Avenues of Technology Transfer:
Foreign Investment and Productivity Change in the Czech Republic*

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I. Introduction

It is often claimed that international technology transfer is a fundamental source of economic growth and development. Using aggregate data, a number of recent studies have concluded that trading with countries that are relatively R&D-intensive leads to higher productivity growth (Coe and Helpman, 1995; Coe, Helpman and Hoffmaister, 1997). While these findings are not inconsistent with the endogenous growth literature, they do not reveal much about *how* technology transfer occurs. The micro-economic literature has emphasized three channels for such transfer: imports of new capital and differentiated intermediate goods (Feenstra, Markusen and Zeile, 1996; Grossman and Helpman, 1995); learning by exporting (Clerides, Lach and Tybout, 1997) and foreign investment (Blomstrom and Kokko, 1997). Particular attention has centered on the role of foreign investment as a channel of knowledge transfer and on the associated spillovers of know-how to other firms in the economy. Foreign investment should be associated with the transfer of knowledge since by definition it is driven by the existence of intangible assets owned by the parent firm (Markusen, 1995). The empirical evidence to date

indicates that foreign investment is indeed a major, if not the dominant, channel of technology transfer to developing countries.[1] Evidence of associated spillovers is much less robust.

Prior to any assessment of spillovers it is important to determine the magnitude of the associated transfers, both in absolute and relative terms. The smaller are the knowledge transfers associated with foreign investment, the smaller the scope for spillovers to other firms. However, even if intrafirm (or intra venture) technology transfers are significant, knowledge may also be acquired and employed by domestic firms without investment-based linkages to foreign partners, e.g., through the use of trade mechanisms (imports; learning by exporting). Comparisons between firms on the basis of performance measures such as productivity growth may find an absence of spillovers because these alternative channels of technology acquisition are not controlled for.

This paper investigates the relative importance of foreign investment as a channel of technology transfer in the Czech Republic during the initial post-reform period (1992-96).[2] We distinguish between firms that established partnerships with foreign firms--either through a joint venture or through acquisition--and those that did not, and ask whether total factor productivity (TFP) growth rates of these two sets of firms differ. Our results suggest that although firm-level TFP growth is substantially higher in firms with foreign partnerships, once common macroeconomic influences and industry effects are controlled for, foreign investment does not have a statistically significant positive impact on firm performance. We show that this is in part

[1] Pack and Saggi (1997) note that intrafirm transactions in royalties and license fees between parent firms and subsidiaries account for over 80 percent of total global flows.

[2] A separate but related literature on technology diffusion has focused largely on two issues: (i) analysis of the determinants of the number of firms or the proportion of industry output produced by a new technology (aggregate diffusion); and (ii) analysis of the determinants of the time at which a firm adopts a new technology relative to other firms (so-called duration models) (Karshenas and Stoneman, 1994). Data constraints prohibit analysis of the types of questions asked in the diffusion literature as it is not possible to identify specific technologies in our data set.

due to selection bias; foreign investment tends to flow to firms of above average size, initial profitability and initial labor productivity. Once an adjustment is made for this bias, the estimated coefficients increase in magnitude, although they remain insignificant at conventional levels. This suggests that firms without foreign partners have been successful in acquiring and employing new knowledge independently through arms-length trade.

In addition to the apparent absence of significant effects on recipient firms' performance, we also observe the existence of strong and statistically significant negative spillover effects on other firms in the industry associated with foreign investment in a sector. This finding is consistent with the results found by Aitken and Harrison (1996) for Colombia and Haddad and Harrison (1993) for Morocco. This negative effect of foreign investment on firms without foreign linkages in the same industry is complemented by a positive effect associated with imports of goods. This provides some support for the hypothesis that Czech firms without a foreign investment relationship benefited from imports to improve their performance and illustrates the importance of arms-length trade as a mechanism of technology transfer.

The paper is organized as follows. Section II briefly reviews the relevant literature on channels of technology transfer and spillovers. Section III describes the data set. Section IV lays out the estimation approach and presents the results of the empirical analysis. Section V concludes.

