, disembodied technology imports and R&D expenses to explain their models. Behera (2014) took R&D intensity and technology import intensity as the determinable component of knowledge relevant to the production process in estimating the technology spillovers. In an attempt to understand the impact of export level and R&D expenses on the construct of innovation, Seenaiiah and Rath (2018) recently presented positive and significant effects of export levels and dummy variable indicating presence of R&D activities on the innovation.

The summary of the studies in the Table 2.1 exhibit details on determinants of FDI spillovers in India at the industrial as well as firm level explaining the effects of foreign presence on productivity, export performance and the innovation process of the domestic firms in the various Indian industries respectively .In his illustrious contribution,Banga (2004), identified *Total Factor Productivity Growth* as a function of spill variables; firm-specific variables; and industry-specific variables as well as an error term whereby the industry specific variables such as *Capital imports, R&D intensity, Export-Intensity, Import intensity, Effective Rate of Protection industry , Advertisement Intensity and Capital-Labour Ratio* were differentiated from the firm specific variables such as *Size of the firm, Age of the firm, R&D Intensity, Export-Intensity, Import intensity, Capital-Intensity of the firm etc.*

In addition, the proxies used for the presence of foreign firms consisted of *foreign equity as a ratio of total equity invested ,market share of the foreign firms* and technology imports to find the spillover variable. Underpinning the premise of constructs, factors and premises of Banga (2004) and the studies reviewed in the Table 2.1, the summary of the the determinants of the spillover effects of FDI in the Indian industrial sector is presented in the following Table 2.2. The determinants best specified as the industrial level and firm level variables are an attempt to provide fairly thorough explanations of the the spillover effects of FDI on productivity, export performance and the innovation process in the secondary sector. Each of the variable taken in the Table 2.2 ha ben explained in details as following:-

Capital (K): Gross Fixed Assets (GFA)

Pradeep et al. (2017) remarked about absence of universally accepted method for measuring capital stock. Nonetheless, Malik (2015) harnessed GFA instead of Net Fixed Asset due to absence of availability of data on the economic rate of depreciation of assets in the case of the Indian manufacturing industry. Apart from him, Joseph and Reddy (2009); Parmeswaran (2009); Behera et al.(2012b);Rijesh (2015) and recently Goldar and Banga (2020) used Net Fixed Assets to measure the capital stock whereas Mondal and Pant (2014);and Pant and Mondal (2020) measured capital stock of the firms using GFA.

Labor (L): Wages and Salaries

Hasan (2002); Goldar et al.(2004); Parmeswaran (2009); Joseph and Reddy (2009); Jadhav and Reddy (2013); Keshari (2013);Mondal and Pant (2014);Malik (2015); and Rijesh (2015) etc. utilized the *wages and salaries* paid by a firm as a proxy for the labour in scouting for factors such

competitiveness, productivity and efficiency etc. Recently, Malik (2019) and Goldar and Banga (2020) used wages and salaries to investigate the employment effects of FDI in the local firms in Indian manufacturing sector.

Energy (E): Power and Fuel

The literature made use of energy as an input as Banga (2004) saw energy input as an expenditure on power and fuel only whereas Goldar (2004) mentioned it as the value of intermediate inputs constructed by summing up materials, power and fuel, and other intermediate inputs and in an updated study by Goldar and Banga (2020) the nominal energy input for a firm is calculated as the sum of its expenses on power and fuel (in current prices) using the energy deflator. However, Rijesh (2015) included the value of raw materials, power and fuel consumption in raw material expenses. On the other hand, Ray (2004,2006) measured fuel intensity as cost to sales turnover ratio.

Raw Materials (M): Stores and Spares

--Studies that included raw material as the explanatory variable comprise mainly of Hasan (2002); Driffield and Kambhampati (2003); Banga (2004);Banga and Goldar (2004); Ray (2006); Marin and Sasidharan (2007); Parmeswaran (2007);Keshari (2013);Klein (2017) among others. Ghosh and Roy (2013) and Pant and Mondal (2020) in their recent studies harnessed raw material import intensity variable to explain the productivity levels of domestic firms along with Goldar and Banga (2020) took expenses on materials i.e. raw materials, stores & spares, value of packaging and packing expenses as an explanatory variable in estimating total factor productivity.

Services: Imports and Exports of Services

Banga and Goldar (2004) documented the

contribution of services to output growth and productivity in the Indian manufacturing industry and took the KLEMS framework for estimation while Goldar and Banga (2020) in the recent study constructed service export intensity as the ratio of export of services to the sales (in %) and service export intensity as the ratio of imported services to total services used (sum of expenses on rent & lease, repair & maintenance, outsourced manufacturing jobs & professional jobs, insurance, selling & distribution expenses and financial services.

