

**FDI liberalization, firm heterogeneity and foreign ownership:  
German firm decisions in reforming India**

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**Abstract:** We contribute to the literature on the heterogeneity of multinational enterprises (MNEs) and the relevance of firm and industry characteristics for analyzing the determinants of outward foreign direct investment (FDI). The focus is on the role of firm-level productivity and industry-level R&D when MNEs decide on whether or not to undertake FDI and on the share of ownership in foreign affiliates. We combine two firm-specific datasets on German MNEs with varying equity stakes in Indian affiliates. We account for the two-step decision process of German MNEs by employing Heckman models. At the same time, we analyze how German firm decisions were affected by the liberalization of FDI regulations in India. We find remarkable differences between the selection and the ownership share equation, and also between the pre-reform and post-reform periods. The evidence has important policy implications and clearly reveals the trade-offs involved in selective FDI approvals and foreign ownership restrictions.

**Keywords:** multinational enterprises, firm characteristics, selective FDI approval, German FDI, ownership share, Heckman model

JEL classification: F23; L25

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## 1. Introduction

Attracting foreign direct investment (FDI) is a high priority among governments in developing (and developed) countries. The influx of foreign capital through multinational enterprises is expected to bring in new technology which can dissipate to the local economy and hence boost productivity and growth at the firm and aggregate level.

We contribute to the substantial literature on FDI in developing countries by studying empirically a (developed country's) firm's decision to locate in India. We focus on two aspects of this choice. First, we model empirically the determinants of the decision to invest in India, compared to a control group of similar firms that did not invest. Second, we investigate the choice of the level of ownership when setting up a foreign affiliate in India. At both levels, we pay particular attention to variables that broadly capture the level of technology that may be transferred to India. Specifically, these are productivity in the parent company and the knowledge intensity (measured as R&D intensity) of the industry in which the parent firm operates. We focus in our analysis also on the importance of FDI liberalization. India relaxed restrictions on FDI starting from the early 1990s and we investigate whether this had any measurable impact on the "quality" of FDI as proxied by the two technology variables.

Our research questions are important for a number of reasons. First of all, a government may be particularly interested in receiving high-tech investment in order to maximize the spillover and growth effects. At the same time, governments may restrict foreign ownership for the host country to appropriate a larger share of FDI-related rents (Asiedu and Esfahani 2001). Indeed, it has been shown that there are important differences in spillovers from majority and minority owned foreign affiliates of multinationals to the local economy (Javorcik and Spatareanu 2008; Blomström and Sjöholm 1999). Javorcik and Spatareanu (2008) in a panel analysis using data for Romanian firms, find that spillovers tend to be higher from partially owned affiliates of multinationals. However, selective approval procedures and ownership restrictions may come at the cost of substantially reducing FDI inflows and limiting the overall potential of local spillovers. A foreign parent company may transfer state-of-the-art technology only to a wholly owned affiliate, rather than to a joint venture (JV), in order to prevent the leakage of technology to the foreign partner (Desai, Foley and Hines 2004; Ramachandran 1993). Hence, the decision on investing and the ownership share may ultimately have profound implications for the relationship between inward FDI and growth in the host economy.

The literature on bargaining as well as transaction costs and incomplete contracts offers important theoretical building blocs to analyze FDI-related ownership issues.<sup>1</sup> The first approach typically posits that firms offering more valuable benefits to the host country improve their bargaining position and, thus, tend to have higher ownership shares. On the other hand, foreign ownership tends to be lower when the host country is highly attractive to FDI, e.g., by offering large local markets. The transaction cost concept of ownership choice takes into account that JVs with local partners may provide benefits to foreign investors relying on local assets and knowledge and, at the same time, give rise to costs if contracts are incomplete and free riding is difficult to prevent.

Arguably, R&D represents an important element with respect to both, FDI-related transaction costs and bargaining. Previous literature finds that firms in R&D intensive industries tend to prefer full to shared ownership in order to assure product quality and prevent leakage of knowledge (e.g., Javorcik 2000; Gomes-Casseres 1989).<sup>2</sup> Yet, it is from firms in these industries that we may expect the largest beneficial effects to emanate to the local economy. These are knowledge intensive industries which provide a large potential for learning for firms in developing countries.

Apart from industry-level knowledge intensity, another indicator of the knowledge potential of a foreign investor is firm-level productivity. In this respect, Raff, Ryan and Stähler (2008) present a theoretical model of the choice a multinational faces between opting for a JV with a local firm or a wholly-owned greenfield investment. Their theoretical analysis shows that more productive firms tend to choose higher ownership shares and prefer greenfield investment, as higher productivity (synonymous with higher level of assets in their model) reduce the costs of greenfield investment vis-à-vis a JV. Their theoretical proposition is backed up with empirical results using data on ownership choices of Japanese multinationals.

Related to our work, several studies analyze the determinants of the ownership structure of FDI projects by employing dichotomous choice models on wholly owned subsidiaries versus JVs. Gomes-Casseres (1989) shows for some 1500 subsidiaries of about 180 US-based MNEs that this binomial choice depends on the nature of each subsidiary's

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<sup>1</sup> For informative accounts of the relevant literature, see Hennart (1991), Nakamura and Xie (1998), Asiedu and Esfahani (2001), and Desai, Foley and Hines (2004).

<sup>2</sup> However, these studies generally proxy industry characteristics using data for the host country, while we use information on the home country industry. Arguably, the characteristics of the home country industry are a better indicator of the technology level used in the industry than those of the host country.

business, in combination with industry and host-country characteristics.<sup>3</sup> The probability for a JV is lower, for instance, when the US parent is more experienced in the specific industry and more familiar with the host country, when the subsidiary is integrated into intra-MNE trade, and when the subsidiary operates in an R&D intensive industry that is part of the parent company's core business. Likewise, Blomström and Zejan (1991) find that Swedish MNEs with less diversified product lines and more foreign experience opt against minority ownership.<sup>4</sup> Javorcik (2000) focuses on intra-industry differences in R&D and marketing efforts to assess the choice between wholly owned subsidiaries and JVs in Eastern European transition countries. She finds that leading parent companies in terms of technology and marketing prefer wholly owned subsidiaries, though not in low-tech industries.

Asiedu and Esfahani (2001) go beyond the dichotomy between wholly owned subsidiaries and JVs and treat the foreign equity share as a continuous variable. Note however that JVs account for only 14 percent of their sample of about 2400 subsidiaries of US-based MNEs. Asiedu and Esfahani (2001) complement firm characteristics by industry- and host country-related determinants of foreign equity shares, as we will do in the following. Firm characteristics include proxies of the parent firms' assets and more widely used variables such as firm size, production diversity and international experience. Most firm characteristics impact significantly on the equity share, with the notable exception of firm size.