II. Channels of Technology Transfer

While there is little doubt that technologies make their way across international boundaries, the mechanisms through which this occurs are not well understood. Aside from case studies, most of

the empirical evidence is based on aggregate data or cross sectional surveys, and subject to multiple interpretations. Various transmission channels may play a role in the technology transfer process. New technologies may be embodied in goods and transferred through imports of new varieties of differentiated products or capital goods and equipment, or through arms-length trade in intellectual property, e.g., licensing contracts. Alternatively, firms may learn about technologies by exporting to knowledgeable buyers, who share product designs and production techniques with them. Finally, technology transfer may occur in the context of formal cooperative arrangements between foreign and local firms, e.g., FDI (acquisition) or project-specific joint ventures.[3] In all these cases technology transfer may also require the availability of workers with appropriate training and special expertise to assist in technology absorption and adaptation, and may diffuse from firm to firm through demonstration effects, labor turnover, or reverse engineering.

Although a variety of channels exist through which technology can be transferred or obtained, it is helpful to differentiate between transfers that are realized in the context of formal cooperative arrangements between a foreign and a domestic firm and those that occur at "arms-length." The latter, which include arms-length trade in machinery and components and direct purchases of knowledge (payment for patents, blueprints, etc.) can be a major avenue of technology transfer. However, not all technologies are available at arms-length. Many may only be obtainable through formal cooperation--either majority ownership (acquisition) or project-

[3] See e.g., Helleiner (1973) and Keesing and Lall (1992) on sub-contracting; Feenstra et al. (1992) on imports of inputs; Blomstrom and Kokko (1997) for a recent survey of the literature on FDI; and Pack and Saggi (1997) for a general survey of the literature on technology transfer.

specific joint ventures.[4] Both types of foreign investment are likely to be associated with transfer of both hard (machinery, blueprints) and soft (management) technologies. Foreign partners will require that production meets specifications (both with respect to design and maximum defect rates), and this may require the implementation of quality control systems. A partner will also want to be assured that production is delivered on time, and that management is able to deal with possible supply disruptions from local input suppliers. Foreign partners may also require the use (and assist in the provision) of particular equipment. Interviews with enterprise managers by the authors suggest that all of these dimensions are prevalent in the Czech Republic.

Theoretical models of foreign investment and spillovers suggest there should be a positive relationship. For example, Das (1987) models a foreign subsidiary as a price leader, and domestic firms as a competitive fringe. Learning by domestic firms is assumed to be proportional to the output of the multinational firm and increases the parent firm's incentive to transfer technology to its subsidiary as profits are higher if more advanced technology is used. The greater output of the subsidiary then induces native firms learn and adopt the foreign technology at a higher rate. Wang and Blomström (1992) use a similar setup, but endogenize both the level of technology transfer from the parent company to the subsidiary and the investment in learning activities by the domestic firm. Foreign firms again transfer technology at a higher rate if domestic firms invest more in the learning activities. Some empirical support for this prediction is found by Blomstrom, Kokko and Zejan (1994).

[4] Notions of arms-length exchange used in the literature vary. For example, Pack and Saggi (1997) make a distinction between intrafirm exchange (FDI) and contractual exchanges (licensing, joint ventures, turn key projects, etc.). They call the latter arms-length arrangements.

The empirical evidence on spillovers from multinationals (affiliates) to indigenous firms is mixed (Blomstrom and Kokko, 1997). Abstracting from the case study literature (see United Nations, 1988), early studies such as Blomström and Persson (1983), using industry level data, found that domestic labor productivity is positively influenced by foreign presence in an industry, measured by the foreign share of industry employment. More recent studies using firm level data are less supportive of the existence of spillovers. Aitken and Harrison (1997) and Haddad and Harrison (1993) find that foreign investment has a negative effect on domestically owned firms. Aitken, Hanson and Harrison (1997) find that the concentration of foreign investment in particular sectors increases the probability that domestic plants export to foreign markets. This provides only weak evidence for spillovers as no account is taken of the possibility that domestic entities without foreign investment that export may have relationships with foreign buyers, including subcontracting. More generally, it would appear necessary to incorporate the possible effect of trade on the performance of domestic firms that do not have foreign investment into the analysis.