Research and Development Intensity

R&D intensity is defined as the ratio of R&D expenditure to sales of firms and indicates at the higher level of productivity. Driffield and Kambhampati (2003) and Goldar et al. (2004) and Ray (2006) supported no effects of R&D intensity on efficiency of the domestic firms in the source countries. Although, Behera (2014); Malik (2015); and Mondal and Pant (2018) stated that FDI acted as a key driver to raise the productivity spillover. According to Joseph and Reddy (2009); Ghosh and Roy (2013); and Pradeep et al. (2017) used R&D intensity to explain significant effects on export competitiveness. On the other hand, Patibandla and Sanyal (2005); and Rijesh (2015) studied the effects of R&D on the productivity of firms in the Indian manufacturing industry.

Capital intensity (KI)

The variable of the capital intensity is calculated by gross fixed assets divided by sales where as in explaining the existence of spillovers, studies of Banga (2004);Goldar (2004);and Behera et al. (2012a,2012b) measured the effects of capital intensity on productivity but Joseph and Reddy (2009) found insignificant effect of capital intensity on export performance. Seenaiiah and Rath (2018)

made conclusions based on a negative and significant effect of capital intensity on the innovation activities in 190 manufacturing firms in India for from 2011 to 2013.

Technology Intensity and/or Technology

Imports Intensity (TI)

Studies such as Ray (2004); Joseph and Reddy (2009); Behera et al.(2012a); Kuntuluru et al. (2012); Behera et al. (2014); Malik (2015); Rijesh (2015); Ghosh and Roy (2018) and Pant and Mondal (2020) categorised into *embodied technology imports* and *disembodied technology imports and R&D investments*.(See notes in Table 2.2) The R&D has been treated separately as variable by Parameswaran (2009), who witnessed an absence of a complementary relationship between technology imports and in-house R&D. However, in many studies, instead *technology intensity* and *technology import intensity* various terminology has been employed to explain the same phenomenon, for instance, Ghosh and Roy (2013) measured *foreign technology intensity* as the ratio of the sum of expenditure on imported capital goods, raw materials, and foreign technical know-how to sales while Goldar and Banga (2004) constructed an *index of technology acquisition intensity inflow* using R&D expenditure, payment of royalty and technical fees for technology imports, and capital goods imports.

Embodied Technology Imports (ET) or Import of Capital Goods (KM)

The embodied technology imports majorly constitute the imports of capital goods in the form of machinery and equipment goods. As has been noted earlier, the literature in Table 2.1 containing the variable of *Technology Import Intensity* does include the embodied technology imports. This phenomenon has been also witnessed recently by

Pant and Mondal (2020) that embodied technologies can be used instantaneously whereas the disembodied technologies are need to be decoded and difficult to use without the necessary human capital in the production process. The improved technology resulting from imports of superior capital goods from abroad at as a positive reinforcement the export performance of a firm, also documented by Siddharthan and Nollen (2004).

Disembodied Technology Import (DT)

Emphasizing the importance of disembodied technology transfers Hasan (2002) highlighted its role in productivity enhancement of domestic firms and Parameswaran (2009) reinforced the significant and positive effects of disembodied technology import stock in low-technology industries and all industries in the manufacturing sector .On the other hand,Kathuria (2002) emphasized on the argument of difficulty in inclusion of disembodied technology import with limited human capital, further strengthened by Keshari (2013) and Pant and Mondal (2020) in findings negative and significant effects of disembodied technology imports on the technical efficiencies in the manufacturing industries in India.

Export Intensity (XI)

As per Pant and Mondal (2020) increases in export intensity of a firm exposes it to advanced technology available abroad, in turn boosting up the productivity of domestic firms and as per Murthy et al. (2019), foreign firms hold a larger export intensity. Marin and Sasidharan (2010) proxied export intensity variable for identifying competence creating activities in foreign subsidiaries. Other studies that include import intensity as the predictor include Kathuria

(2000,2001,2002); Banga 2004; Banga and Goldar (2004); Goldar et al. (2004); Ray (2004); Patibandal and Sanyal (2005); Ghosh and Roy (2013) Pradeep et al. (2017); Seenaiah and Rath (2018); and Goldar and Banga (2020).

Import Intensity (MI)

Import intensity is measured as a ratio of total imports to the total sales. According to Driffield and Khambapati (2003) import intensity influences efficiency because firms can import capital goods and the latest technology. The additional studies that analyse the positive effect of import intensities on the total factor productivity, export performance and innovation include Banga (2004); Ray (2004); Banga and Goldar (2004); Ghosh and Roy (2013); Seenaiah and Rath (2018); Murthy et al. (2019) Goldar and Banga (2020) and Pant and Mondal (2020).

Advertisement Intensity (ADI)

Defined as the ratio of advertisement expenditure to sales, Goldar et al. (2004); Ray (2004); Ray (2006); Kuntuluru et al. (2012) Keshari (2013) took advertisement intensity as a proxy for measuring the product differentiation and expenses on advertisement had the favorable effects on the efficiency through productivity in the domestic firms in India. Recently, Seenaiah and Rath (2018) took advertisement expenses as one of the explanatory variables.

