Chapter 1: The Concept of Technology Spillover and its Measurement
1.1 The Concept of Technology Spillover

Foreign Direct Investment (FDI) by multinational corporations (MNCs) has grown recently, especially penetrating middle-income countries. During the 1990s, the growth of FDI flows trebled the growth that was witnessed in international trade. Most FDI flows are concentrated in the developed nations with international trade transactions and inter-trade linkages. In present trends, the principal source of international finance to developing countries is in the form of FDI. FDI has been widely recognized as a growth enhancing factor for host countries; it not only brings capital but also introduces advanced technology that can enhance the technological capability of the host country firms such that it can generate long-term and sustainable economic growth for the host countries. The technological benefit is not limited to locally-affiliated firms but it can also spread to non-affiliated firms. The latter benefit is usually referred as the technology spillover.

Technology has been seen as a major driving force in output growth and economic integration of the global economy. Neoclassical economic theory has focused on factor accumulation which refers to the source of factor expansion and factor productivity. Technological progress is often treated as an exogenous factor. However, the recent research has treated the technological change in accounting for economic growth (Romer, 1990; Grossman and Helpman, 1991; Aghion and Howitt, 1992; Howitt, 2000). The endogenous growth model suggests that innovation relies on knowledge resulting from cumulative R&D expenditure and at the same time it also contributes to the growth of knowledge stock of R&D activities, which drives economic growth by the creation of new products according to the horizontally differentiated input models; or improvement in the quality of existing ones according to the vertically differentiated input models. The non-rival characteristics of technology, which distinguishes it from other factor inputs make the marginal costs of technology to the additional firms negligible.

Technological investments not only confer benefits to the investors but also contribute to the knowledge base which is then publicly available to the firms/industry. These externalities are called “technology spillovers” (Romer, 1990). With the rapid pace of economic integration in recent decades, increase in productivity in a country not only relies on domestic R&D but also on foreign R&D through interaction with foreign economies. Keller (2004) pointed out that the major sources of productivity growth (that originated from the technological change in OECD countries) are not domestic instead they come from abroad. Keller found that international productivity
variations are mostly explained by the differences in R&D rates across countries and different economies get benefits from the international knowledge spillovers.

The technology spillover effect is a driving force in economic growth and through different channels the technology diffuses across industries of a host country. Trade is a crucial conduit for technology transfer. With the rapid growth of FDI after the 1990s, an increasing tendency to develop R&D in the host country affiliated or non-affiliated firms has resulted in FDI which is seen as an engine of economic growth. Although the theoretical models for FDI and technology transfers are well developed (Glass and Saggi, 1998, 1999), empirical studies provide mixed results. Another potential channel for technology spillover is information technology (IT), which is well known for improving the efficiency of production and reduce the cost of communication and monitoring among the distant firms (Jeon and Rhyu, 2005).

Further, with easy access to modern communications technology, firms in all globalizing countries are under pressure to improve their productive efficiency in the face of competition from newly-emerging domestic firms on one the hand and foreign competition on the other. This is especially true in the case of India, which initiated major economic reforms in 1991, for shift towards an open economy along with privatization of a large segment of the economy. These reforms were phased over a number of years and several reforms have been recently implemented after 2000 (Ahluwalia, 2002). The removal of quantitative restrictions and trade barriers to entry has opened up the economy to international market forces which coupled with the rising economic and social aspirations of the population, has again led to the rapid emergence of a competitive environment especially in the industrial sector. Continuous improvement in productivity and efficiency is necessary particularly if India is to achieve a high growth rate and competitive target set for the industrial sector in the international market. International investors are now evaluating the different local business environment or investment climate (IC), geographical features, local labor laws, transport facilities offered by various regional areas, as well as capabilities and strategies of the local firms, etc. So the technology spillovers are varied across the firms of an industry located in different regional areas in India.