III. The Czech Data Set

Information on Czech enterprises was compiled for the 1992-97 period from surveys using a questionnaire prepared by the authors and a database containing financial and ownership information. Financial variables were defined using international accounting standards from the onset of the survey in 1992. The database comprises 513 firms quoted on the Prague stock exchange whose shares traded at least four times in a given year and report the financial information required.

Of these firms, 294 did not establish joint ventures or attract FDI; 120 concluded one or more joint ventures with foreign companies; and 99 attracted foreign equity investment. Thus, some 42 percent of the sample had a significant foreign link--either a joint venture or significant equity participation (Table 1). As noted earlier, given our interest in assessing the impact of formal foreign linkages on enterprise performance, in what follows no distinction is made between joint ventures and equity investment (FDI). This can also be justified by the fact that we have only a relatively small number of observations and because in the transition context joint ventures are often substitutes for majority ownership. Thus, in what follows the term foreign investment or firms with foreign linkages refers to both joint ventures and direct investment.

While the share of firms with foreign linkages appears to be high, it is representative of Czech industry more generally. Aggregate statistics reveal that during 1994-95 40 percent of all manufacturing firms with more than 10 employees were involved in some kind of foreign partnership (Czech Statistical Office, 1997). However, the latter figure uses a five percent or higher share of foreign ownership, whereas the criterion used in our sample to determine the existence of a foreign partnership or ownership relationship is that at least 20 percent of the equity is owned by a single foreign entity or that the firm has established one or more joint ventures with a foreign partner. Because minority shareholders have little protection under Czech law, equity investors have an incentive to take a majority stake. Most firms with foreign equity ownership in the sample are majority foreign owned (Djankov and Hoekman, 1998).

[Table 1 here]

Firms with foreign partnerships tend to be significantly larger than firms that remain independent: the median level of total employment is 700 as compared to 350 (Table 1). Firms

that attracted foreign investment also have higher levels of initial profitability and labor productivity. This suggests that foreign investors are seeking firms with above average performance and with some market power. These better than average initial conditions may be a factor underlying the above average TFP growth performance of firms with foreign linkages that is observed for the 1992-96 period. These firms register TFP growth that averages about double that of firms without foreign partnerships (Table 1). Note that the magnitude of the TFP growth rates is highest in earlier years and tapers off towards the end of the sample period. This reflects a marked deterioration in macroeconomic conditions in 1996.

Questionnaires suggest that both joint ventures and FDI are associated with technology transfers. Table 2 reports the results of a questionnaire sent to the firms in the sample in early 1997. Two questions related to training and acquisition of new technologies were included. Managerial responses clearly reveal what appears to be a significant difference between firms with and without foreign partnerships. The first question asked managers "Have your workers undergone any training in the last two years?". Managers were given discrete choices "Yes/No." While in firms without foreign partners only 7.8% replied in the affirmative, 55% of managers whose firms were involved in either joint ventures or had attracted significant foreign ownership answered positively. The second question asked whether new technology (machinery, equipment) or related know-how had been obtained in the previous two years. Foreign investment was again associated with substantially greater positive responses--in 65% of cases the partner acquired some kind of new technology, as opposed to 30% for firms without foreign linkages. Note that the relative difference between the two sets of firms on the training variable ("software") is much greater than on the "hardware" variable.

[Table 2 here]

IV. Foreign Investment and Firm Performance

In what follows we directly estimate production functions for the firms included in the sample. This approach is particularly useful given that the assumptions underlying the alternative approach using Tornquist approximations of Divisia indexes (constant returns to scale, perfect competition, and profit maximization) are likely to be violated in the Czech context. Since we use data for the initial post-reform period in the Czech Republic, Divisia indexes may be inappropriate to measure productivity changes.

