JOURNAL OF ECONOMIC DEVELOPMENT 55
Volume 40, Number 3, September 2015

# TECHNOLOGY SPILLOVER AND DETERMINANTS OF FOREIGN DIRECT INVESTMENT: AN ANALYSIS OF INDIAN MANUFACTURING INDUSTRIES

SMRUTI RANJAN BEHERA*

*Indian Institute of Technology Ropar, India*

This paper examines the technology spillover from foreign direct investment (FDI) and subsequently, determines the factors for FDI-participation in Indian manufacturing industries. The result based on a two-equation model facilitating the link between labor productivity and foreign presence suggests that foreign presence plays an important role in the diffusion of technology from foreign firms to domestic firms, provided the recipient firms have the capacity to absorb and adopt the foreign technology. Furthermore, the results suggest that industries experiencing decline in the tariff cost exhibit stronger growth in labor productivity. Finally, we find that large domestic market size and highly productive domestic sectors, are likely to attract more FDI from abroad.

*Keywords*: Foreign Direct Investment, Technology Spillover, Manufacturing Industries
*JEL classification*: O41, F43, E23

## 1. INTRODUCTION

Foreign direct investment (FDI) has been widely recognized as a growth-enhancing factor for investment receiving countries and subsequently considered to be an important component of development strategy, and channels for technology spillover. FDI is believed to bring positive spillovers to domestic firms because the workers that embody the firm specific knowledge assets of the Multinational National Enterprises (MNEs) affiliates can be absorbed by domestic firms (Fosfuri *et al*., 2001). Because the MNEs usually use newly specialized intermediate inputs, whereas the domestic firms use local intermediate goods, the productivity of the latter can be raised through the technology

* I would like to thank the anonymous reviewer of the journal for providing me very useful and insightful suggestions, which enabled new ideas to be incorporated, and has improved the quality of this paper into a large extent. I would also like to thank the Editor of the journal for giving me an opportunity to revise this paper. All remaining shortcomings are, of course, mine.

know-how of the foreign firms. The technology diffusion of MNEs in the host country and its impact on domestic firms has been the subject of research in many empirical studies (Helpman, 1997; Xu, 2000; Girma, 2005). These empirical studies have generally found that there exist significant cross-industry knowledge and technology spillovers in embodied and disembodied forms benefiting both large and small size firms. The outcome of the technology spillover impact of FDI on host economies has two linked steps. The first step involves the MNCs parents' transfer of technology which is supposed to be superior to the prevailing technology of the subsidiary firms and industries of the host country. The second step involves the subsequent spread of this technology to domestic firms - a technology spillover effect.

FDI is considered to be an essential part of development strategy among the less developed countries. FDI not only brings capital, but also introduces advanced technology that can enhance the technological capability of the host country firms, thereby generating long-term and sustainable economic growth (Kohpaiboon, 2006). So, the expectation of gaining from technology spillover persuades many developing countries to offer various incentives in order to attract FDI. However, the positive technology spillover from FDI is subject to the country-specific factors and the nature of trade policy regime. Starting with the pioneering paper by Bhagwati (1973), a sizable literature has attempted to explain the restrictiveness or openness of trade policy regime conditions the gains to host countries from FDI (Bhagwati, 1978, 1985, 1994; Brecher & Diaz-Alejandro, 1977; Brecher & Findlay, 1983). A key hypothesis arising from this literature (usually referred as the Bhagwati hypothesis) is that technology spillover is likely to be far less or even negative under an import substitution (IS) regime, compared with a policy regime referred to export promotion (EP). Furthermore, Kokko *et al*. (2001) study explicitly tested the Bhagwati hypothesis in analyzing the spillover effects of FDI. They focused on technology spillover conditioned by the country's trade policy regime, based on Uruguayan firm-level inter-industry analysis, and subsequently, their findings support the Bhagwati hypothesis. Aitken & Harrison (1999) study reflect that foreign investment normally gravitates towards more productive industries.

Fernandes (2007) provides new evidence on the link between trade liberalization and plant productivity in Columbia. He finds that liberalization has a strong positive impact on plant productivity. In addition, he finds that the impact of liberalization is stronger for larger plants and plants in less competitive industries. Bernard *et al*. (2006) study was based on the productivity spillover of US manufacturing industries. They find that industry experiencing relatively large declines in the trade costs exhibit relatively high gain in productivity growth. They also find that reducing the trade cost increases the probability that low-productivity plants fail and raise the probability that higher-productivity plants expand by entering export markets or increasing their sales to foreign countries. Similarly, Kohpaiboon (2006) study was based on the Bhagwati hypothesis that technology spillover is conditioned by the nature trade policy regime. Her findings support the Bhagwati hypothesis, and also she finds that trade barriers and size of the domestic market play an important role in determining inter-industry differences in FDI participation. Amiti and Konings (2007) used the Indonesian manufacturing census data from 1991 to 2001 to find out the impact of trade liberalization on firms productivity. They find that reducing the input tariff substantially increases the firms' productivity and also they find that the effect of reducing input tariff is much higher than the effect of reducing output tariff.

In the Indian context, Kathuria (2002) finds that domestic firms in Indian manufacturing industries could be benefited from the knowledge spillovers from the presence of foreign-owned firms, provided they have significant technological capabilities to decode the spilled knowledge. Franco and Sasidharan (2010) examine the empirical evidence of export spillover effect in case of an emerging market economy, especially in India, using firm-level data for the period 1994-2006. Their findings suggest that in-house R&D is more relevant than other external sources of technological knowledge, such as disembodied technology imports to fully internalize the positive spillover effect emanating from MNEs. Banga (2006) paper highlights the export-diversifying impact of FDI in a developing country like India. FDI may lead to export diversification in the host country through spillover effects, i.e., the presence of FDI in an industry may increase the export intensity of domestic firms. Goldar and Kumari (2003) study indicate that the deceleration in productivity growth would not be attributed to import liberalization. However, the reduction in an effective rate of protection for industries seems to have a favorable effect on productivity growth in Indian industries. Krishna and Mitra (1998) examined the relationship between trade liberalization in India in 1991, market discipline, and productivity growth. Their findings suggest that there was an increase in competition, as reflected in the drop in markups; and also find the evidence of a reduction in returns to scale and some weak evidence of an increase in the growth rate of productivity over the year following the trade reforms.

Previous studies examined the role of trade policy regime, plant level productivity, and technology spillover from FDI in the context of developed, developing, and low developed countries, and specifically, in this paper only a few selected studies have been cited. However, the previous studies have not clearly examined the interaction between foreign presence and the nature of trade policy regime, and also not examined the interaction between market concentration and foreign presence variables, except a few studies like Kohpaiboon (2006) and Behera (2014).[1] Moreover, critically examining the

[1] Kohpaiboon (2006) has examined the interaction between nature of policy regime and foreign presence variables in Thai manufacturing, but she does not address the interaction between market concentration and foreign presence variables, which could be another possible channel of spillovers from FDI in Thai manufacturing industries. Similarly, Behera (2014) examined the importance of trade policy regime to evaluate the technology spillover from FDI in Indian manufacturing industries. However, his study does not address the relevance of the interaction between market concentration and foreign presence variables in analyzing the technology spillover from FDI in Indian manufacturing industries.

previous literature, it is quite clear that till now there is no extensive research on trade liberalisation, the nature of the trade policy regime, and local firms' productivity spillover in Indian manufacturing industries. Furthermore, none of the previous studies have clearly examined whether the trade liberalization in the 1990s could increase the local firms productivity spillover from FDI, and also subsequently, previous studies do not stress to examine the determining factors to attract FDI into the Indian manufacturing industries. India took the initiative of substantial trade policy reforms in 1990s, and trying to attract huge FDI from the global investors during the subsequent period after the 1990s. Therefore, keeping these factors into consideration, it is imperative to discuss the nature of trade policy regime in India and its impacts on the local firms' productivity spillover from FDI in Indian manufacturing industries. In other words, this paper empirically attempts to examine, whether the nature of trade policy regime and FDI presence in Indian manufacturing industries really benefit the domestic firm's productivity. In addition, this paper also attempts to examine the determining factors to attract FDI into Indian manufacturing industries. With this, the current research hopes to fill up the existing gap in the literature. To the best of our knowledge, in the Indian context, this study is the first, to date, that attempts to analyze the twofold issue, such as: technology spillover from the FDI subject to the nature of trade policy regime and the determining factors to attract FDI into the Indian manufacturing industries.

To empirically analyze the FDI and technology spillover and determining factors for FDI participation in Indian manufacturing industries, this study has been undertaken at the industry-level of 16 manufacturing industries consisting of 2,379 firms,[2] out of which 2148 firms are considered as domestic firms and 231 firms are classified as foreign firms.[3] Our findings suggest that industries experiencing declining trade cost exhibit stronger growth in labor productivity. The intra-industry spillovers from FDI are found to be quite significant. Furthermore, we also find that market size and highly productive domestic sectors are playing a significant role in determining the FDI-participation at industry-level of Indian manufacturing.

The rest of this paper is structured as follows. Section 2 discusses the foreign

[2] See Appendix 2, Table B1 for detailed selection of the industries.