Size of the firm (S)

The size of the firm depicts the scale of operation of firms. Bergmann (2006) found positive and significant effects of size variable on the levels of productivity of domestic firms in the Indian pharmaceutical industries while Siddharthan and Nollen (2004) and Ghosh and Roy (2018) hypothesized a positive relationship between firm

size and export performance in the Indian manufacturing industry. In addition, Kathuria (2009); Joseph and Reddy (2009); Jadhav and Reddy (2013); Keshari (2013); Goldar and Sharma (2015); Klein (2017); and Seenaiah and Rath (2018) took size of the firm as an explanatory variables in their regression equation .

Age of the firm (A)

With respect to differentiating firms on the basis of year of its establishment, Joseph and Reddy (2009); Kuntuluru et al. (2012) and Ghosh and Roy (2018) found a positive relationship between the age of a firm and export performance whereas Seenaiah and Rath (2018) found significant negative impact of the age of the firm on the innovation activity of the domestic firms. In the Indian manufacturing sector, Kathuria (2001), found no significant relationship between age and technical efficiency reflected in the productivity of domestic firms and in the Indian automobile industry, Sur and Nandy (2018) implied a negligible value of negative relationship between age and technical efficiencies of domestic firms.

Market Share (MS)

Calculated as the proportion of the sales to the total market, market share conveys the dominance of a company relative to its competitors, for instance, Banga (2004) studied the effects of market share of foreign on the total factor productivity growth of the domestic firms in India. Behera et al. (2012b) and Keshari (2013) constructed concentration ratio using market share. Finally, Klein (2017) found a positive and significant relationship between market share and productivity growth.

Exchange Rate (EX)

In the Table 2.1, various studies in the Indian context have dealt with exchange rate while taking care of transactions taking place with respect to

exports and imports of capital, services and technology etc. in the foreign exchange. Banga and Goldar (2004) took exchange rate to take care of the tariff rate conversions, while earlier, Kathuria (2001) utilised exchange rate in deflating the expenses on the R&D. Ranjan and Agarwal (2011) explained the determinants of FDI at macroeconomic level with help of exchange rate regime in the BRIC countries.

Foreign Presence (FP)

This study has dealt with the variable of foreign presence as studies in Table 2.2 have been selected on the basis of foreign presence affecting indirectly productivity, export performance and the innovation process in India. Sasidharan and Ramanathan (2003); Behera et al. (2012a, 2012b); Mondal and Pant (2014) and other studies mentioned in the Table 2.2 took ten percent foreign equity level as the defining limit for the foreign acquisition explaining the FDI inflows.

3. Concluding Remarks

The literature review on the determinants of the spillover effects in foreign and the Indian studies shows the predominance of investigating the spillover effects on productivity levels on the firm as well as industries employing the KLEMS (capital-labor-energy-materials-services) model. This reflected the limited contribution on the other factors and determinants affecting the production process in Indian industrial sector. This study has tried to fill the gap by including the major recent studies that dealt with the foreign presence or FDI through the productivity, export performance and innovation effects. Such explicit inclusivity of diverse studies debrief the basic framework of earlier studies that culminate to straightforward answers. The mixed evidence about choice of the methodology and the determinants indicates the

impression of varied direction of the results and significance of relationship between determinants changes when applied to different sector and time periods within the Indian industry.

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Table 2.1: The Relevant Empirical Literature on the Spillover Effects of FDI in India from year 2000-2020.