Following the derivation in Basu and Fernald (1995), assume each firm has a production function for gross output:

(1) $$Y_i = F^i(K_i, L_i, M_i, T_i),$$

where Y is gross output, K, L and M are inputs of capital, labor, and materials, and T indexes technology. The firm's production function F is homogeneous of degree g ($g \neq 1$) in K, L, and M. Firms are assumed to be price takers on factor markets, but may have market power in output markets. The former assumption is reasonable since wages were largely set centrally during the sample period, and most materials were bought abroad at world-market prices. The value of the marginal product is then proportional to the price of the input, P_{Ji}:

(2) $$P_i F_J^i = \mu_i P_{Ji}$$

where F_J^i is the marginal product of input J. Firms may charge a markup μ_i over marginal cost: $\mu_i = P_i / MC_i$, where MC_i is marginal cost. Equations (1) and (2) imply that

(3) $$dy_i = \mu_i \left[s_{Li} dl_i + s_{Ki} dk_i + s_{Mi} dm_i \right] + \frac{F_T^i T_i}{F^i} dt_i$$

where dy_i is output growth, changes in inputs are weighted by revenue shares (s_{Ji} is the input j's share in nominal gross expenditure), and $\frac{F_T^i T_i}{F^i} dt_i$ equals the technology change or TFP growth.

We re-write equation (3) as follows

(4) $$\Delta y_{i,t} = \hat{\alpha}_i + \beta_{Ls} \Delta l_{i,t} + \beta_{Ms} \Delta m_{i,t} + \beta_{Ks} \Delta k_{i,t} + \varepsilon_{i,t}$$

where $\Delta y_{i,t} = ln\, Y_{i,t} - ln\, Y_{i,t-1}$ and similarly for $l_{i,t}$, $m_{i,t}$, and $k_{i,t}$ (all lower case symbols represent logs). All β's are estimated over each industry (sector) s, i.e., a separate production function is fitted to each sector. Since the reported book value of fixed assets may be inaccurate and is unlikely to provide a good measure of the flow of capital services, energy consumption is used as a proxy for capital utilization. This correction has a number of desirable properties and is particularly attractive in the transition context because it is a flow measure that does not depend on accounting measures of fixed assets (Burnside, Eichenbaum and Rebelo, 1995). Also, the data on capital stocks and depreciation are of poor quality. The use of energy consumption as a proxy for capital utilization means, on the other hand, that substitutions of additional capital for reduced energy consumption are obscured. This may be an undesirable assumption, since presumably one of the major restructuring efforts of firms will be to cut energy consumption in the face of rapidly increasing energy prices in the Czech Republic during the sample period.

Since the primary focus in this paper is to test the association between productivity growth and foreign investment, we augment equation (4) by including this explanatory variable as an additional "factor of production." This approach is similar to the empirical design used in

Harrison (1994). In addition, the effects of other changes in the economic (and political) environment (for example, stabilization) have to be controlled for. We do not have good proxies for these changes, nor can we account individually for each of them. Instead, we include annual dummies in the estimating equation which pick up the net effects of changes in the economic environment at the aggregate level. The estimating equation thus becomes

$$\Delta y_{i,t} = \hat{\alpha}_i + \beta_{Ls} \Delta l_{i,t} + \beta_{Ms} \Delta m_{i,t} + \beta_{Ks} \Delta k_{i,t} + \beta_4 FOREIGN + \varepsilon_{i,t} \quad (5)$$

where the additional explanatory variable (FOREIGN) is lagged one year to reduce the possible endogeneity. FOREIGN is 1 if a Czech firm has a foreign partner (either joint venture or FDI), 0 otherwise. Note that this equation is estimated at the level of the firm.

Because of the probable correlation between productivity effects and the independent variable, ordinary least squares (OLS) may give biased and inconsistent estimates. Given the absence of suitable firm-specific instruments to address this problem, we also report the results of estimating a random effects model. The value of the Hausman specification test lies in the indeterminate region, indicating that either fixed or random effects can be used.
However, the use of fixed-effects estimation is inappropriate as it assumes firm productivity growth to be constant over time. This is objectionable since changes in productivity due to foreign linkages is the phenomenon we seek to explore. The random-effects model avoids the imposition of constant productivity growth over time, but has the drawback that productivity shocks at the firm level are assumed to be uncorrelated over time.