In order to investigate empirically the importance of firm-level productivity and industry-level knowledge intensity for the choice of ownership share we combine two firm-specific datasets on German companies being engaged in India as foreign direct investors. The case of German FDI in India is expected to offer relevant insights. Germany belongs to the most important home countries of FDI,<sup>5</sup> and plays an important role in India's efforts to attract FDI and, thereby, promote the process of economic catching up. At the same time, India may be second only to China when it comes to concerns about offshoring in the home countries of MNEs. Furthermore, the Indian example is expected to provide interesting

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<sup>3</sup> Gatignon and Anderson (1988) draw on the same database, the Harvard Multinational Enterprise Project covering the entry modes of US-based MNEs in 1960-1975. In contrast to Gomes-Casseres (1989), these authors consider the continuum of foreign ownership (5-100 percent equity). They find, inter alia, that MNEs with more experience abroad opt for wholly owned subsidiaries; R&D intensity positively affects the first-stage decision to aim at full ownership, while varying degrees of JV partnership are viewed as equivalent in the second stage once full ownership is ruled out.

<sup>4</sup> Blomström and Zejan (1991) address the dichotomy between minority and majority ownership, rather than that of wholly owned subsidiaries versus JVs.

<sup>5</sup> It is only the United States and the United Kingdom whose outward FDI stocks clearly exceeded Germany's outward FDI stocks in 2006 (UNCTAD 2007).

lessons as to how firm decisions were affected by less selective approval procedures and relaxed ownership restrictions since the early 1990s.

The structure of the paper is as follows. Section 2 describes the firm-specific data used here. We employ two-step Heckman models to assess the impact of firm, industry and location characteristics and present the estimation results in Section 3. We find remarkable differences between the selection and the ownership share equation, and also between the pre-reform and post-reform periods. As argued in Section 4, the evidence has important policy implications and clearly reveals the trade-offs involved in selective FDI approvals and foreign ownership restrictions.

## **2. Data issues**

To assess the determinants of German company decisions on engaging in India we draw on the detailed information compiled by the Indo-German Chamber of Commerce for almost 800 so-called financial and technical collaborations of German firms with Indian partners (IGCC 2003). This directory covers subsidiaries of German firms in India, JVs with Indian firms and other collaborations involving the production of goods and services.<sup>6</sup> The snapshot presented in this source relates to the situation as of 2003. The dataset includes JVs that do not fall under the usual FDI definition of involving a minimum of 10 percent of foreign equity participation. Purely technical collaboration (i.e., license) agreements without any financial engagement of the German firm are also listed but are not used in this paper as they do not involve ownership.

It is in several respects that IGCC (2003) offers a particularly rich database. Information related to the type and intensity of the German firms' engagement include: the type of collaboration (financial or purely technical), the year when the collaboration started as well as the founding year of the Indian partner firm, the capital stock of the German subsidiary or Indo-German JV, the German share in paid up capital, annual sales, and employment.<sup>7</sup> In addition, it is clearly identified where exactly in India the German subsidiary or Indo-German JV is located. This renders it possible to account for

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<sup>6</sup> The directory excludes collaborations not involving any production such as agency agreements with Indian partners for the promotion of sales on behalf of German companies as well as representative and liaison offices set up by German firms in India.

<sup>7</sup> It should be noted, however, that some data are missing for various cases; this especially applies to annual sales.

characteristics of Indian states when assessing the determinants of the German firms' engagement.

IGCC (2003) distinguishes between the location of headquarters and factory location of the firms in India with German participation. Many headquarters are located in Delhi, Mumbai or Bangalore, while factories are located in other states. The factory location is of principal interest, notably in the manufacturing sector, when assessing the distribution of production activities (Head and Mayer 2004: 971). Note that the focus of German FDI in India was clearly on the manufacturing sector, accounting for 80-90 percent of total FDI, while the German engagement in the services sector remained marginal until 2003.<sup>8</sup> In various cases, however, there is no separate entry of factory location in the IGCC database. We then assume production to take place at the location of headquarters. We also use the headquarter location in cases for which the database lists several factory locations.

It is important to note that the unit of observation in IGCC (2003) is the subsidiary or JV, rather than the German parent or partner company.<sup>9</sup> Some German companies are actually involved in several FDI projects; prominent examples include major German companies and conglomerates such as Daimler AG, Osram GmbH, Epcos AG, Allianz SE, and Siemens AG. Large FDI projects are the exception. Three quarters of German FDI projects involve subsidiaries or JVs with less than Rs. 60 million of paid up capital in 2003 (slightly more than one million € at exchange rates of 2003); the median of employment is slightly below 50 workers. The median of the German equity share is slightly above 50 percent. Minority shares of up to 25 percent are clearly the exception (about 10 percent of all available observations), while almost a third of all FDI projects are wholly German owned subsidiaries. Financial collaboration typically started in the mid-1990s, i.e., after FDI regulations were relaxed in the course of India's economic reform program of 1991 (CUTS 2003).

In order to obtain more information on the German firms being engaged in India, we combine IGCC (2003) with company profiles available from the online database of Hoppenstedt, a commercial data provider (<http://www.hoppenstedt-hochschuldatenbank.de>). This source covers all German companies with more than 20 employees or annual sales of more than one million € including most of the parent firms with engagements in India. We use information on the German parent relating to: (major

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<sup>8</sup> The German engagement is also concentrated within manufacturing. Mechanical engineering, chemicals, and metal products figure most prominently in terms of the number of FDI projects.

<sup>9</sup> The same applies to the data used by Raff, Ryan and Stähler (2007).

and minor) line(s) of business with NACE industry code(s) (version 1.1), year of foundation, annual sales, number of employees, and number of foreign affiliates. While we principally draw on the online database of Hoppenstedt, the employment and sales figures for many companies are available online only for most recent years. In order to appropriately match the parent firm data with the information on their engagement in India we refer to earlier hardcopies of Hoppenstedt (2004a; 2004b) for data on employment and sales in, preferably, 2002 (or the closest year available).<sup>10</sup>

Apart from stand-alone companies, Hoppenstedt presents employees and sales for (i) specific firms belonging to a company group or conglomerate (“Konzern”) and (ii) the company group as a whole. We use company group data whenever applicable. Option (ii) is preferred since the decision to engage in India is highly likely to be taken at a higher company level. Moreover, option (i) would involve a downward bias for company size when minor segments of the conglomerate such as holdings provide the legal roof of foreign affiliates, while accounting for a small fraction of the conglomerate’s employment and sales.