[3] Firms with foreign equity of 10% or more than of 10 % are considered as foreign firms. According to the International Monetary Fund (IMF) criterion, this is the normal threshold level to classify between foreign and local firms, which have been followed by previous literature (Franco and Sasidharan, 2010; Kathuria, 2002). The analysis is based on the industry-level study of FDI spillover across Indian manufacturing. Furthermore, our principal source of the data base is 'Prowess', and in the data base, the firm-levels data are highly deviated, and some firms' entry/exit the industry at each financial year. In addition, there is no regular and systematic information of some of the factors like R&D expenditure, technology imports, entry/exit and merger/acquisition at firm-level. Thus, this analysis has been restricted to the industry-level, even if the firm-level data from the 'Prowess' are aggregated and later on match to the 2-digit NIC.

presence, and two industrial characteristics of Indian manufacturing industries. Section 3 discusses the empirical framework of the study. Section 4 discusses the econometric approaches of the simultaneous equation models, followed by a discussion of the data and the interpretation of empirical results are presented in Sections 5 and 6, respectively. Finally, Section 7 summarizes the key findings with a set of policy implications.

## 2. FOREIGN PRESENCE, MARKET CONCENTRATION, AND TECHNOLOGICAL GAP IN INDIAN MANUFACTURING INDUSTRIES

Table 1 presents the level of foreign presence of sample industries and two industrial characteristics, namely market concentration and technological gap of the industries.[4] The Centre for Monitoring Indian Economy (CMIE) based data set 'Prowess' is used to reveal the relative significance of key industrial factors like foreign presence, market concentration and technological gap of Indian manufacturing industries. Firstly, the market concentration of an industry is likely to play a vital role to increase the labor productivity of an industry. Furthermore, it is also well acknowledged that highly concentrated industries with a large output share of foreign firms to total industry output play a significant role to increase the labor productivity of Indian manufacturing industries. Moreover, Table 1 reports that the foreign presence is relatively large in leather products and in the electrical machinery industry, where foreign output share accounts for more than 30% of total industry output. Furthermore, in the sectors like food products, metal products, and drugs and pharmaceuticals, foreign output share accounts for more than 15% of the total industry output. The output shares of foreign firms in the remaining sample industries are less than 15% of the total industry output.

Secondly, it seems that foreign firms are possibly located in a highly concentrated industry with large extents of market size. In addition, it is also plausible to note that a firm consisting of large market shares and old in operation has certain advantage than the newly established firms in the market. This advantage spurs the technology diffusion from FDI and local firms' labor productivity in Indian industries. Furthermore, Table 1 reports that the concentration ratio is more than 30% in consumer electronics and beverages and tobacco industry, which is quite larger than the other remaining sample industries. The concentration ratio is relatively low in drugs and pharmaceuticals, rubber and rubber products, paper and paper products, textiles, cotton textiles, food products, non-metallic mineral products, metal products and in electrical machinery industries. However, the market concentration ratio in the remaining sample industries like automobiles, leather products, chemicals and wood products account for more than 15%.

[4] The detailed discussion and construction of the variables are given in the Appendix 1.

**Table 1.** Foreign Presence (%), Market Concentration (%) and Technological Gap of Sample Industries in 2000 and 2007

| NIC (1987) CODE | Industry Group | Foreign Presence (%) | | Market Concentration (%) | | Technological Gap | |
|---|---|---|---|---|---|---|---|
| | | 2000 | 2007 | 2000 | 2007 | 2000 | 2007 |
| 20-21 | Food Products | 18.83 | 17.54 | 2.948 | 5.004 | 1.72 | 3.95 |
| 22 | Beverages and Tobacco | 8.61 | 10.38 | 24.54 | 30.28 | 1.72 | 1.47 |
| 23 | Cotton Textiles | 2.99 | 4.70 | 1.74 | 2.51 | 0.45 | 0.36 |
| 26 | Textiles | 5.03 | 7.81 | 0.97 | 1.42 | 1.40 | 1.49 |
| 27 | Woods Products | 0.21 | 0.14 | 11.58 | 17.54 | 1.33 | 1.20 |
| 28 | Paper and Paper Products | 33.25 | 12.62 | 9.35 | 8.63 | 0.65 | 0.75 |
| 29 | Leather Products | 55.11 | 32.70 | 35.23 | 18.18 | 0.17 | 0.17 |
| 30 | Chemicals | 10.55 | 9.04 | 14.41 | 14.50 | 1.76 | 1.82 |
| 304 (30) | Drugs and Pharmaceuticals | 23.62 | 23.88 | 3.46 | 3.71 | 1.59 | 1.56 |
| 312 (31) | Rubber and Rubber Products | 8.99 | 5.54 | 9.86 | 8.84 | 0.81 | 0.32 |
| 32 | Nonmetallic Mineral Products | 6.28 | 13.43 | 6.22 | 4.96 | 1.12 | 1.20 |
| 34 | Metal Products | 7.29 | 19.90 | 11.97 | 6.780 | 0.73 | 0.90 |
| 35 | Nonelectrical Machinery | 15.43 | 13.11 | 8.68 | 10.75 | 1.68 | 1.06 |
| 36 | Electrical Machinery | 38.32 | 39.79 | 2.52 | 3.78 | 0.70 | 0.49 |
| 365 (36) | Consumer Electronics | 18.76 | 9.15 | 20.35 | 34.09 | 1.14 | 1.09 |
| 375 | Automobiles | 21.24 | 36.66 | 14.63 | 16.52 | 1.26 | 1.75 |

*Source*: Data compiled from Behera (2014) and own computation from the data series discussed in Section 5. For a full discussion of variable construction, see Appendix 1.

Thirdly, the technology difference between foreign and local firms after a certain threshold level could reduce the learning ability and absorptive capacity of the local firms, and consequently it would minimize the productivity and technology spillover. So, the general supposition is that a locally owned industry experiencing high technological differences relative to a foreign firm tends to exhibit lower labor productivity. From the reported figure in Table 1, it is quite clear that the technological differences are quite high in food products, beverages and tobacco, textiles, chemicals, drugs and pharmaceuticals, non-metallic mineral products, non-electrical machinery, consumer electronics, wood products and in the automobile industry. The technology gap in the remaining industries is relatively low. It is also well accepted that an industry experiencing a certain threshold level of technological difference relative to a foreign firm tends to exhibit higher labor productivity than the other industries. Moreover, an industry having some positive level of technological gap indicates that the industry has technologically advanced firms, which dominate the local firms in several aspects. Subsequently, this technological know-how of the advanced firms could spillover to the local firms of an industry.

## 3. EMPIRICAL FRAMEWORK

Similar to some earlier studies on the topic, our strategy to examine the existence of technology spillover from FDI is to estimate an industry-level production function augmented by foreign presence and different kinds of intermediate inputs, etc. Furthermore, to estimate the technology spillover from FDI in Indian manufacturing industries, and followed by Hall and Mairesse (1995), we start with a conventional Cobb-Douglas production technology, as specified:

$$Y_{jt} = A_{jt} Z_{jt}^{\sigma} L_{jt}^{\beta} K_{jt}^{\alpha} e^{\varepsilon jt}, \tag{1}$$

where $Y_{jt}$ represent the output of *j*th industry at time *t*, $K_{jt}$ is capital, $L_{jt}$ is labor, $\alpha$ and $\beta$ are their respective output elasticities. Moreover, *A* represents the industry-specific factor, and *Z* represents the varieties of intermediate inputs as the state of technology that summarizes all knowledge relevant to industry production possibilities at time *t*. Assume R&D intensity and technology import intensity are the determinable component of knowledge relevant to the production process.[5] Furthermore, $\sigma$ represents the elasticity share of intermediate factors upon output and we assume that $0 < \sigma < 1$.[6] However, in this case $\sigma$ reflects the elasticity of intermediate factors specific to the R&D intensity and technology import intensity together upon output.

Dividing Eq. (1) by labor ( $L_{jt}$ ) on both sides,

[5] Coe and Helpman (1995) and Lichtenberg and Van Pottelsberghe de la Potterie B. (1998) pointed out how R&D spillovers embodied in intermediate factors impact on total factor productivity (TFP) so that technology spillovers become higher in the long-run.

[6] Note that $\alpha$ and $\beta$ represent the elasticity share of capital and labor upon output. Similarly, to distinguish the elasticity share of intermediate factors from capital and labor, we presume that $\sigma$ representing the elasticity share of intermediate factors upon output. Moreover, we also presume that the elasticity share of capital and labor, i.e., $\alpha$, $\beta$ would lie between 0 and 1.

$$Y_{jt}/L_{jt} = A_{jt}\overline{Z}_{jt}^{\sigma}\left(K_{jt}^{\alpha}/L_{jt}^{1-\beta}\right)e^{\varepsilon jt} = A_{it}H_{it}^{\beta}\overline{Z}_{it}^{\sigma}\left(K_{it}/L_{it}\right)^{1-\beta} K_{it}^{\alpha+\beta-1}e^{\varepsilon jt} . \quad (2)$$

Taking the natural logarithm in Eq. (2)

$$\ln\left(Y_{jt}/L_{jt}\right) = \ln(A_{jt}\overline{Z}_{jt}^{\sigma}) + \beta_1 \ln\left(K_{jt}/L_{jt}\right) + \beta_2 \ln K_{jt} + \varepsilon_{jt} . \quad (3)$$