The results of OLS and random effects estimations of equation 5 are reported in Table 3. The estimated coefficient on the dummy for foreign partnership is positive, but very small in size and statistically insignificant for both specifications, suggesting that foreign investment has not

involved substantial transfers of technology. This is surprising, given that by definition foreign investment should be driven by the existence of intangible assets held by the foreign partner. One explanation for this result could be that in the case of the Czech Republic, foreign investment is not driven by the factors suggested by the theory of the multinational firm. A more likely explanation is that the regressions take no account of the likelihood that foreign investment choices are not randomly distributed. Instead, the descriptive statistics reported in Table 1 suggest that the firms that attract foreign investment have above average initial performance relative to the average in an industry.

[Table 3 here]

To correct for the possible endogeneity of foreign investment choices, we redo the regression using the generalized Heckman two-step procedure for correcting sample selection bias as developed in Amemiya (1984). This involves separate estimation of the foreign investment decision and the subsequent firm productivity growth performance. The first step uses a probit model to determine the probability of foreign investment based on initial efficiency (proxied by the share of variable costs in total revenues), firm size, and type of industry. The second step involves an OLS or random effects estimation, using only observations on firms with foreign linkages. This results in sample selection bias, defined as the omitted variable problem. The Heckman procedure provides for a specification of the omitted variable that can be used in the truncated sample to alleviate sample selection.[5]

[5] The omitted variable is the ratio of the value of the standard normal density function to the value of the standard normal cumulative distribution function (the inverse Mills ratio) and is computed directly as part of the TSP econometric package we use. Amemiya (1984) generalized the Heckman approach to include all observations in the second step by developing a measure of the inverse Mills ratio for zero observations, i.e., for firms without foreign partnerships. We follow this approach by augmenting the estimating equation (5) with an additional independent variable: the inverse Mills ratio calculated from the results of the probit estimation of

The results of the estimation that corrects for selection bias are reported in Table 4. The coefficient estimates for the foreign partnership dummy become markedly larger in magnitude and significance, but are still not statistically significant on the basis of the conventional criteria (especially in the case of the random effects model). The surprising result that foreign investment does not appear to lead to significant transfers of technology therefore remains. Why this is the case is not clear. One possibility may be that that knowledge spillovers are rapid and substantial. Another is that local firms are able to improve their performance by obtaining and employing technologies and knowledge through trade-based channels. In both cases the performance improvement of firms with foreign partnerships relative to other firms may be reduced.

[Table 4 here]

These possibilities can be considered by including measures of spillover and trade effects in a regression that is restricted to the firms without foreign investment (as spillovers should be sector-specific). To account for spillovers we include the share in total domestic sales (revenues) of firms with foreign partners as a regressor, under the presumption that the larger the share of firms with foreign investment the greater the scope for spillovers. Import penetration at the sector level is included as a proxy for the effect of trade. The variable IMPORTS is defined as the share of imports in total domestic consumption and constructed using Czech customs data. This has the advantage of being easily mapped into the industry breakdown that corresponds to

foreign investment outcomes on 1992 labor productivity and sector origin. The latter can be used as an instrument for the unobserved impacts on foreign investment decisions.

the enterprise data.[6] In both cases, the SPILLOVER and IMPORTS variables are lagged by one year.

Thus the following regression is run on the subset of firm without foreign investment:

$$(6) \qquad \Delta y_{i,t} = \hat{\alpha}_i + \beta_{Ls} \Delta l_{i,t} + \beta_{Ms} \Delta m_{i,t} + \beta_{Ks} \Delta k_{i,t} + \beta_4 SPILLOVER + \beta_5 IMPORTS + \varepsilon_{i,t}$$

As can be seen from Table 5, and contrary to what is predicted, spillovers are negative: foreign investment in an industry has a statistically significant negative effect on the performance of other firms in an industry. Conventional wisdom in the literature (see, e.g., Pack and Saggi, 1997) holds that spillovers from joint ventures should be higher than those from FDI (establishment of majority-owned affiliates). If this is indeed the case in general, the fact that our foreign investment set of firms includes many joint ventures suggests that the negative spillover effect is quite robust. If the sample is separated into joint ventures and FDI and the regression run on each sub-set, we find that joint ventures do have an offsetting effect, in the sense that the coefficient estimate is smaller and statistically insignificant; although the sign remains negative. Given that on average TFP growth of firms without foreign linkages was positive (indicating that these firms were restructuring and improving their efficiency), this suggests that other channels of technology transfer were being actively exploited by these firms that helped to counteract the negative spillover effects of foreign investment.