Hoppenstedt’s company profiles are also used to collect the same set of firm-specific data for a control group of German companies that had not undertaken FDI in India until 2003. The control group is constructed in a way that its overall size as well as its industry structure resembles the size and industry structure of the sample of German FDI cases underlying the subsequent estimations. The selection of companies for the control group is random. We draw the required number  $n_i$  of companies for each industry  $i$  by dividing the (alphabetically ordered) list of Hoppenstedt profiles for all companies in industry  $i$  into  $n+1$  sub-groups, and drawing the company at the dividing line of two neighboring sub-groups for the control group.

The firm-specific datasets are complemented by two sets of variables. First, we consider some important characteristics of the industry in Germany to which the parent firm belongs.<sup>11</sup> We focus on the R&D intensity of the German industry. On the one hand, developing host countries are typically eager to attract advanced technologies that foreign investors in R&D intensive industries are most likely to possess. On the other hand, firms in R&D intensive industries tend to prefer full ownership to prevent leakage of

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<sup>10</sup> While the matching is improved by drawing on Hoppenstedt (2004a; 2004b), this comes at the cost of losing some observations on German parent firms. The reason is that employment and sales thresholds are somewhat higher (35 employees or annual sales of more than €3.5 million), compared to the online database.

<sup>11</sup> Most industry characteristics can be calculated at the 4-digit NACE level. An important exception is R&D intensity which is reported only at the 2-digit level (Statistisches Bundesamt 2002a). Note that the German *Warenverzeichnis* (WZ 2003) corresponds with NACE revision 1.1.

technological knowledge (e.g., Javorcik 2000; Gomes-Casseres 1989).<sup>12</sup> Second, we consider state characteristics that may have a say on a state's attractiveness to FDI and which may also be relevant for a firm's choice of ownership share in the foreign affiliate. Our focus here is on openness measures at the state level. In this way, we account for the fact that India's economic reform program of 1991 has reduced central government control so that policies and institutions at the state level are supposed to matter increasingly in the post-reform era (Singh and Srinivasan 2006; Kochhar et al. 2006).

Appendix A presents exact definitions of all variables. A more detailed presentation of stylized facts on German FDI projects in India is available in Görg et al. (2008).

### 3. Methodology and results

In our empirical analysis we model the investment decision of German firms in India as a two-step problem. First, firms decide whether or not to invest in India. We model this as a zero/one decision depending on firm ( $i$ ) and industry ( $j$ ) characteristics,

$$\Pr(\text{FDI}_i) = \beta_1 X_i + \beta_2 \text{R\&D}_j + \beta_3 \text{K/L}_j + e_i \quad (1)$$

This model is estimated using data for the German investors as well as the control group as defined in the previous section. For those firms that do invest in India, we can then also model the choice of ownership share,

$$\text{osh}_i = \alpha_1 X_i + \alpha_2 \text{R\&D}_j + \lambda_i + v_i \quad (2)$$

where  $\text{osh}$  is the ownership share chosen by firm  $i$ .

This model is estimated using the Heckman (1979) two-step procedure. In equation (2),  $X_i$  denotes a vector of firm characteristics, and  $\text{R\&D}_j$  is the industry's R&D expenditure relative to sales. The parameter  $\lambda_i$  captures the probability of firm  $i$  being observed in this second step (inverted mills ratio in Heckman's parlance) and  $v_i$  is the remaining error term. Equation (1) includes the same set of variables in the selection equation as well as one additional variable to aid identification. The additional variable is a

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<sup>12</sup> Ideally, one would of course refer to R&D intensity at the firm level. However, these data are generally not available; see Marin, Lorentowicz and Raubold (2003) for related survey data on German FDI projects in Eastern Europe.



proxy for the sunk costs of investing abroad, which are assumed to affect the selection but not the choice of ownership. As a proxy for this we use the capital intensity ( $K/L_j$ ) of the industry of the parent company.<sup>13</sup>

Vector  $X_i$  includes size (measured in terms of employment), productivity (measured as labor productivity), age, the number of industries in which the firm is active (as a measure of diversification at the firm level), and number of existing foreign affiliates (as a measure of experience in foreign markets).

Productivity is included as this is highlighted in theoretical and empirical work by Raff, Ryan and Stähler (2008). In their empirical specification they also control for firm size and age in order to capture observable aspects of firm heterogeneity that may be correlated with productivity. We also add a variable capturing the number of industries in which a parent firm is operating to proxy the level of diversification of the parent. Previous papers hypothesize that more diversified parents are less likely to engage in full ownership, although the empirical evidence in support of this hypothesis is weak (e.g., Javorcik 2000; Meyer 1998). Arguably, the level of experience abroad may also have implications for the probability of investing in another foreign country as well as the choice of ownership. If they invest at all, firms with no experience may have to cooperate with foreign partners who know about the foreign environment. By contrast, firms with large experience abroad may not have to rely on foreign partners but are familiar with overseas operations and can therefore choose to go on their own. This implies that we would expect a positive correlation between the number of foreign affiliates a firm has, and its presence as an investor in India and its choice of ownership share (see also Gatignon and Anderson 1988; Blomström and Zejan 1991).

Note that we interpret statistically significant coefficients as indicating correlations rather than causality. Our data are a cross section and it is therefore difficult to control for possible endogeneity. This may be a problem for the firm-level variables included, in particular productivity and size, as these may be jointly determined with the ownership share, and/or the decision to invest in India. Given the cross-section nature of our data it is difficult to come up with convincing instruments that would allow us to control adequately for this possible endogeneity. However, that there is little reason to be concerned about

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<sup>13</sup> This follows the recent literature on firm heterogeneity, sunk costs and foreign investment, such as Helpman, Melitz and Yeaple (2004). Note that, strictly speaking, identification of the two-step estimation does not hinge on this additional variable. If there were no additional variable in the first step, identification would be solely on the different functional form of the two equations. We also experimented with including  $K/L$  in the second step, but the variable always turned out to be statistically insignificant. This strengthens our assumption that it should be excluded from the choice of ownership share equation.

reverse causality running from German FDI in India to parent firm characteristics. As we noted before, most German FDI projects are fairly small, involving less than one million € of invested capital and no more than 50 local workers. Still, in order to mitigate the problem, we follow Raff, Ryan and Stähler (2008: 15) and lag firm size and productivity in equations (1) and (2).

Table 1 presents the estimations of the baseline model. Column (1) shows the selection equation, column (2) the ownership share equation. In terms of the control variables we find that firm size, age, number of foreign affiliates and degree of diversification are statistically significantly correlated with the decision to invest in India (selection equation). Also, the measure of sunk costs matters for selection, as hypothesized we find that firms in industries with higher sunk costs (capital to labor ratio) are less likely to invest in India. For the choice of ownership share, only firm age and degree of diversification are statistically significant, and their signs are opposite to those found in the selection equation.