In Eq. (3), $\varepsilon_{jt}$ is called the idiosyncratic error term, and we assume that the errors ( $\varepsilon_{jt}$ ) are independently and identically distributed (*i.i.d.)*. In other words, the idiosyncratic errors or time varying errors follow the usual assumption of standard normal distribution with zero mean and unit variance. Furthermore, in order to estimate the technology spillovers in Indian manufacturing industries, we consider the labor productivity of domestic firms in an industry (*LPd*) as the endogenous variable. Thus, after incorporating, *LPd* as the endogenous variable, the Eq. (3) can be specified as follows:

$$LPd_{jt} = TFP_{jt} + \beta_1\left(k_{jt}/l_{jt}\right) + \beta_2 k_{jt} + \varepsilon_{jt} . \quad (4)$$

In Eq. (4), the $LPd_{jt}$ is $\ln\left(Y_{jt}/L_{jt}\right)$, and total factor productivity (*TFP*) represents $\ln(A_{jt}\overline{Z}_{jt}^{\sigma})$ .[7] The small letter symbol represents the natural log form, i.e., $\left(k_{jt}/l_{jt}\right)$ and $k_{jt}$ stands for $\ln\left(K_{jt}/L_{jt}\right)$ and $\ln K_{jt}$, respectively. Furthermore, in place of *A* of *TFP*, we may use proxies such as industry-specific factor like foreign presence (*FORP*) in Eq. (4).[8] Furthermore, the level of technology represented by *TFP* is influenced by the level of foreign presence and the nature of trade policy regime in the host country. So, in order to capture the trade policy regime, an interaction variable of foreign presence and trade policy (*TP*) is added into the model. Moreover, as argued by a number of previous empirical studies (e.g., Edwards, 1998; Sachs & Warner, 1995; Melitz, 2003), *TP* could also have an impact on *TFP*. Hence,

[7] Borensztein *et al*. (1998) developed a framework to incorporate the role of FDI by multinational firms as a determinant of economic growth.

[8] Xu (2000) empirically estimates the host country productivity growth by total factor productivity (*TFP*) and *TFP* increases because of the technology diffusion of the MNEs.

$$TFP_{jt} = \beta_{0i} + \beta_3 FORP_{jt} + \beta_4 FORP * TP_{jt} + \beta_5 TP_{jt} + \beta_6 RDI_{jt} + \beta_7 TMI_{jt}, \tag{5}$$

where *TP* represents a proxy of trade policy variable in the *j*th industry.

As discussed in the previous empirical studies on the determinants of industry-level labor productivity and technology spillovers across industries, two additional explanatory variables are used. First, the study takes into account of the role of industry-specific factor like technological gap (*TGAP*) between foreign firms and local firms in an industry and it can be considered as another key determinant for inferences of industry-level labor productivity and the degree of technology spillovers across industries (Kokko, 1994). Second, the market concentration (*MCON*) of an industry is needed to be incorporated into the model because the two industries having the same technical efficiency may show a different value-added per worker because of different domestic market concentration. Furthermore, as argued by Hall (1988), the impact of any possible exogenous factors on industry-level labor productivity would be conditioned by the degree of market concentration. As market concentration is one of the control variable, and in order to capture the effect of market concentration, an interaction variable of market concentration and foreign presence (*MCON*FORP*) is added into the model. By substituting Eq. (5) into Eq. (4), and based on the above discussions, the estimating equation is specified as follows:

$$\begin{aligned} LPd_{jt} = \beta_{0i} + \beta_1 \left( k_{jt} / l_{jt} \right) + \beta_2 k_{jt} + \beta_3 FORP_{jt} + \beta_4 FORP * TP_{jt} + \beta_5 TP_{jt} \\ + \beta_6 RDI_{jt} + \beta_7 TMI_{jt} + \beta_8 TGAP_{jt} + \beta_9 MCON * FORP_{jt} + \varepsilon_{jt}. \end{aligned} \tag{6}$$

*Foreign Presence*

In order to redress the problem of simultaneity involved in the relationship between *FORP* and *LPd*,[9] Eq. (6) is estimated together with a separate equation to explain the FDI determinants at industry-level. The specification of the second equation is discussed

[9] Behera (2014) has estimated a similar kind of model as in Eq. (6), to evaluate the FDI-technology spillover across Indian manufacturing industries. However, his model does not stress to address the relevance of market concentration factors and its interaction with foreign presence variable, which is presumed to be relevant factor to estimate the technology spillover across Indian manufacturing industries. In addition, the most important factor is that his finding does not address the issue of determining factors to attract FDI into the developing countries like India. So, his finding is a simple exercise and based on the narrow estimation of FDI-technology spillover in Indian manufacturing industries. However, the present study empirically examines the technology spillover from FDI and subsequently, examines the relevant factors to attract FDI into the host country industries in India. In this way, this paper goes beyond the Behera (2014) research findings, and empirically attempts to analyze the two-fold issues in a more dynamic way.

below before presenting the empirical results of the two-equation model. Furthermore, to a potential relationship with *LPd*, *FORP* is a function of market size, trade policy, quality of labor and *LPd*.

The size of the domestic market would be one of the relevant factors for MNEs when deciding modes of entry, i.e., either producing at foreign location or exporting from the home country, or locating and producing within the host country (Kohpaiboon, 2006). If the size of the market is large then it is supposed to expand its production in the domestic and foreign market. Large size firms supposed to be more competitive in the international market and face the competitive environments in a more dynamic way. MNEs are more likely to set up its affiliation, if the domestic market size is large. In addition, trade policy (*TP*) is included as an explanatory factor to examine the validity of "tariff hopping" hypothesis that protective tariff barriers stimulate import substituting (IS) FDI. This hypothesis has been supported by various empirical studies (Jun & Singh, 1997; Lim, 2001). Indian trade policies have been liberalized in certain phases after the economic reforms in 1990s. So, after adding the individual effect of market size and trade policy variables, it would be more appropriate to add the interaction term to capture the impact of both trade policies (*TP*) and domestic market size (*MSIZE*). The interaction between *TP* and *MSIZE* implies the impact of *TP* in stimulating FDI, which is likely to be dependent on *MSIZE*. This suggests that at a certain level of tariff protection, a larger market size enhances the stimulating impact of tariff barriers on foreign presence. Furthermore, the impact of market size on FDI determinants depends positively on tariff barriers.

Finally, the labor productivity of domestic firms can be a significant factor for the foreign investors to invest more foreign capital into the host country industries in India. However, we can arrive at a certain conclusion after the empirical estimation and interpretation of results in the next section. Furthermore, the standard hypothesis is that the quality of labor will induce efficiency-seeking FDI inflows into the host country's industries. Moreover, MNEs are interested to invest in the host countries' industries, when they get wide extents of markets, cheap accessing of skill labor in terms of remuneration, better quality of raw materials, and highly productive localized firms. Some foreign investors locate entrepreneurial activities across investment recipient countries in order to access cheaper and/or better quality raw materials and/or labor to enhance productivity (Kophaiboon, 2006).

Based on the above discussions, the second estimating equation is specified as follows:

$$FORP_{jt} = \beta_{0i} + \beta_1 LPd_{jt} + \beta_2 MSIZE_{jt} + \beta_3 TP_{jt} + \beta_4 MSIZE * TP_{jt} + \varepsilon_{jt}\,, \tag{7}$$

where $j = 1,2,...,16$ means it covers sixteen Indian manufacturing industries and the time series varies from $t = 1,2,..., 18$, means it covers the time series information from 1990 to 2007. Furthermore, unfortunately we do not have proper information about the numbers of supervisory and management workers at firm/industry-level in our principal source of the data set 'Prowess'. So, we could not include the quality of labor variable into the estimating equations.

## 4. ECONOMETRIC PROCEDURE

Initially we follow the ordinary least squares (OLS) method to estimate Eqns. (6) and (7). The estimation strategy requires that $\beta$ parameters in both equations would be estimated consistently. Because of the simultaneous nature of the two equations, the OLS cannot provide consistent estimates of $\beta$ parameters in Eqns. (6) and (7). Unbiasedness and consistency of OLS estimates rests on the assumption that the explanatory variables are uncorrelated with the stochastic disturbance terms. This assumption becomes invalid for any individual equation in a system of equations whenever at least one of the explanatory variables of that equation is jointly determined and makes the use of the OLS inappropriate.

The alternative estimators devised to be used in this situation fall into two main categories: systems methods and single-equation methods. The system methods, of which three-stage least squares (3SLS), seemingly unrelated regression (SUR) and full-information maximum likelihood (FIML) are best known and superior to single-equation methods like two-stage least squares estimates (2SLS) in terms of efficiency of the estimates. However, in using 3SLS or FIML, all equations in the system must be properly specified. Since these methods utilize information on the interconnection among all the equations in the system, what is happening elsewhere in the system will be transmitted throughout the whole system, causing biases and distortions. In case of system equations, the complexity usually begins in the special case in which there is a cross-equation error correlation but otherwise there is no simultaneity. In this situation we treat the SUR model, which consists of a series of equations that are linked because the error terms across equations are correlated. The SUR method is a technique for analyzing a system of multiple equations with cross-equation parameter restrictions and correlated error terms. When a covariance matrix of disturbance is unknown, feasible generalized least squares (FGLS) method can be applied to estimate the parameters and correlation coefficients.

Based on a Monte Carlo experiment of a finite sample, two-stage least squares (2SLS) can be emerged as a good promising choice among available alternatives. 2SLS provides a very useful information procedure for obtaining the values of structural parameters in over-identified equations. 2SLS estimation uses the information available from the specification of an equation system to obtain a unique estimate for each structural parameter. 2SLS generally performs well both in bias and mean-squared error, shows a relatively higher degree of stability, and is not greatly affected by the specification (Intriligator *et al.*, 1996). Moreover, 2SLS and 3SLS estimates are asymptotically equivalent if each equation is just identified; 2SLS equation by equation is algebraically identical to 3SLS. Furthermore, regardless of the degree of over-identification, 2SLS equation by equation and 3SLS are algebraically identical if $\hat{\Omega}$ (variance-covariance matrix) is identical (Wooldridge, 2002).