Industrial policy in the post-reform period mainly aims at de-licensing, privatization, FDI promotion and trade liberalization in the manufacturing sectors. To attract FDI, the policy regime

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1 For a recent literature survey, see Athreye and Kapur (2006); Ang (2009) and Madsen, Saxena and Ang, 2010.
for FDI has been liberalized considerably and gradually. Automatic approvals have been implemented from 51 to 100 percentages in equity investment in all-most all industries in India after the 1990s. To attract FDI into the manufacturing sector of India several incentives and policy initiatives have been undertaken, for example, tax incentives, lowering of tax, relaxation of land acquisition policy, etc. Continuous efforts in reducing the tariff rate along with complementary changes in industrial policy, technology import policy, and FDI policy are aimed at making the Indian industry more efficient, technologically up-to-date and competitive with the expectation that the efficiency improvement, technological up-gradation and enhancement of competitiveness will enable rapid growth.

The technology spillover for the host country firms has been an important route of the outsourcing of knowledge, embodied in FDI brought in by the MNCs. So, the expectation of gaining technology spillover has persuaded many developing countries to offer various incentives to attract FDI. In fact, the results of empirical research to test the validity of technology spillover are far from conclusive. From the empirical findings, it appears that the positive technology spillover from FDI is not automatic, but it depends on both country-specific factors and policy environment (Kohpaiboon, 2006). An analysis of the technology spillover impact of FDI on host economies has typically assumed this impact to occur in two linked steps: First, MNCs parent to subsidiaries international transfer of technology that is superior to the prevailing technology in the host economy; and Second, the subsequent spread of this technology to domestic firms in technological spillover effect (Gorg and Strobl, 2001; Lipsey and Sjoholm, 2004).

1.2 Technology Spillover and Its Measurement across Indian Manufacturing Industries

The present study has attempted to analyze the positive effects of FDI and technology spillovers across Indian manufacturing industries. The analysis tries to measure the FDI and its technology spillover effect in terms of horizontal spillovers across sixteen selected manufacturing industries in India. Further, the technology spillovers effect of FDI has been examined by the role of foreign presence across Indian manufacturing industries. In other words, we analyze the presence and the degree of variation in technology spillover effect across Indian manufacturing industries. Which industry benefits by the diffusion of foreign technology such that its labor productivity becomes higher in the short-un and long-run are hereby examined. The intra-industry or horizontal technology spillovers have been analyzed by using the panel data methods taking into account the possible non-stationarity of the variables in level forms. Taking into consideration
of the non-stationary of the variables in level form, the study uses the Pedroni (2000, 2004) panel cointegration approach in the specific empirical models, and group fully modified OLS (GFMOLS), fully modified OLS (FMOLS), and dynamic OLS (DOLS) in order to find the consistent and efficient parameters estimates in the models.

Empirical examination of the dynamic spillovers across sixteen Indian manufacturing industries follows as an extension of the initial analysis, where we are trying to measure the horizontal spillover in short-run and long-run dynamics across sixteen manufacturing industries in India. The dynamic technology spillover effects across Indian manufacturing industries can be examined by incorporating the dynamics effect of the lagged endogenous variables (labor productivity) and other lagged explanatory variables in empirical models. To measure the dynamic spillovers across Indian manufacturing industries, the present analysis applies the Generalized Method of Moments (GMM) techniques of the dynamic panel data models.

R&D and new innovations, however, do not always yield regional economic growth. The benefits of knowledge can move from one place to another without any cost. For instance, a new innovation introduced on the west coast can be appropriated on the east coast. To what extent can the relative benefit of technology spillover in regional market or regional economies be appropriated by the local firms? By considering the business environment and infrastructure variations across different clusters of regional zones of the Indian economy, the variation in technology spillovers of domestic firms across the different clusters can be analyzed. Moreover, there are supporting research studies which discover the importance of geographical location and infrastructure in innovation and spillovers (Adams & Jaffe, 1996; Audretsch & Feldman, 1996; Feldman, 1994, 1999; Jaffe, Trajtenberg, and Henderson, 1993).