In what follows, we concentrate the discussion on the two main variables of interest, firm-level productivity and industry-level technology (R&D intensity). What we find are remarkable differences between the selection and the ownership share equation. In terms of selection, it is apparent that more productive firms are associated with being more likely to invest in India. This mirrors the result that more productive firms invest abroad which is common in the literature (e.g., Helpman, Melitz and Yeaple 2004; Geishecker, Görg and Taglioni 2009). We also find that firms that operate in more research intensive industries are associated with being less likely to invest in India. Hence, German investment in India is likely to be from low research intensive industries, but it is by highly productive firms within a given industry. The focus on lower-tech industries tends to be in some conflict with the preferences of host countries such as India, but may reflect that firms choose more advanced locations for investing in high-tech lines of business.

In the ownership share equation we find that results are in some sense opposite. Firm-level productivity is no longer statistically significant, but we find that the research intensity of the industry is positively associated with ownership share. In other words, among the firms that invest in India, firms choose a higher ownership share the higher is the research intensity (or knowledge stock) of the industry. This is in line with the theoretical proposition that firms in industries using higher levels of technology attempt to prevent dissipation of that knowledge through opting for whole or majority owned affiliates rather than JVs with foreign partners holding the majority of shares.

In order to check the robustness of the second-stage result to the choice of estimation technique we also estimate equation (2) using a tobit estimator. This alternative is appropriate as it allows for the censored nature of the data. Results presented in column (3) are similar to those reported before. Firm-level productivity is not statistically significantly associated with ownership share, while higher industry-level research intensity implies a higher ownership share. In what follows, we concentrate on the Heckman estimation, as this also allows us to model the first-step decision. We are cautious to point out, however, that we estimated all the models reported below also using the tobit estimator, which always produces similar results. These are not reported here to save space.

*[Table 1 here]*

In order to look at our analysis from a more policy relevant angle, we make use of India's move towards liberalizing its FDI regulations starting in 1991 (CUTS 2003; FICCI 2005). Amongst other things, this also included easing restrictions on the operations of foreign firms in India. For instance, Balasubramanyam and Mahambare (2003: 46) argue: "The 1991 reforms marked a major break from the earlier dirigiste regime with its regulation of the spheres of foreign affiliate participation and its modes of operation." Of course, this deregulation may have had implications for the choice to invest in India and, indeed, for the choice of ownership share by foreign parents. In particular, given that restrictions on the level of ownership by foreign firms were in place and that more technology intensive projects were favored by the regulator, the choice before 1991 may not reflect economic optimization but only the effect of such regulation.

In order to investigate this we split our sample into those firms that invested before and after 1991. In the estimation of the selection equation (1) we include the full control group as counterparts for these two samples. The results are reported in columns (1) to (4) of Table 2. Note that the baseline results reported in Table 1 also adequately describe the choice of investment and ownership share for investments by German firms after 1991 (columns 3 and 4). For investments before 1991, i.e., under the regulation regime, results differ. In that case, the probability of investing in India is positively associated with firm-level productivity as well as the research intensity of the industry. This is likely to reflect the aim of the regulation, namely, to attract investments in high-tech industries. The choice of ownership share, however, is independent of firm productivity or industry research intensity. In other words, for those firms that were allowed to invest in India, knowledge intensity at the industry, or productivity at the firm level, do not matter for their choice of

ownership share. This seems to suggest that selective FDI approval procedures, together with foreign ownership restrictions, have helped India to attract the desired form of FDI from German investors – an issue to which we return in Section 4.

*[Table 2 here]*

Before we discuss further the relevance and policy implications of these results, we perform a number of robustness checks. In the first test, reported in Table 3, we take account of the fact that the reform program of 1991 marked just the first step towards the deregulation of FDI, with a sequence of further FDI liberalization in subsequent years (CUTS 2003; FICCI 2005). Accordingly, we split the sample into those investing before and after 1995. Results for firms investing after 1995 are identical to those we obtained in Table 2 for firms investing after 1991. For investments before 1995, the only difference to corresponding columns (1) and (2) in Table 2 is that firms are more likely to invest in India if they are in industries with lower research intensities. However, this effect is much smaller than in the selection equation on investments by firms after 1995.

Liberalization of the investment regime made the country more open to trade and investment. In order to take a different cut at the data we investigate whether the choice of ownership share differs depending on the degree of openness of the Indian state in which the investment is located. We use two alternative measures of openness; openness I relates to the state-wise distribution of investments in so-called 100% export-oriented units (EOU) in 1991-2001, relative to the respective state's share in India's population (Observer Research Foundation 2004). The EOU scheme was introduced in the 1980s to promote Indian exports.<sup>14</sup> More open states have higher values of openness I. An alternative measure, openness II comes from Marjit, Kar and Maiti (2007) who classify 15 major Indian states (covering 82 percent of our sample of German FDI cases) as relatively open or closed. The index ranges from 1 (most open) to 15 (least open) and is based on a systematic assessment of production structures at the state level. States are considered relatively open when production structures correspond relatively well with India's revealed comparative advantages in international trade. Based on these two alternative measures, we classify states as open if openness measure I (II) is above (below) the median, otherwise states are considered closed.

The results are reported in columns (5) to (12) in Table 3. In general, these results are in line with our previous results. In more open states (as in the post-liberalization period), investment decision and ownership share choice are determined by firm-level

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<sup>14</sup> See <http://www.mumbaicustoms.gov.in/scripts/eou.asp> for details on the EOU scheme.

productivity and industry-level R&D intensity. In particular, less productive firms, and firms in more R&D intensive industries are less likely to invest in open states, while, for firms that invested there, those in R&D intensive industries tend to opt for higher ownership shares, arguably in order to protect their knowledge from dissipating into the local economy. In less open states (or in the pre-liberalization period) firm and industry characteristics are less important determinants of investment and ownership share choice.

*[Table 3 here]*

Finally, we attempt to distinguish between “vertical” and “horizontal” German FDI projects in India in order to assess whether the type of FDI matters for the role of firm and industry characteristics. Note that theoretical models such as Raff, Ryan and Stähler (2008) focus on horizontal FDI. It is thus open to question whether the type of FDI matters for the robustness of coefficients estimated for the full sample. As mentioned in the Introduction, FDI involving state-of-the-art technology improves the bargaining position of foreign firms so that foreign ownership tends to increase with R&D intensity. However, this link may weaken if foreign investors are mainly interested in penetrating large local markets, shifting the relative bargaining position towards the government. According to Desai, Foley and Hines (2004), foreign ownership is likely to be higher for vertical FDI; in this way, firms coordinating integrated production activities across different locations may mitigate conflicts with local partners pursuing competing goals. Likewise, Hennart (1991: 486) argues that “conflicts between joint venture partners can be expected to arise ... when foreign subsidiaries export back to the parent’s home market or to third markets.”