| Authors (Year of Publication) | Level of Aggregation | Methodology | Conclusion |
|---|--|---|--|
| Banga (2004) | A balanced panel is used for 153 firms for the year 1993-94 to 1999-2000 across 25 industries. | Regression estimation with Cobb-Douglas representation of technology relating factor inputs with fixed effects model. | The Japanese FDI in the Indian manufacturing have positively contributed to the Total Factor Productivity Growth of the domestic firms though the US FDI did not. |
| Banga and Goldar (2004) | Examined Panel data for 148 three-digit level industries for 18 years, 1980-81 to 1997-98. | Multiple regression analysis using <i>KLEMS</i> model in the production function along with Fixed-Effects model. | Revealed a positive relationship between services input and industrial productivity. |
| Behera et al.(2012a) | Industry level analysis of balanced panel data of 16 manufacturing industries in India with 2,379 firms. | Multiple regression equation with random effects model. | The results showed a positive relationship between international trade orientation of a firm and its level of technical efficiency. |
| Behera et al.(2012b) | Collected cluster level data both rural and city area located firms from 2000 to 2007. | <i>Innovation production function</i> , Regression equation and Generalized Methods of Moments (GMM) estimates. | Region-specific horizontal FDI has a significant positive effect on productivity spillover in all four clusters in northern region. |
| Behara (2014) | Industry level panel dataset for 16 manufacturing industries composed of 2,379 firms for time period 2001 to 2010. | Cobb-Douglas production technology function, regression analysis along with GMM estimates. | Claimed that foreign presence plays a significant role in lifting the technology spillovers in Indian industries and also positively linked it with absorptive capacity. |
| Bergman (2006) | Utilized 43 pharmaceutical firms, included in the organized sector for 2004. | Regression method with OLS technique with White's test for heteroskedasticity. | Found insignificant results of productivity spillover effects in the Indian pharmaceutical industry. |
| Driffield & Kambhampati (2003) | Panel data covering 1800 large and medium public limited companies in India for the period 1987–1994. | SFA (Stochastic Frontier Approach) regression-based method. | Found that there was an increase in overall efficiency in the post-reform period in India in five out of the six sectors. |
| Ghosh and Roy (2018) | Dynamic panel data with firm-level 3,469 observations across industries for the period 1991–2010. | GMM estimates and Hausman–Taylor estimation techniques. | Estimation results showed that effect of foreign ownership was not any significantly different than effect of domestic firms in export performance across industries in Indian manufacturing sector. |
| Goldar (2004) | Used panel data for 17 industries (comprising the manufacturing sector) for the period 1981-82 to 1997-1998 | Translog production (value added) function has been estimated with the Fixed effects model. | There has been a decrease in the growth rate of TFP in Indian manufacturing in the post-reform period. |
| Goldar and Banga (2020) | Compiled a panel for around 7,338 Indian firms and for 15 years from 2000–01 to 2014–2015. | Levinsohn–Pettrin (2003) approach for TFP; regression-based Cobb–Douglas value-added production with fixed effects model. | Presence of significant positive horizontal FDI spillover effects along with negligible or limited |

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|-----------------------------------|---|---|--|
| | | | vertical spillover effect through backward linkage. |
| Goldar and Sharma (2015) | Unbalanced panel data for 63 firms 2000-01 to 2011-12 from the sample of 775 manufacturing industries. | Probit Model with difference in difference estimators. | Witnessed significant positive productivity spillover effects from exports, growth and profitability in the domestic firms in manufacturing industry. |
| Goldar et al. (2004) | Panel data consisting of 63 firms in the engineering industries with taken for 10 years, 1990-91 to 1999-2000. | Stochastic frontier production function (SFPP) using parametric techniques; Multiple regression and applying the panel data estimation techniques (fixed-effects model and random-effects model). | The analysis presented indicated at the efficiency convergence or the catching up of the domestic firms with the foreign owned firms in the engineering sector. |
| Hasan (2002) | Used panel data on 286 Indian manufacturing firms from 1976–1977 to 1986–1987. | Cobb–Douglas and Translog production function and fixed effects model. | Found statistically significant impact of <i>Technology Imports</i> on productivity in domestic firms; and also saw negligible impact of <i>R&D activities</i> . |
| Jadhav & Reddy (2013). | Utilized panel data of 482 firms classified across four industries included in capital goods sector during the sub periods of 1994-95 to 2008-09 to 2009. | Multiple regression model. | Witnessed no major difference between the <i>Average Turnover Ratios</i> of domestic and foreign firms whereas the <i>Rate of Capital Employed</i> of foreign firms was significantly greater than that of domestic firms. |
| Joseph and Reddy (2009) | Covered the years sub-periods of 1993-96, 1997-2000, 2001-04, 2005-08 for 1,466 firm level panel data | Regression with OLS estimation. | Domestic Indian firms did not have horizontal and backward spillover due to increased competition and crowding-out effect of MNEs. |
| Kale and Rath (2018) | Employed firm-level data from Hyderabad and Bengaluru cities of India from 2011-2013. | Semi-parametric method of Levinsohn-Petrinto extension of Olley and Pakes (1995); to correct the endogeneity bias in productivity estimation. | Firms engaged in innovation activities were more productive than non-innovative firms with factors like age of the firm, imports and capital intensity affecting the productivity positively |
| Kathuria (2000) | The period 1994-1996 and 1999-2001 with 10,000 medium and high technology firm data. | Probit model and Tobit model with explanatory variables and the probability of investment in R&D. | The increased inflow of FDI after 1991 negatively affected the propensity to invest in R&D in the earlier years of 1991 but this effect got diminished in later years. |
| Kathuria (2001) | The study uses panel data 368 medium and large sized Indian manufacturing firms for the period 1975-76 to 1988-89. | SFA-regression based method. | The technology diffused to local firms from the presence of foreign-owned firms provided the firms themselves engage in R&D activities to decodify the spilled knowledge. |
| Kathuria (2002) | Used 487 Indian manufacturing firms belonging to 24 industries for the period 1989-90 to 96-97. | SFA-regression based method with fixed effect model | The greater spending on the in-house R&D was the prime condition for inducing greater spillovers . |