The concentration of economic activities is indeed an important condition for the local appropriation process of spillovers (i.e., if there is only one firm in town, new innovations introduced by this firm are unlikely to spillover locally). However, the study analyzes the role of industrial cluster, competition and local business environment for regional economic growth, and development. The factor market conditions, demand conditions, and business environment varies across different clusters of a country like India, and so the degree of technology diffusion and spillover can be varied across different clusters in India. In order to analyze the FDI and technology spillovers effect in a particular cluster as well as inter-cluster technology spillovers, the study has selected ten different clusters across four regions in India. The study has attempted
to explore the horizontal and vertical spillovers, i.e., intra-industry and inter-industry technology spillovers of seven selected industries in a particular cluster.

The rivalry effect of FDI is more likely to dominate spillovers within industry rather than between industries. In a different environment if there is leakage of technical knowledge from the subsidiary of MNCs to domestic producers, such spillovers are most likely to generate productivity improvements in non-competing and complementary sectors. The evidence of within industry FDI spillovers in panel data studies is more important because it suggests the non-excludability of technical knowledge. In other cases, it hints at the evidence regarding the importance of considering inter-sectoral knowledge flows. Scherer (1982) finds evidence regarding R&D spillovers to diffuse across industries. However, in the context of knowledge diffusion between cities, Glaeser (1992) found the importance of spillovers between industries rather than within industries suggesting returns to cross-fertilization of ideas in diverse instead of specialized environments.

In the case of intra-industry spillovers, if the MNCs have domestic vertical linkages in the host country, the subsidiaries benefit from knowledge sharing with client and supplier. In one case, the local market penetration generates beneficial forward linkages and information flows between the subsidiary and the users of its outputs. On the other hand, outsourcing yields backward linkages leading to knowledge transfer to upstream sectors. Hence, the vertical propagation of knowledge or know-how which creates new technological opportunities for host country producers induces inter-industry spillovers but industry-specific knowledge flows are bound to be limited in scope. The study has selected twelve 2-digit level of Indian manufacturing industries to empirically examine the within and between industry technology spillover effect of FDI. The first component of the analysis pertains to the horizontal or intra-industry spillover of FDI across sixteen manufacturing industries in India. This is followed by an attempt to empirically examine both dimensions of spillover effect by covering the intra-industry (horizontal) spillovers and inter-industry (vertical) spillovers of FDI across twelve manufacturing industries in India.
1.3 Objectives of the study

The study relates to organized manufacturing industries in India. It deals with FDI and spillover effects of FDI on labor productivity. The major data sources are the Prowess database of the Centre for Monitoring Indian Economy (CMIE), Annual Survey of Industries (ASI), National Accounts Statistics (NAS) and Reserve Bank of India (RBI) Bulletin.

The present analysis mainly has the following objectives:

1. Analysis of the role of FDI and the technology spillover effect across Indian manufacturing industries, i.e., it attempts to examine the FDI and horizontal (intra-industry) spillover effect on labor productivity across sixteen manufacturing industries in India.

2. Examination of FDI and its dynamic spillover across sixteen Indian manufacturing industries with application of the dynamic panel data models by incorporating the dynamic effect of the lagged endogenous variable (labor productivity) and other lagged explanatory variables in the empirical models.

3. Measurement of the technology spillover across different industrial clusters in India and analysis of inter-cluster comparative technology spillover with respect to some basic parameter in the model. The study tries to examine the technology spillover of seven selected industries in a particular cluster and its inter-cluster comparative spillover analysis across different selected clusters in India.

4. Finally, an attempt to examine the FDI and horizontal (intra-industry) spillovers and vertical (inter-industry) spillovers effect on labor productivity across twelve Indian manufacturing industries.

In this study FDI and technology spillovers across selected Indian manufacturing industries have been analyzed keeping in mind the different kinds of intermediate factors, technology import intensity, R&D intensity, capital, capital intensity, firm and industry-specific effects, etc. at various levels. The dimensions of technology spillovers are analyzed in terms of some microeconomic and macroeconomics parameters at various stages and at different levels.

