Chapter 7

Conclusions and Policy Implications
7.1 Conclusions
The study empirically examined the intra-industry (horizontal) and inter-industry (vertical) technology spillovers effect of FDI across Indian manufacturing industries. A summary of the main findings is given below:

(i) FDI and Its Technology Spillover Effect across Indian Manufacturing Industries
The first aspect examined in this study is the horizontal spillover effect of FDI across Indian manufacturing industries. The infusion of FDI and its positive externality has been examined with respect to sixteen manufacturing industries in India. Out of the sixteen manufacturing industries, twelve are 2-digit level (NIC classification) industries and four belongs to the allied industries, which are part of the chemicals, transportation, electronics and rubber and plastic products industries. From this empirical evaluation, it has been found that foreign presence by way of FDI generates technological spillover to the domestic firms and thereby causes diffusion of information and knowledge to the localized firms across manufacturing industries of India. Further, we find that the higher is the technological differences between domestic and foreign establishments, the bigger will be the imitation problem and hence the lower would be the technology spillover and consequent gains in labor productivity across Indian industries.

From this study we find the long-run relationship between labor productivity of domestic firms and its relevant regressors including FDI, which has been discussed in the empirical model. The long-run relationship has been analyzed by application of the Pedroni cointegration test. Empirical results reveal that cointegration is high for some of our specified estimated models, that is, it is relatively higher between the labor productivity of large size domestic firms and exogenous variables like capital, capital intensity, foreign presence, R&D spending of the domestic firms and foreign firms, technology import intensity of the domestic firms and foreign firms and technological gap of the industry. Therefore, we can infer that there exist a significant long-run relationship between labor productivity over large size domestic firms and the above mentioned exogenous variables in the model, which brings out how FDI and certain other factors impact and result in the higher labor productivity and technology spillover in the long-run. However, we further find that cointegration exists also in the other specified estimated models, i.e. the models for small-size domestic firms. Thus, all types of domestic firms get advantage of foreign technology from their foreign counterparts. Further, we find that the degree of technology spillover is not subject to size of the firms rather it is influenced by some other exogenous factor.
Therefore, we can say on the basis of this analysis, that all sizes of domestic firms get the technological advantage from the FDI-generated firms.

Empirical findings reveal that intra-industry (horizontal) spillover are quite high in industries like foods products, textiles, chemicals, drugs and pharmaceuticals and non-metallic mineral products. However, from this empirical exercise, it appears that some explanatory variables have a dynamic long-run inter-linkage with endogenous variables (labor productivity) in the model and some variables do not possess this kind of dynamic long-run relationship.

(ii) **FDI and Its Dynamic Spillovers Effect across Indian Manufacturing Industries**

The second aspect of this study is the dynamic spillover effect of FDI across Indian manufacturing industries. To examine the dynamic spillover across Indian manufacturing industries the study applies the dynamic panel data models to Indian manufacturing data. Further, the study discusses briefly the literature on GMM estimators of the dynamic panel data models. The emphasis in this analysis is on the interpretation of the multivariate autoregressive model. The dynamic panel data models solve the problem of endogeneity and serial correlation which lies in the model. The GMM is routinely employed for the estimation of autoregressive models in short panels, because it provides simple estimates for fixed–T estimates and optimally enforces the models restrictions on the data covariance matrix. In the application of such a model for this study we find that estimation results provide clear evidence that the lagged explanatory variables such as labor productivity of the domestic firms are quite relevant for the determination of the endogenous variable, signifying dynamic technology spillover.

We find that the dynamic spillover is influenced by number of prominent exogenous factors. The intra-industry foreign presence, R&D spending, and technology import intensity enhance the technological dynamic spillover across Indian industries. In addition, we found that technological disparity between domestic and foreign firms tends to diminish the productivity and technological spillover over the localized firms. The empirical results further indicate that the degree of dynamic spillover is not influenced by the size of the firms rather it is influenced by other exogenous factors. In addition, from the empirical evaluation, it is interesting to mention that all sizes of localized firms benefit from the FDI-generated externalities. One important finding from the analysis is that dynamic productivity spillovers are a subjective function of the lagged endogenous variable (labor productivity) and lagged exogenous factors. Intra-industry foreign
presence by way of FDI and past shock represented by lagged foreign presence in the study helps spread the technological knowhow to the localized firms of Indian industries.