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|------------------------------------|---|--|--|
| Kathuria (2010) | Used panel data for 1,840 firms from 1995 to 2005. | Regression with Cobb–Douglas production function White’s (1980) adjustment for heteroscedasticity. | The level and productivity growth analysis does not indicate the presence of spillovers ,even with taking technology gap into account. |
| Keshari (2013) | Utilised the unbalanced panel data on a sample of 177 firms, spread over 7 years period (2000-01 to 2006-07), drawn from the Indian Machinery Industry. | SFA-regression based method along with Random effect model. | There are positive demonstration and imitation effect generated by the R&D activities. |
| Klein (2017) | Unbalanced panel of 9,561 district Indian manufacturing firms over the 16-year period of 2001-2016. | Cobb-Douglass production function with, Levinsohn and Petrin (2003) approach. | A significant positive horizontal spillover effect has been found for Indian manufacturing firms. |
| Kuntluru et al. (2012) | The panel data of 250 units in organised pharmaceutical industry from 1997-98 to 2004-05 was selected. | Regression equation using <i>Within Ordinary Least Squares</i> methods followed by the fixed effect model. | Found a negative impact of foreign ownership on export performance of firms in the pharmaceutical industry in India . |
| Malik (2015) | Used firm level unbalanced Panel data on 1,685 firms from the Indian Manufacturing sector from 2000-01 to 2007-08. | Semi-parametric method of Levinsohn-Petrin (2003) to correct the endogeneity bias in productivity estimation. | The technology spillovers from FDI are not spontaneous but are constrained by the technological ability of domestic firms and the ownership structure of the foreign firms. |
| Malik (2019) | Employed a balanced panel data of 54 industries for the period 2008–2009 to 2015–2016 | Dynamic labour demand model derived from Cobb–Douglas production function through the system Generalised Method of Moments (GMM) estimator. | The absence of spillovers from FDI to be attributed to the absence of employment effect of FDI in India’s manufacturing industries. |
| Marin and Sasidharan (2010) | Used panel dataset between 2696 and 2720 firms for the time period 1994–2002. | Regression estimation on a log-linear transformation of a Cobb–Douglas production function following semi-parametric approach suggested by Levinsohn and Petrin (2003) | The competence creating subsidiaries have a positive effect on the host economy, whereas competence exploiting subsidiaries have a negative effect independently of the absorptive capability of domestic firms. |
| Mishra (2011) | Panel data from 22 sectors of the manufacturing industries in India from 2006-2010. | Levinsohn-Petrin (2003) approach regression with fixed effects and random effects robust model. | Found marginal, negative and insignificant direct impact of FDI inflow on the productivity of domestic firms with negative productivity spillovers from forward linkages and backward linkages. |
| Mondal and Pant (2014) | 1,168 firms from the five Indian manufacturing industries ‘panel dataset (balanced) covering the years from 2000-01 to 2006-07. | Econometric estimation using OLS production function with Olley and Pakes (1996) estimator; the Hausman test indicated the relative efficacy of fixed effect models to tackle endogeneity. | The foreign presence and associated demonstration effects are more likely to lead to higher competitiveness and firm competitiveness is highly dependent on the absorptive capacity of the firms. |

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| Mondal and Pant (2018) | Utilized an unbalanced panel dataset on 5923 firms Indian manufacturing firms from 1994 to 2010. | Followed the Semi parametric estimation of Levinsohn and Petrin (2003) with fixed effect model | Productivity growth of domestic firms is highly influenced by the export intensity and technology indicators. |
| Murthy et al. (2019) | Employed 1,846 firm level panel data for the time period of 2001-2010 for 13 manufacturing industries. | Logistic regression also called a logit model has been used to study that firms. | The results reflected on improvement in selected parameters such that classification of foreign firms and domestic firms on the basis of eight attributes of spillover effects become more effective. |
| Pant and Mondal (2010) | The sample consisted of unbalanced on 1168 firms from the five industries covering the years from 2000-01 to 2006-07. | Assumed Cobb Douglas production function and regression with Fixed effects model. | The results indicated at importance of abandoning of the policies in 1980s that fostered purchasing of the foreign technology institutional factors in the 1990 for the transfer of technology. |
| Pant and Mondal (2020) | Took unbalanced panel of 5,956 domestic manufacturing firms for 23 industries for two sub-periods, i.e. 1994–2001 and 2002–10. | SFA-regression based method used, following Battese and Coelli (1995). | The results proved negative absorption effect of R&D expenses disembodied technology imports and export activities in 1994–2001 while the former being positive in 2002–10 the latter two were insignificant. |
| Parameswaran (2009) | Employed micro level unbalanced panel on 2,100 firms for the period 1988–1989 to 2000–2001. | Semi-parametric methodology of Levinsohn and Petrin (2003) on Olley and Pakes (1996) with GMM estimators | There exists trade-related R&D spillovers namely, rent spillovers and knowledge spillovers. |
| Patibandla and Sanyal (2005) | Panel data from 1989 to 1999 across eleven industries having 1,132 firms. | Regression with OLS technique. | Mixed results, i.e. foreign ownership in a firm had no significant impact on productivity. |
| Pradeep et al. (2017) | Over 1,000 Indian manufacturing firms studied for the period from 1994 to 2008 with panel data. | Cobb–Douglas production function, estimated using OLS based regression, the random effect model and the GMM estimator. | Established positive spillover effects (especially in R&D) of FDI and R&D on productivity due to the lower manufacturing costs and better FDI environment. |
| Ranjan and Agrawal (2011) | Employed the panel data set consisting data of 35 years ranging from 1975 to 2009. | Random effects model | Market size, trade openness, labour cost, infrastructure facilities and macroeconomic stability and growth prospects are potential determinants of FDI inflow in BRIC whereas gross capital formation and labour force are not. |
| Ray (2004) | Firm level panel data in 27 industry groups for the years 1991 to 2001 in Indian manufacturing sector | Data Envelopment Approach | Found that ownership of domestic firms by foreign enterprises enhanced the efficiency of those firms. |
| Ray (2006) | 23 industry groups during the period for three years 1991, 1995 and 2001 | Frontier Production Functions and regression with multiple regression equation with corrected Ordinary Least Square estimates. | Found a positive relationship between efficiency and fuel intensity in all three time periods in 1991,1995 and 2001. |