This study has been organized as follows:

- Firstly, the study attempts to examine the role and presence of FDI and its horizontal technological spillovers effect on domestic firm’s labor productivity across sixteen organized Indian manufacturing industries. Here, the estimation is based on the long-run relationship between labor productivity (endogenous variable) and its relevant regressors such as foreign
presence (foreign presence is taken as a proxy in place of FDI), technological gap, market concentration, real gross capital stock, capital intensity, R&D intensity of the domestic and foreign firms and technology import intensity of the domestic and foreign firms. Further, analytical description is made regarding the FDI and technology spillovers across Indian manufacturing industries both in terms of short-run and long-run dynamics. It interprets the long-run relationship between labor productivity and its regressors in the empirical model and further it goes into the technology spillovers across industries.

➢ Secondly, this study attempts to find out the dynamic spillover by incorporating the lagged effect of endogenous variables (labor productivity) and other explanatory variables both in level and lagged forms. Review and discussions of the method of dynamic panel data models and the theoretical intuitions behind the GMM estimators and its application to Indian manufacturing industries are done in order to find out the dynamic spillover. This aspect of this study is an extension of the above mentioned first component of the analysis by examining the dynamic spillover across sixteen manufacturing industries in India.

➢ Thirdly, this study attempts to explore the FDI and technology spillovers in a particular industrial cluster along with analyzing the inter-cluster comparative technology spillover across the different selected clusters in India. The horizontal and vertical spillover effect of FDI in a cluster or the vertical (inter-industry) and horizontal (intra-industry) spillovers linkages over seven selected industries in a cluster are hereby analyzed.

➢ Fourthly, the first aspect of this study is developed further by including the two dimensions of technology spillovers effect of FDI that is the horizontal and vertical spillovers across Indian manufacturing industries. Thus, the fourth part of the present study tries to find out the FDI and horizontal (intra-industry) and vertical (inter-industry) technology spillovers across twelve selected manufacturing industries in India. Both intra-industry and inter-industry technology spillovers are transmitted via different kinds of intermediate factors, which have been analyzed in this study.

1.4 Significance and Implications of Research

FDI is perceived by the government presently as an important cross border mechanism to stimulate growth, development, and to create new resources. Since the 1990s and 2000s FDI is freely allowed in many sectors with automatic approval, freedom of location and choice of technology, imports and exports, repatriation of profits, dividend, and capital are also permitted
freely in inter-country trade. Since November 2005, FDI up to 100 percent in most activities is allowed under the automatic route. The government aims to attract large amount of FDI by setting up special economic zones, science parks, and free trade warehousing zones. Foreign investments are particularly sought after in sectors such as power generation, telecommunications, infrastructure like ports & roads, petroleum exploration/processing and mining. A ten-year tax holiday is offered to firms/companies that are engaged exclusively in scientific R&D with commercial applications.

India’s foreign trade has increased though the country’s share in world exports remains low at 1.1 percent for merchandise exports (rank 27); and 2.7 percent (rank 9) for commercial services trade in world trade (International Trade Statistics, WTO, 2008). Between 2000 and 2009, FDI inflows into India were $ 4,029 and 37,745 million respectively. Most FDI inflows come from a few countries. Between 2000 and 2009, foreign investment was mostly made by ten countries accounting for 81 percent of FDI in India. The main investors are Mauritius, Singapore, U.S.A., U.K. and the Netherlands. As Mauritius has a separate agreement with respect to low rates of taxation with India on behalf of double tax avoidance regime it emerges as the largest source of FDI.

Between 2000 and 2009, FDI received by the Indian economy mainly related to the sectors such as manufacturing, computer software and hardware (9%), services sector (financial and non-financial) (22%), telecommunications (9%); automobile industry (4%), and chemicals (2%), respectively. Since, 2000 to 2009 services sector ranked first in attracting FDI. Indian business services (IT, software, financing, insurance, real estate, etc.) are gathering momentum corresponding to the global tradability revolution in services. India is the main destination for off-shoring services such as back office processes, customer interaction, technical support, and R&D spending. Indian services are more sophisticated with higher price tags like reading medical x-rays, analyzing equities, processing insurance claims, etc.