[Table 5 here]

The most obvious potential channel is international trade. If import penetration at the sector level (defined as the share of imports in total domestic consumption, again lagged by one

[6] Partner country export data from the UN COMTRADE CD-ROM (version 2/98) were used to check the accuracy of these data and revealed the two datasets were very similar.

year) is included as a regressor to proxy for the effect of trade, a large and significant positive coefficient estimate is obtained (Table 5). Such imports will have two dimensions, first as a source of external market discipline (competition), and second, as a source of new knowledge, embodied in new inputs and equipment. The industry import data used does not allow us to differentiate between competing goods and inputs that are used by Czech firms in their production process. However, aggregate trade data indicate that the share of capital and intermediate goods in total imports from the EU was high during the sample period (over 70% in 1995 as reported in Hoekman and Djankov, 1997), suggesting that the positive sign of the imports coefficient is likely to reflect significant flows of new knowledge and technologies. Mention can also be made of the fact that numerous Czech firms entered into subcontracting arrangements with European firms--so-called outward processing trade, under which inputs are supplied to Czech firms from European enterprises, processed, and shipped back to the EU.[7]

Of course, imports may also stimulate productivity growth by increasing competitive pressures.[8] However, in principle foreign investment should also have this effect. The fact that it apparently did not in the Czech Republic may in part be a reflection of a concentration of foreign

[7] A positive coefficient might arise if foreign investment and imports were substitutes, so that import penetration is lowest in sectors with high foreign investment. The positive coefficient on IMPORTS would then simply confirm our findings on the negative spillover effect of foreign investment. However, this is unlikely. For one, the absence of policies encouraging trade over FDI (or vice versa) in the Czech Republic suggests the traditional "tariff-hopping" motivation for FDI is absent. If we exclude service sectors from the sample (since import penetration there is zero by definition) and compute simple correlations between foreign investment and import penetration across sectors we obtain a moderately large (but statistically insignificant) value of 0.218, suggesting that trade and foreign investment are more likely to be complements than substitutes.

[8] Harrison (1994) finds that the reduction in tariffs and the subsequent increase in import penetration in Cote d'Ivoire following the 1982 trade liberalization had a positive (although not statistically significant) effect on TFP-growth; Tybout and Westbrook (1995) find increased openness was associated with higher rates of productivity growth in a large sample of Mexican manufacturing firms.

investment in firms with market power or (tacit) collusion between these firms.[9] Although the average size of firms with foreign partnerships is twice that of other firms, the open trade regime and the prevalence of numerous firms with foreign linkages in many industries makes this possibility rather unlikely, it is an issue on which further research could usefully focus.

V. Concluding Remarks

Firm-level data for the Czech Republic during 1992-96 suggest that foreign investment has little discernible impact in terms of technology transfer if measured in terms of the TFP growth of recipient firms. This result is in part a reflection of the endogeneity of selection of Czech firms that obtain foreign partnerships. However, after controlling for this likely source of selection bias, we find that although the impact of foreign investment is positive, coefficient estimates are not statistically significant. This is surprising, given that there is a presumption that foreign investors should be transferring new technologies and knowledge to partner firms. Either this has not been occurring or Czech firms without foreign partnerships have been successful in acquiring and employing new knowledge through spillovers or independently through trade channels. The first possibility is rejected by the data, as spillovers associated with a foreign investment presence in an industry are negative (and statistically significant). Conversely, imports are found to have a significant positive effect on TFP growth of firms without foreign investment. Trade (imports) therefore appears to have played an important role as a channel for improved performance of Czech enterprises.