are selected for a cross sectional database analysis.

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| Rijesh (2015) | Employed firm level panel data 5,551 firms in the Indian manufacturing industry for the period of 1995–2010. | Augmented Cobb-Douglas production function using the Levinsohn and Petrin (2003) econometric technique. | Found that embodied technology imports have a relatively more significant and positive impact than the disembodied technology imports. |
| Sahu and Solarin (2014) | 2,616 firms collected from the period 1999-00 to 2009-10 are taken into considerations. | Cobb-Douglas production function-based regression and fixed effects and random effects model. | Indicated the presence of positive horizontal spillover due to superiority of the foreign firms. |
| Sasidharan and Ramanathan (2007) | Firm level data for the period of 1994-2002 on 4,900 manufacturing firms | Regression with OLS Method following a log linear augmented Cobb-Douglas production function. | The conclusion was negative vertical spillover effects on domestic firms; also found foreign firms to be better performers in terms of TFP |
| Siddharthan and Lal (2004) | Estimated separate firm level cross section sample for each year in 1993-2000 (and favored using an unbalanced panel) | Regression estimated through fixed effects model using pooled data. | A strong increasing trend in the coefficient of the spillover variable was found in the initial years of the liberalisation process and sharpened in the latter years. |
| Siddharthan and Nollen (2014) | Balanced panel data for about 7,000 companies pooled over the years 1994–98 for Indian software industry. | Tobit Regression and fixed effects model | Export performance of MNE affiliates are greater than domestic firms in India. Furthermore, it is determined by firm size and capital intensity in domestic firms. |
| Sur and Nandy (2018) | The unbalanced panel data drawn from sample of 67 firms from the Indian automobile industry over the period 2001-2014. | SFA and Tobit specified regression. | In the Indian automobile sector, the findings reflected that only horizontal spillovers through demonstration effect were present as a major transmission channel in domestic firms. |
| Thakur and Burange (2015) | The panel data on these variables is for the period 2000 to 2010 consisting of 3,029 firm level data in manufacturing sector. | Cobb-Douglas production function approach-based regression along with fixed effects estimation. | Found productivity spillovers varied across different industries in the manufacturing sector, prominent vertical spillovers and; the negative contribution of human capital to TFP. |

Source: Compiled by the authors

Table 2.2: Explanatory Variables Studied in the Relevant Literature on the Spillover Effects determinants of FDI in India from year 2000-2020.