The extension of single equation estimation to system equation estimation methods is to avoid the cross-equation error correlations in the model. Furthermore, the extension of SUR estimation is the technique of three-stage least squares (3SLS). 3SLS involves the application of generalized least squares estimation to a system of equations, each of which has been then first estimated by using 2SLS. In the first stage the reduced form of the parameters is estimated by the 2SLS estimates. In the second stage, the residuals of each equation are used to estimate the cross-equations variances and covariances, just like in the SUR estimation process. In the third and final stage, generalized least squares (GLS) estimate parameters are obtained. The 3SLS procedure can yield more efficient parameter estimates than 2SLS because it takes into account of cross-equation correlation (Pindyck and Rubinfeld, 1998). Furthermore, the 2SLS parameter estimates cannot be obtained for unidentified equations.

## 5. DATA

The data for this study are mainly compiled from the Center for Monitoring Indian Economy (CMIE) based corporate data set 'Prowess'; Annual Survey of Industries (ASI); National Accounts of Statistics (NAS); Customs-Tariff Working Schedule data (Central Excise and Customs, Govt. Of India), and Input-Output Transaction Table (Central Statistical Organization, Govt. Of India).[10] The summary statistics of the key variables used in the econometric analysis are presented in Table 2. The reported results in Table 2 suggest that labor productivity of domestic firms, capital-intensity, capital, and market size have the maximum values as compared to other variables in the regression model. The technology gap maximum value is 1.875, suggesting that in some sample industries the productivity of foreign firms is quite higher than the local firms in Indian industries. Sjoholm (1999) pointed out that a certain threshold level of technology gap is required to spillover the technology from foreign firms to local firms. However, when the gap becomes wider, then it becomes difficult for the domestic firms to upgrade the advanced technology based on their own research efforts and existing experiences. It is well acknowledged that firm with the greater absorptive capacity and more innovation efforts accumulate more benefit from the foreign presence than others. Furthermore, the visual inspections of the summary statistics suggest that Indian manufacturing firms are doing a very negligible amount of investment in R&D, and technology up-gradation expenditure.

[10] The detailed discussion of the data sets used and the construction of variables are given in the Appendix 1.

**Table 2.** A Statistical Summary of the Key Variables

| Variables | Mean | SD | Min | Max |
|---|---|---|---|---|
| *LPd* | 8.895 | 1.616 | 6.138 | 18.777 |
| *k/l* | 11.114 | 4.111 | 1.51 | 17.927 |
| *K* | 12.808 | 3.861 | 1.934 | 20.742 |
| *FORP* | 0.261 | 1.420 | 0 | 0.962 |
| *NRP* | 3.811 | 0.383 | 3.038 | 4.959 |
| *ERP* | 3.908 | 0.374 | 3.045 | 5.005 |
| *RDI* | 0.003 | 0.007 | 0 | 0.062 |
| *TMI* | 0.017 | 0.019 | 0 | 0.166 |
| *TGAP* | 0.705 | 0.564 | 0 | 1.875 |
| *MCON*FORP* | 0.044 | 0.202 | 0 | 2.935 |
| *MSIZE* | 9.073 | 1.892 | 2.549 | 13.892 |

*Source*: Behera (2014) and own computations from the data series discussed in Section 5. For a full discussion of variable construction, see Appendix 1. No. of observations, NT=288.

*Notes*: Mean = simple average; SD = standard deviation; Min = minimum; and Max = maximum. Estimates of *LPd*, *k/l*, *k*, *NRP*, *ERP* and *MSIZE* are the logarithmic transformation of their value. The other variables are converted into logarithmic form as ln (1+*x*) where *x* is the variable.

**Table 3.** Correlation Matrix of the Variables

| | *LPd* | *k/l* | *k* | *FORP* | *MCON *FORP* | *NRP* | *ERP* | *TGAP* | *RDI* | *TMI* | *MSIZE* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *LPd* | 1 | | | | | | | | | | |
| *k/l* | 0.480 | 1 | | | | | | | | | |
| *K* | 0.342 | 0.783 | 1 | | | | | | | | |
| *FORP* | -0.128 | -0.375 | -0.498 | 1 | | | | | | | |
| *MCON *FORP* | 0.011 | -0.132 | -0.211 | 0.363 | 1 | | | | | | |
| *NRP* | -0.196 | -0.580 | -0.183 | -0.001 | 0.021 | 1 | | | | | |
| *ERP* | -0.232 | -0.355 | 0.009 | -0.215 | -0.046 | 0.679 | 1 | | | | |
| *TGAP* | -0.126 | 0.197 | 0.239 | 0.024 | -0.060 | 0.014 | -0.041 | 1 | | | |
| *RDI* | 0.023 | -0.005 | -0.013 | 0.081 | -0.042 | -0.099 | -0.163 | 0.009 | 1 | | |
| *TMI* | 0.042 | 0.129 | 0.068 | -0.057 | -0.033 | -0.126 | -0.043 | 0.004 | -0.059 | 1 | |
| *MSIZE* | 0.485 | 0.371 | 0.637 | 0.122 | -0.081 | -0.047 | -0.145 | 0.093 | 0.196 | -0.025 | 1 |

*Source*: Behera (2014) and own computations from the data series discussed in Section 5. For a full discussion of variable construction, see Appendix 1. No. of observations, NT=288.

The correlation between the explained and the set of explanatory variables are presented in Table 3. The correlation results report that the correlation between labor productivity of the domestic firms and the nature of trade policy regimes proxied by nominal rate of protection (*NRP*) and effective rate of protection (*ERP*) are found to be a negative sign. This suggests that the stringent trade policies could have a negative impact on the local firms' productivity spillover. Similarly, as expected, the correlations between the nature of trade policy regimes and the horizontal foreign presence are found to be a negative sign, which further suggest that the restrictive trade policies of the investment receiving countries would negatively affect the FDI-participation at industry-level. Furthermore, the correlation between market concentration and foreign presence, interaction variable with local firm's productivity is found to be positive, suggesting that given the level of foreign presence, a highly concentrated market structure substantially impact on the local firm's productivity.

## 6. ESTIMATION RESULTS

The regression results relating to determinants of technology spillover from FDI are reported in Tables 4 and 5. In addition, Tables 4 and 5 present the regression results relating to trade policies are proxied by two alternative measures such as *NRP* and *ERP*, respectively. Initially, we examine whether there is any positive spillover from FDI in Indian manufacturing industries. After examining the technology spillovers from FDI, secondly, we examine the determinants of foreign presence in Indian manufacturing industries. From the reported results, we find that the coefficients of capital intensity and capital are found to be statistically different from 0 with an expected positive sign. This suggests that scale factors significantly impact on the value added per worker in Indian manufacturing industries. It is also well accepted that foreign presence plays an important role to spill over the technology from foreign firms to domestic firms of investment recipient countries. Furthermore, it is generally presumed that local participation by multinational firms reveal the proprietary knowledge of the MNCs and this knowledge further spillover to local firms of the host country industries. In addition, the competitive pressure from FDI likely gravitates to the local firms of the host country industries. It is also plausible to note that local firms operating in a highly competitive environment are more effective and therefore better prepare to cooperate with multinational firms, which are usually more demanding and high-quality oriented. FDI presence in an industry is associated with higher competition and creates pressure to the local firms to become more effective. Therefore, foreign presence is considered to be an important indicator of technology spillover and local firms' productivity of the investment recipient countries.

**Table 4.** Determinants of Labor Productivity in Locally Owned Industries of Indian Manufacturing, Dependent Variable: *LPd*