(iii) **FDI and Technology Spillovers Effect across Different Selected Clusters in India**

The third key aspect of the study, empirically examined the technology spillovers in a particular cluster and inter-cluster technology spillover across ten selected clusters of different regions in India. The study examines the technology spillover of a particular cluster by the relevance of intermediate factors like cluster/region-specific horizontal FDI, technological stock of clusters/regions, capital, capital intensity, market concentration index of a cluster and finally the different aspects of the investment climate. The empirical literature and analysis broadly highlight the impact of the business investment climate of a particular cluster upon the productivity of the domestic firms in the cluster. Our findings suggest that good investment climate and buoyant demand conditions, good factor conditions, firm rivalry strategy and allied and supported industries can augment the productivity of domestic firms in a particular cluster.

The mechanism of the innovative production functions along with a conventional production function measure the technology spillover of a cluster. Inter-clusters spillover analysis is undertaken through the inter-linkages of cluster-specific, region-specific technological stock and different aspect of the horizontal FDI. However, from this study, the inter-regional knowledge transmission and intermediate factor of production turn out to be the major conduit for technology spillover of a cluster. We find that the domestic firms benefit from their foreign counterparts in a cluster and also obtain benefit from their region-specific foreign firms. It is observed that localized firms in northern region clusters benefit from their region-specific foreign firms rather than from their cluster-specific foreign firms. Northern clusters obtain the positive spillovers from the region-specific foreign presence.

Technology stock (cumulative R&D spending) of a cluster/region substantiate in some cases to expedite the cluster-specific technology spillovers and labor productivity over localized firms. Further, the cluster-specific regional R&D spending does not exert a strong influence to augment the productivity of local firms across northern region clusters. The investment climate factors which envelop the scientific, institutional environment like credit facilities of the commercial banking system are effective in the Baddi and Bhiwadi industrial clusters. This
indicates that firm’s plant location in the urban area helps them to avail more credit facilities from the banking system in comparison to the rural area located firms.

The cluster-specific technology stock in Kolkata cluster affects positively to increase the labor productivity through technology spillover. This means that local firms get benefit when more technological stock builds up inside the cluster. Another interesting point we can note for this cluster is that domestic firms get benefit from their region-specific foreign firms rather than from their cluster-specific foreign firms. Further, we find that firms having their plant located in the rural or city areas are acquiring the same benefits from their foreign counterparts. Therefore, we can say that for this cluster technology spillover is not subject to the factors like distance, scientific, and institutional environment like credit facilities of the banking system, etc.

The technology spillover is quite insignificant in Ankleswar and Thane clusters, because of low presence of foreign firms in this region. Further, we find that the influential factors like cluster/region-specific technology stock and cluster/region-specific horizontal foreign presence do not have significant impact to enhance the labor productivity and technology spillover across the western region clusters. In Ankleswar cluster, the study further finds that firms with plant location in city areas geographically avail more assistance than the plant located in rural areas.

From the empirical exercise we find that technology spillover in southern region clusters are relatively higher in comparison to the clusters of other regions in India. Further, we find from this analysis that technological spillover to domestic firms in Bangalore cluster is relatively higher in comparison to Chennai and Hyderabad clusters of southern region in India. This is probably because of the greater and sizeable level of foreign presence in this cluster. Empirical exercise do not support our hypothesis that firms located in urban areas or in the core part of the cluster can have greater scope for gaining technology spillover than the rural or periphery areas located firms. Rather, from empirical evaluation, the study suggests that technology diffuses equally across rural area and city area located firms.

(iv) Intra-Industry and Inter-Industry Technology Spillovers Effect of FDI across Indian Manufacturing Industries

Finally, the study examined the intra-industry (horizontal) and inter-industry (vertical) technology spillovers effects of FDI across twelve Indian manufacturing industries. Estimation results provide evidence in favor of the long-run relationship between labor productivity of domestic firms and relevant regressors in the empirical model. The estimated relationship clearly
indicates that there are horizontal and vertical technology spillovers across Indian industries. We in the conceptual framework consider a worldwide leading edge technology which is the maximum level technology of an industry and can be accomplished by maximizing the variety of intermediate inputs used. We hypothesize that the industry of a country tries to reach the maximum level of worldwide leading edge/most advanced technology by maximizing the intermediate factors.