| Author (Year of Publication) | K | L | E | M | S | RDI | KI | TI | DT | ET/KM | XI | MI | ADI | S | A | MS | EX | FP | Other Factors | |
|--------------------------------|---|---|---|---|---|-----|----|----|----|-------|----|----|-----|---|---|----|----|----|--|--|
| Banga (2004) | X | X | X | X | - | X | X | X | X | X | X | X | X | X | X | X | X | X | X | Output as total sales,TFP and finished goods inventory of the firms. |
| Banga and Goldar (2004) | X | X | X | X | X | X | - | X | X | X | X | X | - | - | - | - | X | X | Real Gross Output | |
| Behera (2014) | X | X | - | - | - | X | - | X | - | - | - | - | - | X | X | - | - | X | R&D Intensity, Labor Productivity, Market Concentration, Value Added, Tariff. | |
| Behera et al.(2012a) | X | X | - | - | - | X | X | X | - | - | - | - | - | X | - | - | - | X | Technology Gap between domestic and foreign firms, Market concentration. | |
| Behera et al.(2012b) | X | X | - | - | - | X | X | - | - | - | - | - | - | - | - | X | - | X | Locational Dummy variable, Value added (output), Market Concentration. | |
| Bergman (2006) | X | X | - | - | - | X | - | - | - | - | - | - | - | X | - | - | - | X | Output as value added | |
| Driffield & Kambhampati (2003) | X | X | - | X | - | X | X | - | - | - | X | X | - | X | X | X | - | X | Output, Time Trend and Openness dummy variable, HHI. | |
| Ghosh and Roy (2018) | X | X | - | X | X | X | X | X | X | X | X | - | X | X | X | - | - | X | Credit (Sunk Cost), Labor productivity, Foreign Technology Intensity | |
| Goldar (2004) | X | X | X | X | X | - | X | X | - | - | - | - | - | - | - | - | - | X | Real Gross Value Added Capital-Labor Ratio,Capital-Output Ratio,TFP. | |
| Goldar and Banga (2020) | X | X | X | - | X | X | - | - | - | - | X | X | - | X | X | - | - | X | Services Export Intensity and Services Import Intensity, Leverage, Liquidity, TFP, Spillovers Dummy variable | |
| Goldar and Sharma (2015) | X | - | - | X | - | - | - | - | X | X | - | - | X | X | X | - | - | X | Business group dummy estimates, Debt-Equity ratio | |
| Goldar et al. (2004) | X | X | - | - | - | X | - | - | - | - | X | X | X | - | - | - | - | X | Liquidity ratio, Central Excise Duty, Vertical integration and Dummy Variables. | |
| Hasan (2002) | X | X | - | X | X | - | X | X | X | X | - | - | - | - | - | - | - | X | Output and Technology embodied in domestic capital goods,R&D expenses | |
| Jadhav and Reddy (2013) | - | - | - | - | - | X | - | - | - | - | X | - | X | X | X | - | - | X | Firm Leverage, Net Sales, Asset turnover, Return on capital employed, R&D intensity, Marketing Intensity. | |
| Joseph and Reddy (2009) | X | X | - | X | - | X | X | X | - | X | X | - | - | X | X | - | - | X | Labor Productivity and value added per capital. | |
| Kathuria (2000) | - | - | - | X | - | X | - | - | X | - | X | - | - | X | - | - | - | X | Value Added and HHI. | |

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|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|
| Kathuria (2001) | X | X | - | X | - | X | - | - | X | X | X | - | - | - | X | - | X | X | <i>Capital goods, import intensity, Change in Demand, Fixed investment, Technology Gap</i> |
| Kathuria (2002) | X | X | - | - | - | X | - | - | X | X | X | X | - | - | X | - | - | X | <i>Fixed investment, Change in Demand, Capital goods import intensity, Disembodied technology Import intensity</i> |
| Kathuria (2010) | X | X | - | X | - | X | - | - | X | X | X | - | - | - | X | - | - | X | <i>Capital goods import intensity, Disembodied technology Import intensity, Output of foreign firms, HHI, Value added, Time dummy,</i> |
| Keshari (2013) | X | X | - | X | - | X | X | - | X | - | - | - | X | X | X | X | - | X | <i>Time Specific Dummy Variable, Capital structure, Market concentration, Imported Intermediate Goods intensity.</i> |
| Klein (2017) | X | X | - | X | - | - | - | - | - | - | - | - | - | X | X | X | - | X | <i>Dummy Variable, HHI, Industry size, Technology Gap.</i> |
| Kuntluru et al. (2012) | - | X | - | X | - | X | - | X | X | X | - | - | X | X | X | - | - | X | <i>Export Performance, Skills, Operating Profit, Tax provision.</i> |
| Malik (2015) | X | X | X | X | - | X | - | X | - | - | X | - | - | - | - | - | - | X | <i>HHI, Horizontal, Backward and Forward spillover variables.</i> |
| Malik (2019) | X | X | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <i>GVA, Time Year dummies, Total employment and Time period.</i> |
| Marin and Sasidharan (2010) | X | X | - | X | - | X | - | - | - | - | - | - | - | - | X | - | - | X | <i>HHI, import penetration, spillover variables.</i> |
| Mondal and Pant (2014) | X | X | X | X | X | X | - | - | X | - | - | - | - | - | - | - | - | X | <i>Concentration ratio,Capital-Labor Ratio..</i> |
| Mondal and Pant (2018) | X | X | X | X | - | X | - | X | X | X | X | - | - | X | - | - | - | X | <i>HHI,spillover variables,TFP.</i> |
| Murthy, Saran and Malhotra (2019) | - | - | - | - | - | X | - | - | X | - | X | X | - | - | - | - | - | X | <i>Foreign firm dummy, HHI, Horizontal, Backward and Forward variables.</i> |
| Pant and Mondal (2010) | X | X | - | X | - | X | - | - | X | - | - | - | - | - | - | - | - | X | <i>HHI, spillover variables,TFP.</i> |
| Pant and Mondal (2020) | X | X | - | X | - | X | - | - | X | X | X | - | - | - | - | - | - | - | <i>Raw material import intensity, import penetration, HHI, Spillover variable.</i> |
| Parameswaran (2009) | X | X | X | X | - | X | - | - | X | X | - | - | - | - | - | - | - | X | <i>Trade related knowledge spillover stock.</i> |
| Patibandla and Sanyal (2005) | X | X | - | - | - | - | - | - | - | - | X | X | - | X | - | - | - | - | <i>Value Added Intensity and Industrial dummy variable,R&D spending.</i> |
| Pradeep et al (2017) | X | X | - | - | - | - | - | - | - | - | X | - | - | - | - | - | - | X | <i>Spillover Variables (R&D,Export and FDI),output</i> |