| *TP=NRP* | | | | | | | |
|---|---|---|---|---|---|---|---|
| (1) | (2) OLS | (3) OLS | (4) 2SLS | (5) 2SLS | (6) 3SLS | (7) 3SLS | (8) SUR |
| *Intercept* | 0.103 | 1.938*** | 2.005*** | 0.976** | 0.520* | 1.938*** | 1.542** |
| | (1.940) | (1.919) | (1.826) | (0.903) | (0.160) | (0.886) | (0.90) |
| *k/l* | 0.364* | 0.393* | 0.364* | 0.377* | 0.364* | 0.393* | 0.388* |
| | (0.047) | (0.048) | (0.046) | (0.046) | (0.046) | (0.047) | (0.047) |
| *K* | 0.093* | -0.118 | 0.93** | 0.104 | 0.093** | 0.118* | 0.109* |
| | 0.044 | (0.044) | (0.042) | (0.043) | (0.044) | (0.043) | (0.043) |
| *FORP* | 1.183*** | 2.892* | 1.183*** | 2.135* | 1.153*** | 2.892* | 1.959* |
| | (0.546) | (1.937) | (0.414) | (0.788) | (0.041) | (0.798) | (0.045) |
| *MCON*FORP* | 0.371 | 0.171 | 0.361*** | 0.213** | 0.371* | 0.171*** | 0.213*** |
| | (0.432) | (0.431) | (0.024) | (0.015) | (0.124) | (0.120) | (0.123) |
| *TP* | -1.694* | -2.097* | -1.694* | -2.670* | -1.659* | -2.097* | -2.025* |
| | (0.474) | (0.484) | (0.461) | (0.542) | (0.046) | (0.476) | (0.477) |
| *FORP*TP* | -2.719 | -5.234* | -0.719 | -6.139* | -1.719*** | -5.235* | -0.362*** |
| | (2.007) | (2.072) | (1.972) | (2.039) | (1.097) | (2.035) | (0.257) |
| *TGAP* | -0.883* | | -0.883* | | -0.853* | | 0.027*** |
| | (0.169) | | (0.166) | | (0.162) | | (0.023) |
| *TGAP*FORP* | | -4.387* | | -4.707* | | -4.387* | -3.112* |
| | | (0.771) | | (0.757) | | (0.757) | (1.179) |
| *RDI* | 1.840 | 1.944*** | 1.840*** | 2.449 | 1.860*** | 1.944*** | 1.662*** |
| | (0.636) | (0.549) | (0.450) | (1.279) | (0.352) | (0.364) | (0.330) |
| *TMI* | 0.738 | 2.188*** | 0.738*** | 1.757** | 0.733*** | 2.188** | 1.767*** |
| | (0.033) | (0.007) | (0.062) | (0.056) | (0.062) | (0.937) | (0.035) |
| *Year Dummies* | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Industry Dummies* | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.532 | 0.543 | 0.532 | 0.571 | 0.532 | 0.543 | 0.547 |
| *Adj.* $R^2$ | 0.510 | 0.522 | | | | | |
| *F-statistics* | 15.35* | 16.15* | 10.58* | 9.25* | | | |
| *chi*$^2$ | | | | | 143.15* | 150.55* | 153.57* |
| *Obs.* | 288 | 288 | 288 | 288 | 288 | 288 | 288 |

*Notes*: Numbers in parenthesis are standard errors and *, **, and *** indicate the level of statistical significance at 1%, 5%, and 10%, respectively. The instrument variables are *NRP, ERP, MCON*FORP, TGAP, RDI, TMI*. Based on Eq. (6), the intercept represents the industry-specific dummies.

The result presented in Tables 4 and 5 shows that the foreign presence coefficients are found to be positive and significantly different from 0. This suggests that horizontal effect is economically meaningful and substantially affect the value-added per worker.

In both alternative specifications of trade policies, proxies, we find that horizontal spillovers are seems to be substantially stronger. Furthermore, the 3SLS and SUR estimation methods are usually superior to the single equation 2SLS estimates. So, the equations estimated by 3SLS and SUR are our preferred estimations. The reason is that there would be an endogeneity problem between the productivity of locally owned industries and foreign presence. However, the 3SLS and SUR estimates usually solve the issue of endogeneity and take into accounts of the cross-equations correlation.

For the impact of competition, the coefficients of the interaction variable of market concentration and foreign presence are found to be positive and statistically different from 0. This suggests that, given the level of foreign presence, a highly concentrated market structure significantly impacts on the value added per worker. In addition, we find that higher concentration seems to be consistent with larger spillovers from foreign presence in upstream sectors.

Regression estimates turn out to be remarkably resilient to the use of the two alternative trade policy measures. As argued in Goldar and Kumari (2003), there was a significant impact on tariff reduction in the industry-level productivity. The *ERP* measure uses input as well as output tariff, so the *ERP* estimates would be a better indicator to reflect the trade policy regimes in Indian industries. Tariffs are the major instruments used to influence the country's development path in productivity. The role of tariffs to promote the domestic industry was effectively begun in the 1970s and 1980s with the imposition of an escalating tariff structure. Later on the tariff structures have been de-escalated after the major trade policy liberalization in 1990s in India. The negative coefficients of trade policy variables suggest that the effect of tariff reduction in productivity would be stronger, when there will be less restriction on imports (see Tables 4 and 5). This finding is in line with previous studies that have examined the relationship between trade policy variables and local firms' productivity (Pavcnik, 2002; Amiti & Konings, 2007). This gain in productivity is due to the technology embodied in foreign inputs and the reduction of tariff on intermediate inputs. We would expect that importing firm would enjoy the largest gains from this direct effect of tariff reduction at various levels.

The negative coefficient of *FORP*TP* fails to reject the "Bhagwati hypothesis" that industries with trade regimes characterized by greater outward orientation tend to yield more benefits in the form of technology spillover from foreign affiliates. This significant negative estimate has been consistent with the previous literature (Krishna & Mitra, 1998; Kohpaiboon, 2005, 2006). Furthermore, we find that the coefficient of *TGAP* is significantly different from 0 with an expected negative sign. This suggests that given the level of foreign presence and degree of trade restrictiveness, a locally owned industry that exhibits the laggard technological capability relative to a foreign firm tends to exhibit slow technology accumulation and lower labor productivity. Moreover, some technological gap is required for spillover to take place, and at an initial stage, the degree of technology spillover could be increased subject to the size of the technological gap. However, beyond a certain threshold level, the gap may be so large that it would be difficult for a domestic firm to absorb the foreign technology based on their own research effort and existing experience, etc. (Sjoholm, 1999).

**Table 5.** Determinants of Labor Productivity in Locally Owned Industries of Indian Manufacturing, Dependent Variable: *LPd*

| | *TP=ERP* | | | | | | |
|---|---|---|---|---|---|---|---|
| (1) | (2) OLS | (3) OLS | (4) 2SLS | (5) 2SLS | (6) 3SLS | (7) 3SLS | (8) SUR |
| *Intercept* | 4.618* | 4.273* | 2.498** | 1.318 | 4.618* | 6.273* | 5.692* |
| | (1.867) | (1.902) | (1.247) | (1.222) | (1.834) | 1.868 | (1.885) |
| *k/l* | 0.188* | 0.207* | 0.990* | 0.683* | 0.188* | 0.207* | 0.201* |
| | (0.043) | (0.043) | (0.280) | (0.351) | (0.042) | (0.043) | (0.043) |
| *K* | 0.025 | 0.016 | 1.471* | 0.880 | 0.025 | 0.016 | 0.022 |
| | (0.042) | (0.041) | (0.511) | (0.659) | (0.041) | (0.040) | (0.041) |
| *FORP* | -3.950 | 3.726 | 3.998* | 2.109*** | -3.950 | 3.726*** | 1.314*** |
| | (6.298) | (6.653) | (1.634) | (1.744) | (6.188) | (0.537) | (0.735) |
| *MCON*FORP* | 0.397** | 0.166** | 0.001 | 0.028 | 0.397* | 0.166** | 0.233** |
| | (0.037) | (0.041) | (0.706) | (0.459) | (0.029) | (0.034) | (0.035) |
| *TP* | 0.438 | -0.212 | -5.969* | -3.559** | -0.438** | -0.212*** | -0.276*** |
| | (0.445) | (0.450) | (2.281) | (1.803) | (0.038) | (0.042) | (0.043) |
| *FORP*TP* | 1.166 | -0.347 | -1.086* | -2.052*** | -1.166* | -0.347** | -0.120*** |
| | (1.626) | (1.681) | (0.882) | (1.203) | (0.097) | (0.051) | (0.079) |
| *TGAP* | -0.765* | | -0.004 | | -0.765* | | -0.373*** |
| | (0.173) | | (0.376) | | (0.170) | | (0.265) |
| *TGAP*FORP* | | -3.654* | | -1.823 | | -3.654* | -2.331** |
| | | (0.792) | | (1.564) | | (0.778) | (1.217) |
| *RDI* | 2.718** | 4.872* | 6.881** | 3.833*** | 2.718*** | 4.872*** | 4.117* |
| | (0.087) | (1.066) | (2.661) | (1.955) | (1.893) | (1.873) | (1.848) |
| *TMI* | 1.175 | 3.177* | 1.702* | 2.540** | 1.175** | 3.177* | 2.514* |
| | (0.205) | (0.226) | (0.670) | (0.307) | (0.132) | (0.152) | (0.165) |
| *Year Dummies* | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Industry Dummies* | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.523 | 0.529 | 0.51 | 0.512 | 0.513 | 0.527 | 0.532 |
| *Adj.* $R^2$ | 0.502 | 0.517 | | | | | |
| *F-statistics* | 12.83* | 13.08* | 10.57* | 11.21* | | | |
| $chi^2$ | | | | | 119.58* | 121.94* | 124.78* |
| *Obs.* | 288 | 288 | 288 | 288 | 288 | 288 | 288 |

*Notes*: Numbers in parenthesis are standard errors and *, **, and *** indicate the level of statistical significance at 1%, 5%, and 10%, respectively. The instrument variables are *k/l*, *k*, *NRP, ERP, MCON*FORP, TGAP, RDI, TMI*. Based on Eq. (6), the intercept represents the industry-specific dummies.