The distinction between vertical and horizontal FDI is bound to be tentative. We draw on bilateral exports and imports, as reported by the OECD in its International Trade by Commodities database,<sup>15</sup> assuming that German FDI in India is more likely to be vertical (horizontal) in industries for which Indian-German trade relations – notably Indian exports to Germany – are stronger (weaker).<sup>16</sup> This is obviously an imperfect indicator of vertical and horizontal FDI, but arguably informative as vertical FDI leads to trade between host and home country (e.g., Markusen, 2002). One striking difference in results between vertical and horizontal investments is that for the former, industry-level R&D intensity and firm size are positively correlated with the choice of ownership share. This is not the case

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<sup>15</sup> The data are available at:

[http://www.oecd.org/document/18/0,3343,en\\_2649\\_34235\\_1906706\\_1\\_1\\_1\\_1.00.html](http://www.oecd.org/document/18/0,3343,en_2649_34235_1906706_1_1_1_1.00.html) (accessed: April 2009).

<sup>16</sup> More precisely, we consider Indian exports to Germany over German exports to India in 2002 in SITC categories that correspond to the NACE codes for which our sample contains German FDI cases. The matching of SITC and NACE codes is mostly at the 3-digit NACE level.

for horizontal investments. This appears to be in line with the bargaining argument discussed in the Introduction. Vertical investments may bring stronger benefits to the host economy and, thus, firms may be in a better bargaining position and be able to choose to have higher ownership shares.

*[Table 4 here]*

#### **4. Policy implications**

There are essentially two approaches of drawing on inward FDI in order to boost firm productivity and economic growth. India adopted the first approach prior to its reform program in 1991 by selectively targeting FDI inflows and strictly regulating foreign ownership shares. Policymakers aimed at attracting high-tech, R&D intensive FDI projects and luring foreign investors who readily accepted Indian JV partners. R&D intensive FDI was supposed to offer the best way to receive state-of-the-art technology, and JVs were deemed necessary for the Indian partners to learn from foreign investors and imitate superior technological processes, product design and management procedures. India shifted to the second approach in the course of economic reforms starting in the early 1990s, including the gradual dismantling of FDI regulations. By opening up less R&D intensive lines of business to FDI and relaxing foreign ownership restrictions the country provided rather indirect incentives for foreign investor to transfer state-of-the-art technology. Policymakers increasingly let foreign investors decide on the type of FDI projects and ownership shares. In particular, India increasingly accepted that foreign investors tend to prefer retaining ownership control over superior technologies they possess.

Our empirical estimation results clearly reflect the different approaches in the pre- and post-reform era. The observation of R&D intensity positively affecting the selection of German FDI projects prior to 1991, as well as in closed Indian states, is hardly attributable to deliberate choices of German investors, but rather to FDI regulations in line with local policymakers' preferences. The same applies to R&D intensity not having had a significant impact on the German ownership share in the pre-reform period and in closed Indian states. The preferences of German investors came to the fore when and where foreign companies were allowed to choose. Less R&D intensive FDI projects were more likely to be undertaken in the post-reform era and in more open Indian states. Furthermore, investors undertaking R&D intensive FDI projects clearly preferred higher ownership shares when having the freedom of choice.

One may be tempted to conclude at this point that policymakers interested in high-tech FDI inflows with local partners being involved in JVs have good reasons to enforce their preferences on foreign investors through selective approval procedures and foreign ownership restrictions. Such a conclusion would miss an important point, however. Constraining the choices of foreign investors comes at a cost. The inspection of our sample of German investments, in combination with the previously reported estimations results, suggests that policymakers face a serious trade-off: The regulatory pre-reform approach ensures that realized FDI projects correspond to the host country's preferences with respect to firm and industry characteristics as well as ownership structure. At the same time, this approach tends to reduce the number of realized FDI projects. Importantly, regulations may discourage the number of preferred projects as much as projects that are discouraged deliberately. In other words, when assessing the policy implications of the pre- and post-reform approaches it has to be taken into account whether (possibly undesired) reform effects on the structure of FDI in India were compensated by positive effects on the absolute number of FDI projects, including projects with the (possibly still) desired characteristics.

Table 5 substantiates this point by classifying the (counts of) FDI projects in our sample according to the R&D intensity of the industry to which the investor belongs in Germany, the timing of FDI projects and their location in different Indian states. Not surprisingly, the overall number of FDI projects soared in the post-reform period – by a factor of 4.5 when comparing 1992-2003 with 1981-1991.<sup>17</sup> The deregulation of low-tech projects accounts for a substantial proportion of the increase in the overall number of FDI projects, but the number of higher-tech projects also multiplied.<sup>18</sup> Indeed, projects in the high R&D category still outnumbered projects in the low R&D category after the latter were liberalized. Put differently, the highly selective pre-reform approach had not only the desired effect of discouraging low-tech projects, but also appears to have substantially reduced the number of preferred projects.

The table also portrays the experience of two groups of selected Indian states. The four states rated “more open” accounted for 42 percent of so-called 100% export-oriented units (EOUs) in India in 1991-2001 (Observer Research Foundation 2004), while their population share was only 26 percent. Moreover, Marjit, Kar and Maiti (2007) classified all four states as more open than the group of five “closed” states. Various authors, including

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<sup>17</sup> Note that the pre-reform period covered in the table goes back to the 1950s.

<sup>18</sup> Just 16 R&D intensive cases were observed in 1981-1991.

Singh and Srinivasan (2006) and Kochhar et al. (2006), have stressed that policies and institutions at the state level matter increasingly since the early 1990s, with economic reforms having reduced central government control and having increased the potential for greater disparities across states. Indeed, the five closed states, accounting for 37 percent of India's population, hosted very few FDI projects. This applies to all R&D categories in both, the pre- and post-reform period. By contrast, the effects of opening-up to world markets on the structure as well as the overall frequency of FDI are evident for the four more open states. The share of low-tech FDI project clearly increased in these states in the post-reform period (to about one quarter). More strikingly, however, German FDI projects in all R&D categories are concentrated in the group of more open states to almost the same extent. Specifically, more open states did not lose relative attractiveness for high-tech FDI projects, compared to states that remained less open.

The distribution of vertical FDI, i.e., cases where India's export pattern pointed to a relatively strong integration into intra-industry trade with Germany, reveals another trade-off policymakers are facing when pursuing selective FDI regulations in order to direct foreign investors into high-tech projects. As can be seen from Table 5, vertical FDI accounted for two thirds of the increase in the overall number of German FDI projects, comparing the post-reform period with the pre-reform period. It was particularly in industries with low R&D intensity that vertical FDI appears to have received a boost through the reform program. This suggests that insisting on high-tech FDI has the undesired side-effect of discouraging export-oriented FDI, a type of FDI which policymakers in developing host countries are typically also fond of receiving.