The more developed states in the Indian union attract the largest part of FDI because firms choose to locate their activities in the most developed areas of the country in the interests of competitiveness. Eight regional offices received more than 75 percent of FDI inflows. New Delhi and Mumbai and their regional clusters received 55.19 percent of the total FDI inflows (April 2000 to October 2009) with respectively 19.19 and 36 percent each (from different regional offices of RBI). Chennai, Bangalore and Hyderabad are the next most attractive places for the
global investors. Most of the software firms are located in regional clusters in Mumbai and Bangalore, where Indian industry was originally developed, but MNCs are also growing in numbers in Delhi, Andhra Pradesh and Tamilnadu. Competitiveness and productivity as contributors to production are found in these clusters condensed in the south axis of Chennai-Bangalore and in the northern region mainly in Delhi, Gurgaon and NOIDA.

India on account of its buoyant economy, larger consumer market and a 61,000 unit banking system is becoming an attractive destination for global investors and foreign enterprises. According to the World Investment Report (WIR) and A. T. Kearney’s FDI Confidence Index (India Brand Equity Foundation (IBEF), 2008), India ranks after China and shares the same position as USA as an investment destination. TNCs invest in India to improve productivity, competitiveness and profits by reducing costs. This is made possible by improving the productivity of domestic firms in Indian industry. Given the significance of the Indian manufacturing industries for competitiveness and productivity, the study attempts to empirically measure the FDI and horizontal and vertical technology spillovers effect on domestic firms’ labor productivity across Indian manufacturing industries in a more comprehensive framework.

Some existing studies have theoretically, analytically and empirically investigated the productivity, competitiveness, intra-industry trade of goods and services, and technology spillovers effect related to Indian manufacturing industries. These include the following:

Siddarthan and Lal (2003) present evidence regarding the significant spillover effect of FDI to local firms. In fact, the spillover effect was moderate during the initial years of liberalization but increased sharply after economic liberalization in India. The study shows that domestic firms which have a higher labor productivity gap cannot benefit much from the MNEs while domestic firms those that have a low productivity gap are able to absorb a greater technological externality and spillover effect from FDI.

Mitra et al. (2002) study related to total factor productivity and technical efficiency of the Indian states for the period 1976 to 1992 and examines the role of infrastructure for determining the performance of Indian industry. Veeramani and Goldar (2005) measure the impact of investment climate across Indian states and investigate its effect upon the total factor productivity in the manufacturing sectors of the different states during the pre-reform and post-reform periods.

Kumar and Sen Gupta (2008) find that the Indian manufacturing sector exhibits a great deal of regional variation and marked a dualism between the organized and the unorganized
segments in terms of productivity and wage levels. Further, the level of labor absorption in the organized manufacturing sector has been weak as it reflects declining labor intensity in this sector. They find that there have been significant changes in the composition of exports in the last 20 years, because India is still a very small player in terms of production of knowledge intensive and advanced technological products. However, the analysis gives a comprehensive framework for the state and conditions of the manufacturing sectors in productivity and focuses on the determinants of its competitiveness.

Gupta, Hasan and Kumar (2008) focus on the Indian manufacturing sector growth rate after the economic reforms period. By using the ASI data at the three digit level, their paper finds that the post-reform period performances of the manufacturing sectors were heterogeneous across industries. The paper gives importance to infrastructure development and financial development to accelerate growth of the Indian manufacturing sectors. They also consider the development of labor intensive industries and factors responsible for the growth and development of manufacturing.

Banga (2003) paper shows that FDI has a significant impact on the export-intensity of industries in the non-traditional export sector in India. The impact of FDI on exports, however, differs with respect to the source country of FDI. She finds that US FDI is seen to have a positive and significant effect on export-intensity of industries in the non-traditional export sector in India, while Japanese FDI does not have any significant effect. In the traditional export sector, and taking aggregate manufacturing sector she finds that FDI has no impact on the export-intensity of the industry. At the firm level, the spillover effect of Japanese FDI and US FDI are varied in the non-traditional export sector. The study shows that US firms have larger spillover effects on the exports of domestic firms as compared to Japanese firms.