We attempt to examine how the interaction of *TGAP* and *FORP* affects the productivity of domestic firms and what role it plays in accounting for the extent of spillover from foreign presence. Our results suggest that the interaction of *TGAP* and *FORP* coefficients are consistently negative and statistically significant at the 1% level. This suggests that, given the level of foreign presence, a domestic firm that exhibits the laggard technological capability relative to a foreign firm tends to exhibit lower productivity spillover. This result is also consistent with the earlier findings of Kokko (1994). The possible interpretation is that the technological gap between foreign and domestic firms in the upstream market (where R&D is crucial) is too large for the latter to upgrade their technology based on their own research effort. Moreover, the results also consistent with the hypothesis that the technological gap between domestic firms and their competitors from abroad is too large for the former to exploit additional spillovers relying on their own-R&D-based absorptive capacity.[11]

We next examine whether firms with greater absorptive capacity benefit more from the foreign presence than others. It is well acknowledged that firms' absorptive capacity facilitated by R&D intensity is a crucial factor to harvest the potential benefit from foreign multinationals (Girma, 2005). We start with the two measures of firm's innovation effort, i.e., R&D intensity (*RDI*) and technology import intensity (*TMI*). Our results show that the coefficients of *RDI* and *TMI* are found to be significantly different from 0 with a positive sign. This suggests that domestic firms involved in R&D and technology up-gradation activities benefit more from the foreign presence in upstream industries than others. Our results also suggest that foreign multinationals build their local supply chains by transferring technology to the domestic firms with sufficient absorptive capacity. We find that both measures of firm's innovation efforts are economically meaningful. Moreover, from the results, it is also plausible to note that domestic firms with a higher absorptive capacity can exploit knowledge embodied in intermediate goods produced by multinational better than others.

Table 6 reports the regression results relating to determinants of foreign presence in Indian manufacturing industries. As discussed before, in order to solve the issue of endogeneity, the single equation of 2SLS and system equations of 3SLS and SUR is our preferable estimates. The results related to the two alternative measures of trade policy variables (*NRP* and *ERP*) are presented in separate columns of Table 6. We find that the coefficients of *LPd* in all specifications are found to be positive and statistically significant. This suggests that FDI likely gravitates to the highly productive domestic sectors. Moreover, the results also suggest that highly productive domestic sectors act as a key player to attract FDI into the Indian manufacturing industries.

The coefficients associated with the interaction effect of trade policy variable and

[11] This finding is consistent with the insight of Marcin (2008). Similarly, Findlay (1978), Wang & Blomstrom (1992) suggest that the magnitude of FDI spillovers is based on the level of technological gap between domestic and foreign firms.

market size in all specifications are found to be negative and statistically significant. This suggests that, at the given level of market size, any increase in the tariff rates discourages additional foreign investment to locate and establish their plants in India. Furthermore, we find that the coefficients of market size are found to be positive and statistically different from 0. This suggests that in a large-open economy like India, the size of the domestic market plays an important role to attract foreign investment from abroad. Moreover, the empirical exercise reveals that, especially the country like India, lager the domestic market size, the greater the direct investment from abroad.

Foreign firms are likely to be located in a highly protected domestic industry. The import liberalization and major sector de-escalation tariff reforms policies in the 1990s facilitate the Indian sub-continent as an attractive destination for tariff-hopping FDI. The removals of quantitative barriers in a phased manner and the lowering of tariffs on imports have opened the Indian economy to international investors, which further expedite the industrial sectors to become more competitive than before. So, after the trade reforms initiation in the 1990s, and specifically, after the massive reforms of external trade barriers in the 2000s, tariffs have been reduced to less than 40% in most of the manufacturing industries in India. Previous studies have argued that FDI may affect trade. Moreover, previous studies have analyzed the twofold role FDI, i.e. either substitute trade (in the case of tariff-hopping investment) or complement trade (in the case of intra-firm trade). However, according to the WTO regime, the relationship between trade and FDI is more complex. There are now reasons to believe that the trade can cause outward or inward FDI. Moreover, the empirical result suggests that the reducing of tariffs with degrees of protection substantially stimulates the multinational firms to locate and establish their plants in India.

Another interesting result of the FDI determinant equation relates the interaction effect of the degree of protection and size of the domestic market. The result shows that the interaction of *TP* and *MSIZE* coefficients are found to be negative and statistically different from 0. The negative and statistically significant coefficient between *TP* and *MSIZE* supports the hypotheses that, in a large-open economy and bigger domestic market like India, the tariff reductions after trade liberalization play an important role to attract FDI from abroad. To sum up, the results of the regression analysis do not indicate any significant adverse effect of trade policy liberalization on productivity growth and FDI determinants in Indian manufacturing industries. Rather, there are the indications that a lowering of tariff would have positively contributed to labor productivity growth and induce to attract huge direct investment from abroad.

**Table 6.** Determinants of Foreign Presence in Indian Manufacturing Industries, Dependent Variable: *FORP*

| | *TP=NRP* | | | | *TP=ERP* | | | |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) OLS | (3) 2SLS | (4) 3SLS | (5) SUR | (6) OLS | (7) 2SLS | (8) 3SLS | (9) SUR |
| *Intercept* | 2.666* | 2.692** | 2.358* | 2.570* | 2.074* | 0.381 | 1.433*** | 1.902* |
| | (0.822) | (1.182) | (0.827) | (0.806) | (0.796) | (0.886) | (0.823) | (0.779) |
| *LPd* | 0.006 | 0.023** | 0.022*** | 0.017* | 0.011*** | 0.007 | 0.044* | 0.025* |
| | (0.007) | (0.010) | (0.012) | (0.007) | (0.007) | (0.008) | (0.014) | (0.007) |
| *MSIZE* | 0.320* | 0.492* | 0.307* | 0.324* | 0.150*** | 0.010 | 0.032*** | 0.109*** |
| | (0.088) | (0.129) | (0.088) | (0.087) | (0.091) | (0.099) | (0.099) | (0.089) |
| *TP* | -0.798* | -1.832* | -0.739* | -0.797* | -0.435** | -0.365*** | -0.222 | -0.360** |
| | (0.217) | (0.335) | (0.216) | (0.213) | (0.207) | (0.218) | (0.219) | (0.202) |
| *MSIZE*TP* | -0.088* | -0.136* | -0.083* | -0.089* | -0.036*** | -0.001 | -0.008*** | -0.025*** |
| | (0.023) | (0.034) | (0.023) | (0.023) | (0.023) | (0.025) | (0.002) | (0.002) |
| *Year Dummies* | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| *Industry Dummies* | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.139 | 0.15 | 0.16 | 0.16 | 0.171 | | 0.172 | 0.17 |
| *Adj.* $R^2$ | 0.105 | | | | 0.147 | | | |
| *F-statistics* | 3.51* | 5.19* | | | 4.50* | 8.46* | | |
| $chi^2$ | | | 26.85* | 35.70* | | | 35.24* | 47.95* |
| *Obs.* | 288 | 288 | 288 | 288 | 288 | 288 | 288 | 288 |

*Notes*: Numbers in parenthesis are standard errors and *, **, and *** indicate the level of statistical significance at 1%, 5%, and 10%, respectively. The instrument variables are *MSIZE*, *ERP*, *NRP*, *MSIZE*TP*.

## 7. CONCLUSIONS AND IMPLICATIONS

This paper examined the technology spillover from FDI and the determinants of FDI based on a cross-industry analysis of Indian manufacturing. The objective of this study was to investigate the technology spillover effect of FDI subject to the role of trade policy regimes, and to determine the factors for FDI-participation at industry-level of Indian manufacturing. In order to allow for the simultaneity between industry-level labor productivity and foreign presence, this study uses a system of two equations (technology spillover determinants and FDI determinants) to test the key hypothesis. The empirical results fail to reject the Bhagwati hypothesis. This suggests that technology spillover unlikely to take place in highly-trade restricted industries compared to more export-oriented and less-trade restricted industries. Furthermore, the regression result confirms the existence of positive externalities associated with foreign direct investment (FDI). Moreover, the results indicate that foreign presence through multinational firms brings new channels of knowledge and technology spillover to the local firms of Indian manufacturing industries.

This paper investigates several of the channels by which trade policy regime is thought to enhance technology spillover. We find that greater exposure to import liberalization via declining tariff cost promotes productivity gains and initiate to attract huge direct investment from abroad. The results also suggest that trade policy acts as a conduit for the transfer of technology from highly advanced multinationals firms to local firms. Furthermore, given the level of trade restrictiveness, the size of the domestic market plays an important role in determining inter-industry differences in FDI participation. The most robust empirical results relate to the importance of the absorptive capacity of domestic firms, which appears to be a fundamental precondition for enabling them to decode these indirect benefits from FDI. The results also suggest that firms' involvement in more R&D spending has the capacity to absorb and adopt the advanced technology, and enabling them to fully internalize the potential benefits from FDI.

Finally, although this paper confirms the existence of positive externalities associated with FDI, but the policy implications are not straightforward. On the one hand, our results provide some rationale for the use of investment incentives focusing on foreign firms. On the other hand, we find that a locally owned industry, having less technological capability relative to a foreign firm could not reap the benefit from the foreign presence in the same industry, and hence, lower would be the labor productivity. Therefore, in our view, the policy implications in this paper are consistent with the suggestions of Blomstrom and Kokko (2003) and Marcin (2008). The policies are designed to strengthen the absorptive capacity of domestic firms. This can be achieved through the direct subsidies to domestic firms investing in knowledge and human capital formation. The direct subsidies, creating research infrastructure, and improving the other fundamentals like better investment climate can create a healthy competition and close the gap between foreign and local firms, and thereby raise the absorptive capacity of domestic firms. Furthermore, there must be a proper coordination between government and local-level authority so that domestic firms can take the best advantage of the trade policy regimes and therefore, it can easily learn and whenever necessary import the most advanced technology developed elsewhere in the world from the technology leaders firms. This advantage definitely brings new initiative to domestic firms and enables them to adopt the advanced technology, and thereby enhance their labor productivity.