Finally, the bottom part of Table 5 underscores the reform effects on the ownership structure of German FDI projects in India. Full German ownership was a rare exception in the pre-reform era, while accounting for almost 40 percent of post-reform projects. Policymakers may book it under costs of reform that giving foreign investors the choice of ownership went along with an absolute decline in the number of FDI projects with foreign minority shares, thereby impairing the chances of local JV partners to learn from foreign investors and imitate their superior technology. However, policymakers must weigh this decline against the number of FDI projects with full or majority foreign ownership that were arguably made possible only by the reforms. For instance, comparing the post-reform period with the pre-reform period in the high R&D category, the decline in the number of cases with minority ownership was overcompensated five times by additional projects with full or majority foreign ownership. Once again it appears that imposing the host



government's preferences on foreign investors might come at considerable cost, by impairing the incentives of foreign investors to undertake FDI that has at least some of the desired characteristics.

*[Table 5 here]*

## **5. Summary and conclusion**

We find both firm and industry characteristics related to technology intensity to be relevant when MNEs decide on (i) whether or not to engage with FDI in a host country and (ii) the share of ownership in foreign affiliates. We estimate Heckman models by drawing on two largely unnoticed datasets on German MNEs with varying equity stakes in Indian affiliates and a control group without any FDI in India. In contrast to most previous studies employing dichotomous choice models on wholly owned subsidiaries versus joint ventures, the data used in the present study allows treating the German MNEs' equity shares as a continuous variable. Furthermore, we explicitly account for the effects of India's opening up to world markets in the early 1990s on MNEs' FDI and ownership decisions.

It turns out that more productive German firms are generally more likely to undertake FDI in India, while firm productivity hardly matters for foreign ownership shares. More strikingly, India's reforms clearly affected the role of industry-specific R&D intensity in the two-stage decision process of German MNEs. During the post-reform period, FDI projects in R&D intensive industries were less likely; and FDI projects in such industries were associated with higher German equity shares. By contrast, the limited number of pre-reform FDI projects was mainly R&D intensive and minority owned.

Obviously, the bilateral Indo-German setting of the present paper cautions against rash generalizations. The findings for German FDI do not necessarily apply to companies based elsewhere. The motivations underlying FDI in India may differ from those of FDI in smaller developing countries. Ideally, one might aim at panel analyses covering various host countries and revealing more than just a snapshot of one particular year. However, such data are at present not available.

Keeping these caveats in mind, the present study offers interesting policy conclusions, notably on the trade-offs policymakers are facing when trying to lure FDI of a preferred type. Selective FDI approval procedures, together with foreign ownership restrictions, seem to have helped pre-reform India to attract the desired form of FDI - high-tech projects with foreign minority shares, enabling local joint venture partners to benefit

from project-specific spillovers. Nevertheless, host-country governments aiming at growth and productivity enhancing FDI may be well advised to relax foreign ownership restrictions and open up lower-tech industries to FDI, as India has done since the early 1990s. Strict regulations ensuring that still realized FDI projects correspond to the host country's preferences may substantially reduce the number of realized projects – including those with the preferred characteristics.

## References:

- Asiedu, E., and H.S. Esfahani (2001). Ownership Structure in Foreign Direct Investment Projects. *Review of Economics and Statistics* 83 (4): 647-662.
- Balasubramanyam, V.N., and V. Mahambare (2003). FDI in India. *Transnational Corporations* 12 (2): 45-72.
- Blomström, M., and F. Sjöholm (1999). Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter? *European Economic Review* 43 (4-6): 915-923.
- Blomström, M., and M. Zejan (1991). Why Do Multinational Firms Seek out Joint Ventures? *Journal of International Development* 3 (1): 53-63.
- CUTS (2003). Investment Policy in India: Performance and Perceptions. Jaipur: CUTS Centre for Competition, Investment and Economic Regulation.
- Desai, M.A., F. Foley and J.R. Hines (2004). The Costs of Shared Ownership: Evidence from International Joint Ventures. *Journal of Financial Economics* 73 (2): 323-374.
- FICCI (Federation of Indian Chambers of Commerce and Industry) (2005). FICCI Handbook on Foreign Direct Investment. New Delhi.
- Gatignon, H., and E. Anderson (1988). The Multinational Corporation's Degree of Control over Foreign Subsidiaries: An Empirical Test of a Transaction Cost Explanation. *Journal of Law, Economics, and Organization* 4(2): 305-336.
- Geishecker, I., H. Görg and D. Taglioni (2009). Characterising Euro Area Multinationals. *World Economy* 32 (1): 49-76.
- Görg, H., V. Lauber, B. Meyer and P. Nunnenkamp (2008). Firm Heterogeneity and Choice of Ownership Structure: An Empirical Analysis of German FDI in India. Kiel Working Paper 1462. Kiel: Institute for the World Economy.
- Gomes-Casseres, B. (1989). Ownership Structures of Foreign Subsidiaries: Theory and Evidence. *Journal of Economic Behavior and Organization* 11 (1): 1-25.
- Head, K., and T. Mayer (2004). Market Potential and the Location of Japanese Investment in the European Union. *Review of Economics and Statistics* 86 (4): 959-972.
- Heckman, J.J. (1979). Sample Selection Bias as a Specification Error. *Econometrica* 47 (1): 153-161.
- Helpman, E., M.J. Melitz and S.R. Yeaple (2004). Export versus FDI with Heterogeneous Firms. *American Economic Review* 94 (1): 300-316.
- Hennart, J.-F. (1991). The Transaction Costs Theory of Joint Ventures: An Empirical Study of Japanese Subsidiaries in the United States. *Management Science* 37 (4): 483-497.