Banga (2005) tries to find out the relationship between the wages and employment after the import liberalization in Indian manufacturing industries. She concludes that higher trade has been mostly associated with higher employment but lower wages. However, given the differences in the labor laws across countries, these effects have been found to be mainly country-specific.

Bergman (2006) finds the intra-industry spillover effects of FDI in the pharmaceutical industry of India. An econometric application has been carried out in order to examine the impact of FDI on the industry. Spillover effects of FDI are visible through many of the spillover channels and the regression results shows that firms with foreign ownership experience a higher level of
productivity. In fact, the correlation between FDI and productivity in domestic firms is insignificant due to various reasons for instance absorptive capacity of the local firms, market structure, trade and technological policies, etc.

Pant and Mondal (2010) find that technology transfer from FDI in India is more likely to be achieved by the presence of foreign firms rather than by simple purchase of technology. They support the view that the technology transfer and spillover is dependent on the absorptive capacity of the localized firms. They emphasized the role of institutional factors like competitive environment of industries. The greater the extent of competitiveness of an industry the more likely would be the technology spillover of an industry.

Although, there is existing literature on FDI and technology spillovers across Indian manufacturing industries, the present study attempts to examine a new dimension of spillover effect of FDI on domestic firms: effect on labor productivity can be within an industry or between the industries. The present study tries to examine this new dimension in spillover studies by covering both intra-industry and inter-industry spillover effect of FDI across Indian manufacturing industries. A broader view regarding short-run heterogeneity and long-run dynamics of technology spillovers is attempted through the application of panel cointegration procedure to the specified empirical model in order to estimate the within and between industries technology spillover effect of FDI across manufacturing industries in India.

Another aspect lacking in the existing literature is the variation in the technology spillover effect between different regions and across different industrial clusters in India. This analysis attempts to explore a new kind of cluster-specific technology spillover and an inter-cluster comparative study of technology spillover with respect to some basic parameters in the regression model, which has been discussed in this study. Both empirically and analytically the study (within its model parameters) examines the role of inter clusters/regional technology stock, different kinds of intermediate inputs reflecting horizontal FDI, capital and capital intensity, and cluster-specific factors like market concentration, etc to determine the technology spillover in a cluster.

1.5 Overview of Chapters
The study has seven chapters and it is organized as follows:
Chapter 1 discusses the introductory concept of technology spillovers; its measurement across Indian manufacturing industries, the objectives of the study, and the significance and importance of this study in the present scenario.
Chapter 2 gives the literature review of FDI and technology spillover in different contexts. First, it defines the meaning of technology spillovers and its related research. It discusses the different extent of technology spillovers from FDI, that is it explains vertical welfare, pecuniary or rent spillovers and it is called as inter-industry spillover, and simultaneously it includes the related review of horizontal, knowledge, non-pecuniary, or technological intra-industry spillovers. Further, it discusses the typology of spillovers studies categorically divided into two parts: technology flow approach and cost function approach. It covers both approaches in terms of meaning and definition as well as its review related literature. Two other approaches in the typology of spillovers study namely the production function approach, and the paper trail approach are covered in this chapter. Finally, the intra-industry and inter-industry spillover effect of FDI, which occurs through the supplier and buyer chains in the host country upstream market is analyzed.