# APPENDIX

**Labor Productivity of Domestic Firms (*LPd*)**: The labor productivity at firm-level is constructed by dividing the gross value added (*GVA*) to the number of man-days (labor) of firm of an industry. The *GVA* data at the firm-levels are obtained from the Prowess data base. However, the analytical estimation is based on the industry-level study, so the labor productivity has been constructed to the industry-specific variable. So, in order to construct the labor productivity of domestic firms (*LPd*) as an industry-specific variable, we are simply doing the average of labor productivity over all domestic firms in an industry for a specific period of time.

**Capital** (*k*): For the present study, to construct the capital variable from the Prowess data set, we simply follow the methodology derived by Srivastava (1996) and Balakrishnan *et al.* (2000). They have used the perpetual inventory method, which involves capital at its historic cost. However, the direct interpretation of the perpetual inventory method is not an easy task. Therefore, the capital stock has to be converted into an asset value at replacement cost. The capital stock is measured at its replacement cost for the base year 1993-94. Next, we follow the methodology of Balakrishnan *et al.* (2000) to arrive at a revaluation factor. The derivations of revaluation factors, $R^G$ and $R^N$ for initial years gross (*G*) and net (*N*) capital stocks are discussed below.

The balance sheet values of the assets in an initial year have been scaled by the revaluation factors to obtain an estimate of the value of capital assets at replacement cost.[12] Nevertheless, the replacement cost of capital $= R^i \times$ value of capital stock at historic cost; where $i$ stands for either gross (*G*) or net (*N*) value. The formula to obtain the value of the capital stock at historic cost $GFA_t^h$ is given below:

$$GFA_t^h = P_t I_t \times \left( {(1+g)(1+\pi)} \Big/ {(1+g)(1+\pi)-1} \right),$$

where $P_t$ represents the price of the capital stock at time *t*; $I_t$ represents the investment at time period *t,* is the difference between the gross fixed assets across two years, i.e., $I_t = GFA_t - GFA_{t-1}$ ; $g$ stands for the growth rate of investment, i.e., $g = \left( I_t \big/ I_{t-1} \right) - 1$ and $\pi = \left( P_t \big/ P_{t-1} \right) - 1$. Furthermore, the revaluation factor for the gross fixed asset is defined as $R^G = {(l+g)(l+\pi)-1} \big/ {g(l+\pi)}$. Here, *l* stands for the life of the machinery and equipment. However, the revaluation factor is constructed by assuming

[12] See Srivastava (1996, 2000) for detailed discussion of the perpetual inventory method to compile the real gross capital stock from the CMIE based data set Prowess.

that the life of machinery and equipment is 20 years and the growth of the investment is constant throughout the period. We again presume that the price of the capital stock has been changed at a constant rate from the date of incorporation of the firm to the later period, i.e., from 1990 to 2007.

The revaluation factor has been used to convert the capital in the base year to the capital at replacement cost, at current prices. We then deflate these values to arrive at the values of the capital stock at constant prices for the base year. The deflator used for this purpose can be obtained by constructing the capital formation price indices from the series of gross capital formation of NAS. Then, subsequent year's capital stocks are arriving by taking the sum of investments in the capital stock at constant prices.

**Labor** (*l*): For the present study, the principal source of the database is Prowess. Our key analysis is based on the Prowess data set. However, the Prowess database does not provide any exact information of labor for each individual firm. Thus, we need to use this information as man-days per firm. Man-days at firm-level is obtained by dividing the salaries and wages of the firm to the average wage rate of an industry to which the firm belongs. The formula to obtain the man-days at firm-level is given below:

Number of man-days per firm = salaries and wages/average wage rate.

Furthermore, to get the average wage rate of an industry, we collect the information from ASI. The ASI has the information on total emoluments and total man-days for the relevant industry groups. The average wage rate can be obtained by dividing the total emoluments to the total man-days for the relevant industry groups (average wage rate= total emoluments/ total man-days).[13]

**Capital Intensity** (*k/l*): The capital intensity at firm-level can be obtained by dividing the real gross capital stock to the labor of that firm. To get capital intensity as an industry-specific variable, we simply divide the summation over all firms' capital stock to the summation over all firms' labor (man-days) within an industry.

**Foreign Presence** (*FORP*): Foreign presence is measured by the output share of foreign firms to the total industry output. In some previous empirical studies, employment or capital shares have been used to measure the foreign presence. Taking a foreign presence as an employment share tends to underestimate the actual role of foreign affiliates because MNEs affiliates tend to be more capital intensive than the local non-affiliated firms. On the other hand, the capital share can be easily distorted by the presence of foreign ownership restrictions. Hence, the output share could be considered

[13] For the present analysis when we compiled the labor variable from Prowess and ASI sources, then information's of total man-days and total emoluments in ASI data were available up to 2004-05. Thus, from ASI data we extrapolating the data range from 2004-05 to 2007 to get the average wage rate of an industry. The salaries and wages at firm-level are obtained from Prowess data set.

as the preferred proxy to measure the foreign presence of an industry (Kohpaiboon, 2005, 2006).

**Trade Policy** (*TP*): Trade policy is proxied by using two alternative measures, namely the nominal rate of protection (*NRP*) and effective rate of protection (*ERP*).

**Nominal Rate of Protection** (*NRP*): The nominal rate of protection of a commodity is defined as the percentage of excess of domestic price over world market prices resulting from protective measures. If tariff are the only sources of protection, then *NRP* is the tariff itself. The present study calculates both the published tariff rate by taking into account of the exemptions, and collection rate. We calculate the published rates with exemptions by simply averaging the tariff based on Customs-Tariff Working Schedule (Central Excise and Customs, Govt. Of India) by using an appropriate concordance between the Customs-Tariff Working Schedule and ASI sectors.

**Effective Rate of Protection** (*ERP*): We construct the *ERP* as defined by Corden (1966), to capture the net effect of lowering tariffs on output and intermediate inputs. The computation of *ERP* of the *j*th industry at time *t* is given below:

$$ERP_{jt} = \frac{output\ tariff_{jt} - input\ tariff_{jt}}{1 - \sum_s \alpha_{js}},$$

where $\alpha_{js}$ is the share of input, *s* in the value of output *j*. The input-tariff for industry *j* is constructed as follows:

$$input\ tariff = \sum_s \alpha_{js} \cdot output\ tariff_{st}.$$

The industry wise ERP's are calculated by mapping the different tariff codes with the two-digit ASI industries. The tariff rates for various product categories have been derived from the Customs-Tariff Working Schedule under HS codes. We then match the HS codes, product lines of NIC codes by using the appropriate concordance to calculate the average industry-level tariff. We combine these industry-level output tariff with Input-Output Transaction Table from 1993-1994 to 2003-04 to calculate the input-tariff and effective rates of protection.

**Technological Gap** (*TGAP*): Technological gap between foreign firms and local firms is proxied by the ratio of average value added per worker of the foreign firms to that of local firms.

**Interaction variable** (*MCON*FORP*): In order to measure the market concentration, we take widely used proxies for the Herfindahl-Hirschman Index (*HHI*) of concentration. The *HHI* of market concentration formula is given below:

$$HHI_{jt} = \sum_i \left( \frac{S_{ij}}{\sum S_{ij}} \right)^2,$$

where $S_{ij}$ is a total sale of the *i*th firm in the *j*th industry. To calculate the interaction variable, we multiply the *HHI* market concentration to the foreign presence of an industry.

**R&D Intensity**

*RDI***:** The R&D intensity at firm-level is measured by the share of R&D expenditure to total sales. To make the R&D expenditure as an industry-specific variable, we simply divide by taking the sum of R&D expenditure of all firms within an industry to the summation of total sales of all firms in that industry for a specified year. Then in subsequent years, *RDI* at industry-level are constructed by using this procedure.

**Technology Import Intensity**

The technology imports can be broadly classified into two categories as embodied technology, consisting of imported capital goods, and disembodied technology consisting of blue prints and license fees is considered as remittances on royalty and license fees. Furthermore, the technology import intensity at firm-level can be obtained by dividing the summation of embodied and disembodied technology to the total sales of the firm. To calculate the technology import intensity (*TMI*) as an industry-specific variable, we simply divide the sum of total disembodied and embodied technology of all firms' within an industry to the summation of total sales of all firms' of that industry for a specific year. Then in subsequent years, *TMI* at industry-level are constructed by using this procedure.

**Market Size** (*MSIZE*): The size of the domestic market is measured by the sum of gross output and import of all firms within an industry for a specific year.