- Hoppenstedt (2004a). *Handbuch der Großunternehmen*. Darmstadt: Hoppenstedt Firmeninformationen GmbH.
- Hoppenstedt (2004b). *Mittelständische Unternehmen*. Darmstadt: Hoppenstedt Firmeninformationen GmbH.
- Hoppenstedt (2008). Online database; <http://www.hoppenstedt-hochschuldatenbank.de>; accessed: February 2009.
- IGCC (Indo-German Chamber of Commerce) (2003). *Directory of German Companies in India: I: Collaborations, Joint Ventures, Subsidiaries*. Mumbai.
- Javorcik, B.K. (2000). *Technological Leadership and Foreign Investors' Choice of Entry Mode*. World Bank, Policy Research Working Paper 2314. Washington, DC.
- Javorcik, B.K., and M. Spatareanu (2008). To Share or Not to Share: Does Local Participation Matter for Spillovers from Foreign Direct Investment? *Journal of Development Economics* 85(2): 194-217.
- Kochhar, K., U. Kumar, R. Rajan, A. Subramanian, and I. Tokatlidis (2006), *India's Pattern of Development: What Happened, What Follows?* IMF Working Paper, WP/06/22, International Monetary Fund, Washington, D.C.
- Marin, D., A. Lorentowicz and A. Raubold (2003). *Ownership, Capital or Outsourcing: What Drives German Investment to Eastern Europe?* In: H. Herrmann and R. Lipsey (eds.), *Foreign Direct Investment in the Real and Financial Sector of Industrial Countries*. (pp. 147-163). Berlin: Springer.
- Marjit, S., S. Kar and D.S. Maiti (2007). Regional Trade Openness Index and Income Disparity: A New Methodology and the Indian Experiment. *Economic and Political Weekly*, March 3<sup>rd</sup>: 757-769.
- Markusen, J.R. (2002). *Multinational firms and the theory of international trade*. MIT Press: Cambridge, M.A.
- Meyer, K.E. (1998). *Direct Investment in Economies in Transition*. Cheltenham: Edward Elgar.
- Nakamura, M., and J. Xie (1998). Nonverifiability, Noncontractibility and Ownership Determination Models in Foreign Direct Investment, with an Application to Foreign Operations in Japan. *International Journal of Industrial Organization* 16 (5): 571-599.
- Observer Research Foundation (2004). *India 2004: Observer Statistical Handbook*. New Delhi: Rupa Co.

- Raff, H., M.J. Ryan and F. Stähler (2007). Firm Productivity and the Foreign-Market Entry Decision. Economics Working Paper 2008-02. Kiel: Christian Albrechts University.
- Raff, H., M.J. Ryan and F. Stähler (2008). Whole versus Shared Ownership of Foreign Affiliates. Kiel Working Paper 1433. Kiel: Institute for the World Economy.
- Ramachandran, V. (1993). Technology Transfer, Firm Ownership, and Investment in Human Capital. *Review of Economics and Statistics* 75(4): 664-670.
- Singh, N., and T.N. Srinivasan (2006). Indian Federalism, Economic Reform, and Globalization. In: J.S. Wallack and T.N. Srinivasan (eds.), *Federalism and Economic Reform: International Perspectives* (pp. 301-363). Cambridge: University of Cambridge Press.
- Statistisches Bundesamt (2002a). Fachserie 4. Reihe 4.3. Produzierendes Gewerbe. Kostenstruktur der Unternehmen des Verarbeitenden Gewerbes sowie des Bergbaus und der Gewinnung von Steinen und Erden. [http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/Navigation/Homepage\\_NT.psm1](http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/Navigation/Homepage_NT.psm1); accessed: August 2008.
- Statistisches Bundesamt (2002b). Fachserie 4. Reihe 4.1.1. Produzierendes Gewerbe. Beschäftigung und Umsatz der Betriebe des Verarbeitenden Gewerbes sowie des Bergbaus und der Gewinnung von Steinen und Erden. [http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/Navigation/Homepage\\_NT.psm1](http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/Navigation/Homepage_NT.psm1); accessed: August 2008.
- UNCTAD (2007). *World Investment Report 2007*. Geneva: United Nations.

## Appendix A – Definition and sources of variables

Variable	Definition	Source
<u>German subsidiary or joint venture in India:</u>		
osh	German share in paid up capital, percent; 2003	IGCC (2003)
age	Year of subsidiary or JV going into operation	IGCC (2003)
<u>Characteristics of German (parent) firm:</u>		
size	Size of the (parent) company, measured by number of employees; in logs; 2002 or closest year available.	Hoppenstedt (online; 2004a, 2004b)
productivity	Labor productivity of the (parent) company, proxied by sales per employee; in logs; 2002 or closest year available.	Hoppenstedt (online; 2004a, 2004b)
# affiliates	Number of foreign affiliates; proxy of (parent) firm's international experience	Hoppenstedt (online)
diversification	Number of industries (4-digit NACE codes) in which the (parent) firm is active; proxy of degree of diversification	Hoppenstedt (online)
<u>Industry characteristics in Germany:</u>		
K/L	Capital intensity, proxied by net assets per employee; 1000 €, in logs; 2002 (2-digit NACE)	Statistisches Bundesamt (2002a; 2002b)
R&D	R&D intensity, measured by R&D expenses in percent of gross production; in logs; 2002 (2-digit NACE)	Statistisches Bundesamt (2002a)
<u>Location characteristics in Indian states:</u>		
openness I	State's share in 100% export oriented units (EOU) in all India in 1991-2001, relative to the state's population share	Observer Research Foundation (2004)
openness II	Index on regional openness to trade; ranking of states in terms of their exposure to trade, as defined in the source; range from 1 (most open) to 15 (closed)	Marjit et al. (2007)

## Tables

**Table 1: Baseline estimation results**

	(1) Heckman Selection	(2) Heckman Ownership share	(3) Tobit Ownership share
<i>Firm variables</i>			
ln(productivity)	0.806 (0.296)***	-0.008 (0.110)	0.060 (0.136)
ln(size)	0.515 (0.055)***	0.021 (0.032)	0.076 (0.028)***
age	0.137 (0.072)*	-0.065 (0.031)**	-0.075 (0.042)*
diversification	-0.689 (0.243)***	0.226 (0.093)**	0.199 (0.123)
# affiliates	0.419 (0.106)***	-0.018 (0.044)	0.026 (0.050)
<i>Industry variables</i>			
ln(R&D)	-4.072 (0.646)***	1.007 (0.305)***	0.904 (0.381)**
ln(K/L)	-1.277 (0.329)***		
Observations	508		271
Wald test (p-value)	0.000		
Mills ratio (p-value)	0.267		
R-squared			0.09

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

All regressions include two digit industry dummies.

**Table 2: Results for pre- and post-liberalization investments**

	(1) Pre 1991 Heckman Selection	(2) Pre 1991 Heckman Ownership share	(3) Post 1991 Heckman Selection	(4) Post 1991 Heckman Ownership share
<i>Firm variables</i>				
ln(productivity)	0.749 (0.318)**	-0.029 (0.180)	0.800 (0.360)**	0.118 (0.176)
ln(size)	0.538 (0.084)***	-0.010 (0.078)	0.484 (0.058)***	0.025 (0.035)
age	0.058 (0.113)	0.027 (0.074)	0.144 (0.075)*	-0.072 (0.030)**
diversification	-0.832 (0.361)**	0.632 (0.187)***	-0.608 (0.255)**	0.061 (0.096)
# affiliates	0.379 (0.144)***	-0.148 (0.085)*	0.448 (0.115)***	-0.013 (0.049)
<i>Industry variables</i>				
ln(R&D)	2.699 (0.767)***	-0.054 (0.473)	-4.076 (0.617)***	1.045 (0.278)***
ln(K/L)	1.019 (0.313)***		-1.240 (0.316)***	
Observations	314		435	
uncensored obs	77		198	
Wald test (p-value)	0.000		0.000	
Mills ratio (p-value)	0.478		0.056	

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

All regressions include two digit industry dummies.