Chapter 3 analyzes the spillover effect of FDI across sixteen manufacturing industries in India. This chapter gives an analytical description regarding technology spillovers effects across sixteen manufacturing industries due to the infusion of FDI. Foreign presence by way of FDI reflects the horizontal spillover across manufacturing industries in India. To measure the FDI and its horizontal technology spillover effect, sixteen manufacturing industries have been selected, out of which twelve are broad 2-digit level and four allied industries which are part of chemicals, transportation, electronics, and rubber and plastic products. The study has undertaken an industry-level analysis of sixteen manufacturing industries out of which 2148 firms are considered as domestic firms and 231 firms are considered as foreign firms, so that the total firms in these sixteen selected industries are 2379. Data has been collected from the various sources for example: the principal source is CMIE based Prowess data set, while other data sources are the Annual Survey of Industries (ASI), National Accounts of Statistics (NAS), RBI Bulletin, and Handbook of Statistics on Indian Economy, etc. The analysis gives a long-run relationship of labor productivity with respect to the set of explanatory variables, which further leads to the technology spillovers across Indian manufacturing industries. To estimate the long-run relationship the study has employed the methodology of Pedroni panel cointegration, group fully modified OLS (GFMOLS), fully modified OLS (FMOLS), and dynamic OLS (DOLS) techniques.

Chapter 4 empirically examines the FDI and its dynamic spillovers effect across Indian manufacturing industries. It discusses the dynamic panel data models and its application to Indian
manufacturing industries. It discusses the theoretical intuition behind the methods of GMM while focusing on the multivariate autoregressive distributed lag models. This chapter analyzes the lagged effect of the dependent variables (labor productivity) and other level and lagged form of explanatory variables, which corresponds to the dynamic spillovers across sixteen Indian manufacturing industries. The study examines the dynamic spillover across Indian manufacturing industries by incorporating the dynamic role of the lagged endogenous variables. The difference GMM and system GMM has been exerted in our autoregressive distributed lag models (ARDL) with variables in level and lagged difference forms. The size of the firms can act as a major determinant for the technology spillovers because the absorptive capacity of the large-size firms might be higher in comparison to the small-size firms. Thus, two separate ARDL panel data models one for small size firms, the other for large size firms have been estimated to examine the idea of the absorptive capacity and dynamic technology spillover at the industry level.

Chapter 5 analyzes the horizontal and vertical technology spillovers effects of FDI across ten selected clusters in the north, south, east and west regions in India. In order to measure the technology spillover across industries in a particular cluster the study has taken seven broad 2-digit level industries like chemicals, metal products, non-metallic mineral products, non-electrical machinery, electrical machinery, transport equipment and textiles. Clusters have been selected on the basis of plant location of both foreign and domestic firms. To measure the technology spillover in a particular cluster, foreign firms’ presence (plant location) is the basic requirement in a cluster. Further, to measure the technology spillover of a particular cluster the analysis here develops an innovative production function along with a conventional production function, which measures the FDI and technology spillover in a cluster and simultaneously it accounts for the inter-cluster technology spillover. In fact, the specification of the production function is to measure the technology spillovers across different selected clusters in India and its inter-cluster spillover analysis with respect to some basic parameters in the model. The technology spillover across ten selected clusters and its inter-cluster technology spillover analysis can be empirically examined by applying the panel data methods of pooled OLS estimate, within group estimate (WG) and Generalized Method of Moments (GMM) estimates. In addition, the analysis here take into accounts for the role of investment climate, factor conditions, demand conditions, firm’s strategy, rivalry environment in a cluster, and the role of allied and supported industries for the technology spillover in a cluster.
Chapter 6 discusses the horizontal and vertical spillover of FDI across Indian manufacturing industries. In order to empirically examine the intra-industry and inter-industry technology spillover the study has taken twelve broad 2-digit level industries namely, food products, beverages and tobacco, cotton textiles, textiles, woods products, paper and paper products, leather products, chemicals, non-metallic mineral products, metal products, non-electrical machinery and electrical machinery. This study analyzes the role of intermediate factors which come from its own industry and intermediate factors from other industry in different ways and can be incorporated into the production function such that domestic firms’ labor productivity becomes higher. The intra-industry and inter-industry technology spillovers from FDI are transmitted via different kinds of intermediate factors and it gives an equilibrium relationship between the variables over long-run dynamics such that labor productivity of the domestic firms becomes higher.

Finally, Chapter 7 outlines the findings and conclusions of this study and gives some policy implications.