[9] The possibility suggested by Harrison (1996) that in imperfectly competitive markets entry by foreign investors implies that domestic incumbents lose market share and thus impedes their ability to attain scale economies

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Table 1: Descriptive Statistics on Firms

Sector	Total Sample	No Foreign Partner	Foreign Partner
Mining	11	6	5
Food and beverage	54	36	18
Textiles and Apparel	39	28	11
Furniture and Other Wood Products	11	5	6
Printing and Publishing	13	3	10
Chemicals	30	14	16
Shoes and Leather Products	6	4	2
Non-Metallic Mineral Products	21	11	10
Basic Metals	13	4	9
Fabricated Metal Products	24	12	12
Electric and Electronics	82	37	45
Transport Equipment	12	3	9
Other Manufacturing	10	6	4
Construction	82	55	27
Retail Services	15	11	4
Financial services	90	59	31
Average Initial Employment*	1,226.61 (442.00)	876.29 (350.00)	1793.62 (705.00)
Average Initial Profitability*	13.568 (11.683)	12.986 (11.028)	14.527 (12.685)
Average Initial Labor Productivity*	189.57 (153.64)	179.24 (138.66)	205.68 (163.54)
TFP Growth 1992-93 (in %)*	8.307 (5.292)	8.652 (4.812)	5.042 (7.226)
TFP Growth 1993-94 (in %)*	4.442 (3.457)	3.472 (2.755)	13.624 (10.749)
TFP Growth 1994-95 (in %)*	3.307 (2.493)	2.443 (1.884)	6.824 (4.557)
TFP Growth 1995-96 (in %)*	-0.268 (1.427)	-0.341 (0.890)	0.184 (3.018)
Number of Observations	513	294	219
Share in Total	100.0%	57.3%	42.7%

* Medians are reported in parentheses.

Table 2: Evidence of Technology Transfer

Questions	Total Sample	No Foreign Partner	Foreign Partner
Have your workers undergone any training in the past two years?	Yes: 28% (144 of 513)	Yes: 8% (23 of 294)	Yes: 55% (121 of 219)
Have you obtained any new technology or knowledge of new production processes (apart from quality control) in the past two years?	Yes: 43% (222 of 513)	Yes: 30% (89 of 294)	Yes: 65% (143 of 219)

Source: Questionnaire held during early 1997.

Table 3: Regression Estimates
(Full Sample)

	OLS	Random-Effects
Constant	0.277 (2.356)	0.026 (0.918)
Sector-Specific Inputs	Yes	Yes
Foreign investment	0.008 (0.602)	0.005 (0.054)
Dummy for 1993	0.036 (5.678)	0.037 (9.124)
Dummy for 1994	0.027 (2.264)	0.027 (0.709)
Dummy for 1996	-0.041 (2.884)	-0.042 (1.135)
No. of observations	513	513
Adjusted R2	0.847	0.805

Table 4: Regression Results with Correction for Selection Bias
(Full Sample)

	OLS	Random-Effects
Constant	0.016 (1.385)	0.016 (0.554)
Sector-Specific Inputs	Yes	Yes
Foreign investment	0.030 (1.548)	0.031 (0.924)
Selection Bias for control group	-0.015 (2.216)	-0.013 (1.972)
Dummy for 1993	0.037 (5.674)	0.037 (9.257)
Dummy for 1994	0.033 (2.667)	0.032 (0.845)
Dummy for 1996	-0.055 (3.405)	-0.052 (1.384)
No. of observations	513	513
Adjusted R2	0.847	0.809

Table 5: Testing for Spillover Effects
(Firms without Foreign Linkages)

	Specification I		Specification II	
	OLS	Random-Effects	OLS	Random-Effects
Constant	0.056 (2.978)	0.055 (2.857)	0.054 (2.824)	0.052 (2.453)
Sector-Specific Inputs	Yes	Yes	Yes	Yes
Spillovers (Share of firms with foreign investment in total industry sales)	-0.078 (2.754)	-0.075 (1.778)	-0.073 (2.513)	-0.071 (1.625)
Imports	---	---	0.067 (2.357)	0.058 (2.648)
Dummy for 1993	0.057 (4.678))	0.054 (5.409)	0.054 (4.432))	0.051 (4.675)
Dummy for 1994	0.013 (1.115)	0.013 (1.048)	0.012 (1.134)	0.012 (0.983)
Dummy for 1996	-0.028 (1.834)	-0.029 (2.204)	-0.028 (1.763)	-0.031 (2.465)
Observations	294	294	294	294
Adjusted R2	0.804	0.738	0.819	0.747