**Table 3: Robustness checks: liberalization and openness**

	(1) Pre 1995  Heckman Selection	(2) Pre 1995  Heckman Ownership share	(3) Post 1995  Heckman Selection	(4) Post 1995  Heckman Ownership share	(5) Openness Measure I closed Heckman Selection	(6) Openness Measure I closed Heckman Ownership share	(7) Openness Measure I open Heckman Selection	(8) Openness Measure I open Heckman Ownership share	(9) Openness Measure II closed Heckman Selection	(10) Openness Measure II closed Heckman Ownership share	(11) Openness Measure II open Heckman Selection	(12) Openness Measure II open Heckman Ownership share
<i>Firm variables</i>												
ln(productivity)	0.895 (0.369)**	-0.034 (0.154)	0.732 (0.391)*	0.035 (0.198)	0.074 (0.679)	-0.116 (1.074)	0.887 (0.331)***	-0.041 (0.124)	0.876 (0.369)**	0.179 (0.206)	0.679 (0.326)**	-0.116 (0.146)
ln(size)	0.517 (0.072)***	-0.004 (0.058)	0.479 (0.063)***	0.027 (0.035)	0.554 (0.080)***	-0.009 (0.111)	0.481 (0.061)***	0.003 (0.039)	0.541 (0.070)***	0.114 (0.062)*	0.464 (0.065)***	-0.035 (0.048)
age	0.164 (0.089)*	-0.009 (0.050)	0.109 (0.085)	-0.100 (0.033)***	0.099 (0.096)	-0.044 (0.055)	0.152 (0.082)*	-0.082 (0.040)**	0.018 (0.088)	-0.113 (0.039)***	0.246 (0.088)***	-0.064 (0.050)
diversification	-0.835 (0.300)***	0.396 (0.145)***	-0.542 (0.276)**	0.048 (0.100)	-0.679 (0.328)**	0.313 (0.186)*	-0.577 (0.265)**	0.201 (0.114)*	-0.720 (0.303)**	0.126 (0.134)	-0.526 (0.279)*	0.315 (0.137)**
# affiliates	0.389 (0.126)***	-0.052 (0.070)	0.487 (0.123)***	-0.022 (0.055)	0.486 (0.146)***	-0.069 (0.110)	0.424 (0.116)***	-0.041 (0.061)	0.361 (0.133)***	0.112 (0.066)*	0.503 (0.123)***	-0.124 (0.073)*
<i>Industry variables</i>												
ln(R&D)	-2.274 (0.573)***	-0.175 (0.284)	-4.223 (0.634)***	1.203 (0.298)***	1.098 (0.942)	0.189 (0.379)	-4.517 (0.669)***	1.071 (0.355)***	0.427 (0.431)	-0.366 (0.289)	-4.692 (0.821)***	1.456 (0.404)***
ln(K/L)	-13.076 (0.275)***		-1.224 (0.325)***		4.331 (0.480)***		-2.521 (0.340)***		3.518 (0.226)***		-2.755 (0.421)***	
Observations	361		397		325		420		358		314	
uncensored obs	124		160		88		183		121		77	
Wald test (p-value)	0.000		0.000		0.000		0.000		0.000		0.000	
Mills ratio (p-value)	0.435		0.097		0.360		0.243		0.426		0.478	

Standard errors in parentheses  
\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%  
All regressions include two digit industry dummies.

**Table 4: Results for vertical and horizontal FDI**

	(1) vertical Heckman Selection	(2) vertical Heckman Ownership share	(3) horizontal Heckman Selection	(4) horizontal Heckman Ownership share
<i>Firm variables</i>				
ln(productivity)	0.614 (0.307)**	0.082 (0.130)	1.587 (0.827)*	-0.151 (0.276)
ln(size)	0.479 (0.090)***	0.083 (0.045)*	0.585 (0.078)***	-0.027 (0.047)
age	-0.001 (0.123)	-0.057 (0.046)	0.209 (0.094)**	-0.071 (0.044)
diversification	-1.055 (0.433)**	0.171 (0.139)	-0.508 (0.311)	0.237 (0.134)*
# affiliates	0.545 (0.184)***	0.049 (0.081)	0.367 (0.137)***	-0.042 (0.053)
<i>Industry variables</i>				
ln(R&D)	-3.902 (0.632)***	0.751 (0.355)**	-3.359 (0.843)***	0.133 (0.289)
ln(K/L)	-1.025 (0.233)***		-1.053 (0.338)***	
Observations	213		295	
uncensored obs	93		144	
Wald test (p-value)	0.000		0.000	
Mills ratio (p-value)	0.425		0.047	

Standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

All regressions include two digit industry dummies.

**Table 5 – German FDI cases (number) in pre- and post-reform India: Distribution across industries, states and ownership shares**

	All industries	High R&D intensity	Medium R&D intensity	Low R&D intensity
	<i>All Indian states</i>			
Pre reform	77	35	35	7
Post reform	194	68	76	50
	<i>Five closed states<sup>a</sup></i>			
Pre reform	3	1	2	--
Post reform	4	--	2	2
	<i>Four more open states<sup>b</sup></i>			
Pre reform	59	27	27	5
Post reform	128	46	50	32
	<i>Vertical FDI<sup>c</sup></i>			
Pre reform	46	22	18	6
Post reform	122	50	35	37
	<i>Full German ownership</i>			
Pre reform	6	3	2	1
Post reform	76	27	32	17
	<i>German majority share<sup>d</sup></i>			
Pre reform	29	16	12	1
Post reform	97	33	37	27
	<i>German minority share<sup>d</sup></i>			
Pre reform	42	16	21	5
Post reform	21	8	7	6

<sup>a</sup> Andhra Pradesh, Assam, Bihar, Kerala, Uttar Pradesh. – <sup>b</sup> Gujarat, Karnataka, Maharashtra, Tamil Nadu. – <sup>c</sup> Ratio of Indian exports to Germany over German exports in the same industry to India > 0.3. – <sup>d</sup> Minority: less than 50 percent; majority: 50-99.9 percent.