**Table B1.** Classification of Firms across Indian Manufacturing Industries in 2007

| Serial No. | NIC (1987) CODE | Industry Group | Domestic Firms | Foreign Firms | Total Firms | % of foreign firms |
|---|---|---|---|---|---|---|
| 1 | 20-21 | Food Products | 146 | 12 | 158 | 7.59 |
| 2 | 22 | Beverages and Tobacco | 85 | 4 | 89 | 4.49 |
| 3 | 23 | Cotton Textiles | 307 | 4 | 311 | 1.28 |
| 4 | 26 | Textiles | 245 | 13 | 258 | 5.03 |
| 5 | 27 | Woods Products | 20 | 1 | 21 | 4.76 |
| 6 | 28 | Paper and Paper Products | 40 | 5 | 45 | 11.11 |
| 7 | 29 | Leather Products | 14 | 1 | 15 | 6.66 |
| 8 | 30 | Chemicals | 410 | 77 | 487 | 15.81 |
| 9 | 304(30) | Drugs and Pharmaceuticals | 117 | 21 | 138 | 15.21 |
| 10 | 312(31) | Rubber and Rubber Products | 12 | 2 | 14 | 14.28 |
| 11 | 32 | Nonmetallic Mineral Products | 96 | 14 | 110 | 12.72 |
| 12 | 34 | Metal Products | 176 | 24 | 200 | 12 |
| 13 | 35 | Nonelectrical Machinery | 229 | 26 | 255 | 10.19 |
| 14 | 36 | Electrical Machinery | 226 | 21 | 247 | 8.50 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15 | 365(36) | Consumer Electronics | 6 | 2 | 8 | 25 |
| 16 | 375 | Automobiles | 19 | 4 | 23 | 17.39 |
| | | Total | 2148 | 231 | 2379 | 9.70 |

*Source*: Data compiled from Behera (2014) and own calculations from the CMIE data set Prowess.
*Notes*: According to National Industrial of Classification (NIC) the four 3-digit level industries are drugs and pharmaceuticals (304) coming under chemicals (30), rubber and rubber products (312) coming under rubber and plastic products (31), consumer electronics (365) coming under electrical machinery (36), and automobiles (375) coming under the transportation industry (37).

## REFERENCES

Aitken, B.J., and A.E. Harrison (1999), "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela," *American Economic Review*, 89 (3), 605-618.

Amiti, M., and J. Konings (2007), "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia," *American Economic Review*, 97 (5), 1611-1638.

Balakrishnan, P., K. Pushpangandan, and M.S. Babu (2000), "Trade Liberalization and Productivity Growth in Indian Manufacturing: Evidence from Firm Level Panel Data," *Economic and Political Weekly*, 35, 3679-3682.

Banga, R. (2006), "The Export-Diversifying Impact of Japanese and US Foreign Direct Investment in the Indian Manufacturing Sector," *Journal of International Business Studies*, 37 (4), 558-568.

Behera, S.R. (2014), "Local Firms Productivity Spillover from Foreign Direct Investment: A Study of Indian Manufacturing Industries," *International Journal of Technological Learning, Innovation and Development*, 7 (2), 167-190.

Bernard, A.B., J.B. Jensen, and P.K. Schott (2006), "Trade Costs, Firms, and Productivity," *Journal of Monetary Economics*, 53 (5), 917-937.

Bhagwati, J. (1973), "The Theory of Immiserizing Growth: Further Applications," in M.B. Connolly, & A.K. Swoboda, eds., *International Trade and Money*, Toronto: University of Toronto Press.

_____ (1978), *Anatomy and Consequences of Exchange Control Regimes*, New York: Balinger Publishing.

_____ (1985), *Investing Abroad: es'mee Fairbairn Lecture*, Lancaster: Lancaster University Press.

_____ (1994), "Free Trade: Old and New Challenges," *Economic Journal*, 104 (423), 231-246.

Blomstrom, M., and A. Kokko (2003), "The Economics of Foreign Direct Investment

Incentives," NBER Working Papers, 9489.

Borensztein, E., J. De Gregorio, and J.W. Lee (1998), "How Does Foreign Direct Investment Affect Economic Growth?" *Journal of International Economics*, 45, 115-135.

Brecher, R.A., and C.F. Diaz-Alejandro (1977), "Tariffs, Foreign Capital and Immiserizing Growth," *Journal of International Economics*, 7 (4), 317-322.

Brecher, R.A., and R. Findlay (1983), "Tariff, Foreign Capital and National Welfare with Sector Specific Factors," *Journal of International Economics*, 14 (3), 277-288.

Coe, D.T., and E. Helpman (1995), "International R&D Spillovers," *European Economic Review*, 39(5), 859-897.

Corden, M. (1966), "The Structure of a Tariff System and the Effective Protective Rate," *Journal of Political Economy*, 74 (3), 221-237.

Edwards, S. (1998), "Openness, Productivity, and Growth: What Do We Really Know?" *Economic Journal*, 108 (447), 383-398.

Fernandes, A. (2007), "Trade Policy, Trade Volumes and Plant-Level Productivity in Colombian Manufacturing Industries," *Journal of International Economics*, 71 (1), 52-71.

Findlay, R. (1978), "Relative Backwardness, Direct Foreign Investment, and the Transfer of Technology: A Simple Dynamic Model," *Quarterly Journal of Economics*, 92 (1), 1-16.

Fosuri, A., M. Motta, and T. Ronde (2001), "Foreign Direct Investment and Spillovers through Workers' Mobility," *Journal of International Economics*, 53, 205-222.

Franco, C., and S. Sasidharan (2010), "MNEs, Technological Efforts and Channels of Export Spillover: An Analysis of Indian Manufacturing Industries," *Economic Systems*, 34 (3), 270-288.

Girma, S. (2005), "Absorptive Capacity and Productivity Spillover from FDI: A Threshold Regression Analysis," *Oxford Bulletin of Economics and Statistics*, 67 (3), 281-306.

Goldar, B., and A. Kumari (2003), "Import Liberalization and Productivity Growth in Indian Manufacturing Industries in the 1990s," *The Developing Economies*, 41 (4), 436-460.

Hall, B.H., and J. Mairesse (1995), "Exploring the Relationship between R&D and Productivity in French Manufacturing Firms," *Journal of Econometrics*, 65, 263-293.

Hall, R.E. (1988), "The Relation between Price and Marginal Cost in US Industry," *Journal of Political Economy*, 96, 921-947.

Helpman, E. (1997), "R&D and Productivity: The International Connection," NBER Working Papers, 6101, Cambridge: MA.

Intriligator, M., R. Bodkin, and C. Hsiao (1996), *Econometric Models, Techniques and Applications* (2nd ed.), New York: Prentice Hall.

Jun, K.W., and H. Singh (1997), "The Determinants of Foreign Direct Investment in Developing Countries," *Transnational Corporations*, 5 (2), 67-105.

Kathuria, V.K. (2002), “Liberalization, FDI and Productivity Spillovers - An Analysis of Indian Manufacturing Firms,” *Oxford Economic Papers*, 54, 688-718.

Kohpaiboon, A. (2005), *Industrialization in Thailand: MNEs and Global Integration*, Unpublished Doctoral dissertation, The Australian National University, Canberra.

_____ (2006), “Foreign Direct Investment and Technology Spillover: A Cross-Industry Analysis of Thai Manufacturing,” *World Development*, 34, 541-556.

Kokko, A. (1994), “Technology, Market Characteristics, and Spillovers,” *Journal of Development Economics*, 43, 279-293.

Kokko, A., M. Zejan, and R. Tansini (2001), “Trade Regimes and Spillover Effects of FDI: Evidence from Uruguay,” *Weltwirtschaftliches Archiv*, 137(1), 124-149.

Krishna, P., and D. Mitra (1998), “Trade Liberalization, Market Discipline and Productivity Growth: New Evidence from India,” *Journal of Development Economics*, 56, 451-76.

Lichtenberg, F., and B. Van Pottelsberghe de la Potterie (1998), “International R&D Spillovers: A Comment,” *European Economic Review*, 42, 1483-1491.

Lim, E.G. (2001), “Determinants and the Relation between Foreign Direct Investment and Growth: A Summary of Recent Literature,” IMF Working Paper, Washington, DC: International Monetary Fund.

Marcin, K. (2008), “How does FDI Inflow Affect Productivity of Domestic Firms? The Role of Horizontal and Vertical Spillovers, Absorptive Capacity, and Competition,” *The journal of International Trade and Economic Development*, 17 (1), 155-173.

Melitz, M.J. (2003), “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity,” *Econometrica*, 71, 1695-1725.

Pavcnik, N. (2002), “Trade Liberalization, Exit, and Productivity Improvement: Evidence from Chilean Plants,” *Review of Economic Studies*, 69 (1), 245-276.

Pindyck, R.S., and D.L. Rubinfeld (1998), *Econometric Models and Economic Forecasts* (4th Ed.), Irwin McGraw-Hill.

Sachs, J., and A. Warner (1995), “Economic Reform and the Process of Global Integration,” *Brookings Paper on Economic Activity*, 1 (25th Anniversary), 1-95.

Sjoholm, F. (1999), “Technology Gap, Competition and Spillovers from Direct Foreign Investment: Evidence from Establishment Data,” *The Journal of Development Studies*, 36, 53-73.

Srivastava, V. (1996), *Liberalization, Productivity and Competition: A Panel Study of Indian Manufacturing*, New Delhi: Oxford University Press.

_____ (2000), “The Impact of India’s Economic Reforms on Industrial Productivity, Efficiency and Competitiveness,” Report of a Project sponsored by the Industrial Development Bank of India, New Delhi, National Council of Applied Economic Research.

Wooldridge, J.M. (2002), *Econometric Analysis of Cross Section and Panel Data*, Massachusetts: MIT Press.

Wang, J., and M. Blomstrom (1992), “Foreign Investment and Technology Transfer: A Simple Model,” *European Economic Review*, 36, 137-155.

Xu, B. (2000), "Multinational Enterprises, Technology Diffusion and Host Country Productivity Growth," *Journal of Development Economics*, 62, 477-493.

*Mailing Address: Smruti Ranjan Behera, Department of Humanities and Social Sciences, Indian Institute of Technology Ropar, Nangal Road, Rupnagar, Punjab-140001, India. E-mail:smrutibehera2003@gmail.com.*

*Received March 25, 2014, Revised January 29, 2015, Accepted July 6, 2015.*