The study finds that technology spillovers can be transmitted through various kinds of intermediate factors. Further, the analysis suggests that the greater the extents of intermediate factors, the larger are the labor productivity and technology spillovers of an industry. Pedroni cointegration test presents evidence in favor of the long-run relationship in the model and existence of technology spillover across Indian manufacturing industries. The cointegrating vectors incorporating variables like intra-industry foreign presence and other/inter-industry foreign presence make us believe that such factors spur the labor productivity and technology spillover across Indian industries. Further, the study quantifies the positive role of R&D intensity, inter-industry R&D intensity, technology import intensity and inter-industry technology import intensity to stimulate the technology spillover and labor productivity across Indian industries. The empirical results provide basis to infer that both intra-industry and inter-industry technology spillovers are present in industries like cotton textiles, textiles, woods products, paper and paper products, leather products, chemicals, non-metallic mineral products and electrical machinery.

7.2 Policy Implications
The findings of this study have several policy implications, which can help to augment the labor productivity of domestic firms through technology spillovers across Indian manufacturing industries. These are discussed below:

(i) We find that in industries like drugs and pharmaceuticals, textiles, food products, chemicals and non-metallic mineral products, etc. the scope of labor productivity enhancement by means of technology spillovers are quite high, because domestic firms in these industries are picking up more foreign technology from their foreign counterparts. Other selected manufacturing industries cannot appropriate such gains in technology from foreign firms to lift the labor productivity of domestic firms. This indicates that the absorptive capacities of the domestic firms in some industries are quite low. It is the role of the government and policy makers to address this kind of problem. Some domestic firms/companies have low absorptive capacity and high technological
gap so that they cannot absorb foreign technology, information, and knowledge spillover from the foreign firms. This problem needs to be tackled by the policy makers and governments of India if productivity of domestic firms has to be raised.

(ii) The study analyzed the technology spillover of a particular cluster and its inter-cluster technology spillover analysis across the different selected clusters in India. Empirical evaluation shows that the southern region clusters perform better in terms of elevating the labor productivity by accruing the foreign technology, information and managerial practices, etc. from the FDI-generated firms. In addition, macroeconomic parameters like good factor market conditions, better business environment, demand conditions, rivalry between the firms of an industry and allied and supportive industries turn out to be the significant factor for competition and technology spillover in a cluster. Thus, it is important for the state government to establish suitable policy framework to attract more foreign funds into the state. By the application of a suitable tax incentive policy, land acquisition policy, healthy environment and good work culture, transparent labor laws, minimizing the corruption, etc. it is possible for the state governments to attract more foreign capital into the different regions of India. Further, foreign technology and capital can lift up the productivity of domestic firms and technology spillovers across different regions in India.

(iii) Results of empirical exercise indicate that some industries are able to gain from both intra-industry and inter-industry technology spillovers effect of FDI. Due to the high technological differences between the foreign and localized firms in an industry, the technology knowhow of an industry may not be able to penetrate to another industry. Thus, a major stumbling block to the progress of Indian manufacturing industries is that some industries can appropriate both direct and indirect spillover to augment the labor productivity and some other industries cannot retrieve the direct and indirect spillover to build up the productivity and technology spillover.

Thus, it is the role of the policy makers to help in the process of productivity growth by minimizing the technological gap between the foreign and local firms, and further, creating a situation such that domestic firms of an industry can easily acquire and assimilate the foreign technology from the foreign firms. Minimization of the technological differences between foreign and local firms can reduce the imitation and gestation periods and finally, contribute to increase in labor productivity over localized firms in an industry.

(iv) In order to attract more foreign capital, Government of India can consider to initiate good labor laws, transparency in the tax system, reducing the extra burden of the tax on corporate
individuals, suitable tax policy, and land acquisition policy in different regional areas. Therefore, government can provide a progressive and favorable atmosphere to the foreign investors as well as to the local investors.

(v) There must be proper coordination between the state and central government to implement a suitable policy on tax system, land acquisition policy and minimization of corruption so that India can attract more foreign investors. Though, some of the rules and regulations are varied across different states in India, a pertinent and healthier macro level policy framework can be applied across different states in India and it is feasible to apply such a policy across different regions in India.