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|-------------------------------|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|---|---|
| Ranjan and Aggarwal (2011) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | X | X | <i>GDP, inflation, Trade openness, Infrastructure index, Workforce and Grass Capital Formation.</i> |
| Ray (2004) | - | - | X | - | - | X | X | X | X | - | X | X | X | - | - | - | - | - | X | <i>Vintage of Capital.</i> |
| Ray (2006) | - | - | X | X | - | X | - | - | X | X | - | - | X | - | - | - | - | - | - | <i>Exports, Imports of raw material and capital goods, Vintage of capital.</i> |
| Rijesh (2015) | X | X | - | X | - | - | X | - | X | X | - | - | - | - | - | - | - | - | - | <i>Export Growth rate, Technological imports, R&D spending, TFP.</i> |
| Sahu and Solarin (2014) | X | X | - | - | - | - | - | - | - | - | - | - | - | X | - | - | - | - | X | <i>GVA, Depreciation.</i> |
| Sasidharan and Rath (2007) | X | X | - | X | - | - | - | - | - | - | - | - | - | - | - | - | - | - | X | <i>Industry Dummy and Year Dummy variable.</i> |
| Seenaiiah and Rath (2018) | - | - | - | - | - | - | X | - | - | - | X- | X | - | X | X | - | - | - | X | <i>Dummy Variables for Innovation and R&D, Educational level and Experience of the manager, Training to the employee.</i> |
| Sidharathan and Nollen (2014) | X | X | - | X | - | - | X | X | - | X | X | - | - | X | - | - | - | - | X | <i>Dummy variable , Imports of raw materials.</i> |
| Sur and Nandy (2018) | X | X | X | X | - | X | - | - | - | - | - | - | - | X | X | - | X | X | X | <i>Net Income (output), GDP Deflator.</i> |
| Thakur and Burange (2015) | X | X | - | - | - | X | - | - | X | - | - | - | - | - | - | - | - | - | X | <i>Spillover variables, Output (Sales), TFP.</i> |

Source: Compiled by the authors.

Notes: (i) K=Capital, L=Labor, E=Energy Input M=Raw Materials, S=Import and Export of services, RDI=Research and Development Intensity, KI= Capital Intensity, TMI= Technology Imports Intensity ,XI= Export Intensity, MI=Import Intensity, DT=Disembodied Technology Imports ,ET/KM=Embodied Technology or Capital Imports ,ADI=Advertisement Intensity ,S=Size of the firm ,A=Age of the firm ,MS= Market Share EX=Exchange Rate, FP=Foreign Presence, TFP=Total Factor Productivity, HHI=Herfindahl Index, GVA=Gross Value Added, GDP=Gross Domestic Price. Other Factors include the presence of variables in the study that are not common among the studies but form an additional variable are mentioned separately in the last column

(ii) The (X) marked against the publication shows the presence of that variable in the study while the (-) indicates the absence of that variable.

(iii) The (X) marked against the Technology Import intensity indicates the presence of both the Embodied Technology Imports and Disembodied Technology Imports whereas (X) marked against either the Embodied Technology Imports or Disembodied Technology Imports does not indicate the presence of Technology Imports Intensity.

(iv) The data on the summarised variables is to be collected from the Prowess database of the Centre for Monitoring Indian Economy with NIC 2008 classification of the industries specifications. Some of the formulas driven for the complex variables on the basis of the literature surveyed in the section 2.1 are measured as following: - R&D Intensity = R&D expenditure/Sales. Capital Intensity=Gross Fixed Assets/Sales, Technology Intensity= (R&D investment +Technology Imports Intensity)/Sales, Technology

Imports Intensity = (Embodied Technology Imports + Disembodied Technology Imports)/Sales where Embodied Technology Imports =Imports of Capital Goods and Disembodied Technology Imports=Expenditure on Patents +Royalties payments Technical fees etc., Advertisement Intensity = Advertisement Expenses/Sales.

(v) Rijesh (2015); Hasan (2002);Patibandla and Sanyal (2005);and Pradeep et al. (2017) studied R&D expenses.